EARLY READING ACHIEVEMENT OF CHILDREN IN RURAL LOW-WEALTH COMMUNITIES: CONTRIBUTIONS OF SINGLE AND DOUBLE DEFICITS

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ABSTRACT

PLEDGER McQUEEN FEDORA: Early Reading Achievement of Children
in Rural Low-Wealth Communities:
Contributions of Single and Double Deficits
(Under the direction of Judith L. Meece)

This study tested the Double-Deficit Hypothesis (Wolf & Bowers, 1999) that rapid naming deficits and phonological awareness deficits are separate core deficits independent of each other and students exhibiting deficits in both cognitive processing areas would be the most severely impaired in entry-level reading ability. Specifically, this study investigated the contribution of deficits in rapid naming and phonological awareness separately and in combination to entry level basic reading skills of first grade students in rural low-wealth communities. Measures of phonological awareness, rapid naming, and reading achievement were administered to 126 first grade students in two rural school districts. Deficit subgroup comparisons indicated that students with deficits in rapid naming and phonological awareness existing co-morbidly were the most severely impaired in entry level basic reading skills. These results suggest that students who struggle the most with early reading skills may be those who are impaired in these two critical domains of early reading ability. The results of this study partially support the double-deficit hypothesis, and have implications for early identification and early intervention.

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CHAPTER I

INTRODUCTION

Success in school is dependent to a great degree on the ability to read and comprehend text. Research has established that for learning to read, the first few years of school are critical (Adams, 1990; Alexander & Entwisle, 1988; Juel, 1988; National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). Successfully learning to read requires the conjoint development of an array of complex skills and knowledge that must work together in order to progressively move the learner to higher levels of reading mastery. Overall, American students score among the highest levels in international comparisons of reading (Snow et. al., 1998). Unfortunately, these high scores are not uniform across all groups of students and regions of America.

According to the National Reading Panel (NRP, 2000), longitudinal studies indicate that more than 17% of students will experience reading problems in the first three years of school. Throughout America, a disproportionate number of poor readers are found in rural towns, low-wealth communities, male samples, and certain ethnic minority groups (Snow et. al., 1998). In a recent study on school readiness, Durham and Smith (2006) found rural status to be associated with lower initial reading scores especially for certain ethnic minority groups and levels of socioeconomic status. Rural students comprise approximately 30% of the student population nationwide (Beeson & Strange, 2003; Reeves, 2003), and roughly 65% of all rural schools receive Title 1 funds (Nagle, Hernandez, Embler, McLaughlin, & Doh,

2006). These figures indicate that more than half of the students attending rural schools are low-achieving students attending the nation's highest-poverty schools.

Early education research indicates that young children from low-wealth families are at greater risk of beginning school less well prepared to learn to read (Lee & Burkam, 2002; Snow et. al., 1998; Vernon-Feagans, Gallagher, & Kainz, in press). Once in school, students from low-wealth families lag behind more in advanced reading skills (Entwisle, Alexander, & Olson, 2007; West, Denton, & Reaney, 2001) and lose more reading skills over the summer than higher wealth peers (Alexander & Entwisle, 1996; Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996). For boys from low-wealth families, a significant gender gap in reading ability develops over the elementary grades (Entwisle et al., 2007; Lee & Burkam, 2002).

A further complication for students in schools in low-wealth communities is teacher qualifications which have been shown to contribute to academic achievement (Darling-Hammond, 2000; Rivkin, Hanushek, & Kain, 1998). In order to ensure equity in opportunity for students to participate successfully in schooling, teachers need to be well trained. Meeting this criterion is especially challenging for schools in low-wealth, rural communities due to limited resources, difficulty attracting and retaining qualified teachers (Lee & Burkam, 2002; Nagle et al., 2006), and limited access to professional development (Vernon-Feagans, et al., in press). As a result, compared to urban and suburban communities, rural communities are less likely to have skilled teachers and resources to address severe reading difficulties (Vernon-Feagans et al., in press). For example, in 2003, 43% of teachers in rural schools held a Master's degree as compared to 52% of teachers in suburban and 49% of teachers in urban schools (Grigg, Donahue, & Dion, 2007). Additionally, teachers in low-wealth, rural

communities may lack training in current best practices that would aid them in accurately making judgments of students' level of early reading ability. For students at risk for reading difficulty, early assessments are especially important because research has demonstrated that once students fall behind, they tend to stay behind (Clay, 1979; Juel, 1988; Snow et al., 1998).

Recent Research on Learning to Read

Over the last 20 years we have gained much knowledge about the process of learning to read. The National Research Council (NRC, 1998) and the National Reading Panel (NRP, 2000) identified five domains of reading and related skills instrumental in the acquisition of early reading proficiency. The first skill identified by the NRC and NRP, Phonemic Awareness, is the most advanced subskill of the broader category of skills referred to as Phonological Awareness which is defined as the awareness of the sound structure of language in general(Yopp & Yopp, 2000). Phonemic awareness is the ability to hear and manipulate the sounds in spoken words and the understanding that spoken words and syllables are made up of sequences of speech sounds (Yopp, 1992). Lack of phonemic awareness is viewed by most reading researchers as the primary source of word reading difficulty (Wolf & Bowers, 1999). The second skill, Phonics, is a guide to the alphabetic transcription system (Orton, 1964) and refers to the manner in which individuals use letters to represent speech sounds. The third skill, Fluency, is the automaticity of underlying subskills of reading that allow the reader to read a text accurately, quickly, and with proper expression and comprehension (LaBerge & Samuels, 1974). Fluency can be indexed as words read per minute; therefore, in most studies, measures of rapid automatized naming (RAN) are used to assess fluency (Fuchs, Fuchs, Hosp, & Jenkins, 2001). Rapid Automatized

Naming involves the automatic retrieval of phonological information when presented with visual stimuli such as objects, colors, letters, or numbers (Bowers, 1995). The fourth skill, Vocabulary, refers to the words a reader knows. It is the ability to understand and use words to acquire and convey meaning; therefore a strong vocabulary aids comprehension (NRP, 2000). Finally, the fifth skill, Comprehension, is the active and intentional thinking in which the meaning is constructed through interactions between the text and the reader (Durkin, 1978). Reading comprehension is a cognitive process that requires the integration of an array of complex skills and is heavily dependent on vocabulary (NRP, 2000). Additional information on these five domains of reading and related skills is presented in the Glossary.

Converging research documents the importance of single-word decoding (the use of letter-sound knowledge to pronounce words in print) in learning to read (Fletcher, Lyon, Fuchs, & Barnes, 2007; Shaywitz & Shaywitz, 2004; Stanovich, 1986). Research further demonstrates that the beginning stages of learning to read depend in great measure on phonological awareness at the phoneme level (Adams, 1990; Bradley & Bryant, 1983; NRP, 2000), rapid naming, and oral language proficiency (Snow et al., 1998). For students experiencing difficulty acquiring early reading skills, research has demonstrated that the etiology of most reading problems is difficulty in single-word decoding. The basis for single-word decoding is awareness of the phonological structure of language (Fletcher et al., 2007). Therefore, once phonological awareness develops, and the student understands the alphabetic principle, that speech can be separated into phonemes and phonemes can be mapped onto graphemes (Blachman, 1997) then word recognition is often mastered. For students who do not master these concepts early in the reading process, word recognition is delayed and may result in reading difficulty due to a core deficit in phonological awareness.

The phonological core deficit theory (Stanovich, 1988) has been the most dominant theory on the source of widespread reading problems for several decades (Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997; Harm & Seidenberg, 1999; Shankweiler & Liberman, 1972; Wolf & Bowers, 1999). According to this theory phonological based difficulties are the primary source of single-word decoding[1] difficulties, which result in reading difficulties. As a result of the widespread acceptance of this theory, phonological awareness and decoding skills have been the primary focus of research on preventive models of reading instruction. Results indicate that instruction in these areas has improved many at-risk students' skills and early reading (Brown & Felton, 1990; Mathes, Denton, Fletcher, Anthony, Francis, & Schatschneider, 2005). Yet researchers continue to report a wide range of responsiveness to current instructional models with some at-risk students exhibiting minimal or no benefit from instruction (Al Otaiba & Fuchs, 2002; 2005; Hatcher & Hulme, 1999; Torgesen, 2000). For example, in an intervention study designed to improve reading outcomes for students at-risk for reading problems entering kindergarten, O'Connor (2000) reports 7% of students had sustained reading problems after intervention. Other investigators have reported as many as 30% of students at-risk for reading difficulty may not benefit from current instructional models in phonological awareness and decoding (Brown & Felton, 1990; Mathes, Howard, Allen, & Fuchs, 1998).

Implications for both immediate and long-term consequences of reading difficulty are significant given the importance of learning to read and its role in academic achievement. Therefore, reading researchers have begun to focus on developing a better understanding of the heterogeneity of poor readers by looking for other correlates of reading that may impede the development of reading skills (Wolf, Goldberg O'Rourke, Gidney, Lovett, Cirino, &

[1] Decoding is defined as the use of phonics to translate graphemes into phonemes in order to read words.

Morris, 2002). Drawing on research in the neurosciences, reading researchers have begun to look at rapid naming as another source of difficulty (Ackerman & Dykman, 1993; NRP, 2000). Research has established that speed of naming visually presented stimuli is strongly associated with reading achievement (Badian, 1993; Blachman, 1984; Denckla & Rudel, 1976). Proficiency in rapid naming results in fluency, another key skill in learning to read. Further, comprehension is dependent on the ability to decode rapidly and recognize single words fluently and automatically (Fletcher et al., 2007). Until recently, processes underlying naming speed have been subsumed under phonological awareness (Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997) by most reading researchers. An important implication of a deficit in rapid naming concerns fluency and automaticity in interventions designed to remediate reading problems. Several studies have thus argued for examining rapid naming skills independent of phonological awareness (Schatschneider, Carlson, Francis, Foorman, & Fletcher, 2002; Wolf & Bowers, 1999; Wolf, Bowers, & Biddle, 2000).

The Double-Deficit Hypothesis

Drawing on reading research and research in the neurosciences, Wolf and Bowers (1999) hypothesized a double-deficit in phonological awareness, including the subskill of phonemic awareness, and rapid naming. These researchers propose that students who have a deficit in phonological awareness and a deficit in rapid naming are doubly impaired. Thus, the double-deficit hypothesis combines two of the NRP's (2000) five key skills that are the foundation of early reading acquisition. Further, researchers speculate that these students may struggle more than peers with a single deficit (e.g., phonological awareness) and may be the most severely impaired (Torgesen, Wagner, & Rashotte, 1994; Wolf & Bowers, 1999). Therefore, students with double-deficits are likely to be those in the 2% to 7% of the student population

found to be the least responsive to interventions and the most resistant to remediation in the early grades (O'Connor, 2000; Torgesen, 2000; Vellutino, Scanlon, Small, & Fanuele, 2006). For purposes of this study, the term phonological awareness will be used with the understanding that this term includes phonemic awareness.

Purpose of Study

While there is a growing body of research on the double-deficit hypothesis, none of the studies has focused specifically on low-wealth, rural populations. Therefore, a number of questions remain regarding the occurrence of the double-deficit subtype in the rural population. Of interest for this dissertation were questions concerning the frequency and impact of a double-deficit in students attending schools in rural, low-wealth communities. More specifically, if a high incidence of double-deficits is found, what factors might contribute to this high incidence? How might single- versus double-deficits affect basic reading skills in rural populations? Do double-deficits have a greater impact on first grade students' entry level reading skills than deficits in a single area of early reading skills? How are single- versus double-deficits distributed across different gender groups and across groups of different levels of risk for early reading difficulties? Will there be a disproportionate number of male students with deficit status? Last, how accurate are teacher judgments in identifying students at risk for early reading difficulty?

To address these questions, this dissertation study examined data[2] from a larger intervention study, the Targeted Reading Intervention: A Rural Early Literacy Initiative, under the direction of Dr. Vernon-Feagans. The study included a sample of kindergarten and

[2] Data source: The National Research Center on Rural Educational Support which is funded by a grant from the Institute for Educational Sciences at the US Department of Education; Grant number: PR305A004056.

first grade students from schools in low wealth, rural communities. This investigation was exploratory in nature and was expected to evaluate the need for further research.

CHAPTER II

LITERATURE REVIEW

Over the last 20 years we have gained much knowledge about the process of learning to read. From reading research, it has been well established that phonological awareness, rapid naming, and oral language proficiency mediate success in learning to read (Snow et al., 1998). Once given formal instruction, most students learn to read with relative ease (Lyon & Moats, 1997). However, converging research indicates that, even with scientifically-based early reading instruction, there remains a group of students who are not benefiting from current instructional models (Berninger, Abbott, Zook, Ogier, Lemos-Britton, & Brooksher, 1999; Brown & Felton, 1990; Hatcher & Hulme, 1999; Schneider, Ennemoser, Roth, & Kispert, 1999; Torgesen, 2000; Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, & Garvin, 1999; Uhry & Shepherd, 1997; Vellutino, Scanlon, Sipay, Small, Pratt, Chen, & Denckla, 1996; Vellutino, Scanlon, & Lyon, 2000). In an effort to address continued problems with reading, the National Academy of Sciences established a committee to examine the prevention of reading difficulties. The committee was charged with conducting a study of the effectiveness of interventions for students at-risk of early reading difficulty. In order to accomplish this objective, the committee identified and summarized research literature relevant to the critical skills required for early reading success. The NRC's consensus report on *Preventing Reading Difficulties in Young Children* (National Research

Council ,1998) focused on the effectiveness of interventions for students at-risk for early reading difficulty.

At the request of the United States Congress, a National Reading Panel (NRP) was established to build upon and expand the earlier research on reading development. The National Reading Panel (2000) screened approximately 100,000 research studies and summarized the relevant research literature focused on the foundational skills of early reading acquisition. Findings from their report indicate that (1) instruction in phonemic awareness (a subskill of phonological awareness) results in improvement in students' phonemic awareness, reading and spelling; (2) systematic phonics instruction produces significant benefits for students in kindergarten through sixth grade and for individuals having difficulty learning to read; (3) guided repeated oral reading has a significant positive impact on word recognition, fluency, and comprehension across multiple grade levels; (4) vocabulary instruction that is age and ability appropriate leads to gains in comprehension; and (5) explicit instruction in reading comprehension strategies helps increase retention and understanding of text and is therefore, most effective.

On the basis of this research, numerous instructional models have been developed, incorporating one or more of the National Reading Panel's five key skills that are instrumental in the acquisition of beginning reading. Further, under the Elementary and Secondary Education Act (1965) reauthorized as the No Child Left Behind Act (2001), schools are now mandated to use scientifically-based practices to ensure that every student is able to read by the end of third grade. Yet, converging intervention research in classroom instruction indicates that even with scientifically-based early reading instruction there remains a small percentage of students who are not benefiting from instructional models

developed thus far (Torgesen, 2000). As a result, researchers have begun to investigate subsets of early reading skills. Three specific subtypes of skills have received attention relative to problems of children at risk for reading failure: phonological awareness, rapid naming, and a combination of the two skill sets (double-deficit).

Contributions of Phonological Awareness to Early reading skills

The first deficit subtype, phonological awareness, is a subskill of phonological processing, the ability to process the phonological features of language. The Phonological Deficit Theory, which posits that phonological based difficulties are the primary source of reading difficulties (Foorman et al., 1997; Harm & Seidenberg, 1999; Stanovich, 1988), is the most widely accepted theory of the source of widespread reading problems. According to Perfetti's (1977) *Verbal Efficiency Theory,* weak quality in orthographic, phonological, and semantic knowledge delays rapid retrieval of information resulting in a less efficient system that weakens the ability to allocate attention to comprehension whereas automaticity in lower level subskills frees the reader's attention to focus on comprehension (LeBerge & Samuels, 1974). Research has demonstrated that deficits in processing the phonological features of language explains a significant proportion of early reading problems (Bradley & Bryant, 1983; Manis, Seidenberg, Doi, McBride-Chang, & Petersen, 1996; NRP, 2000), as well as correlated difficulties in reading comprehension, background knowledge, memory (Gathercole & Baddeley, 1993), and vocabulary (Liberman & Shankweiler, 1985; Wagner & Torgesen, 1987).

Further, researchers now know that phonological awareness skill is highly predictive of later reading achievement (Shankweiler & Liberman, 1972; Torgesen et al., 1999; Wagner & Torgesen, 1987), independent of individual cognitive ability (Stanovich, 1988). Therefore,

students who have difficulties learning to read are likely to have core deficits in phonological awareness skills (Ball & Blachman, 1991; Bradley & Bryant, 1978; Torgesen, 2000). Phonological awareness refers to the awareness of the sound structure of language in general (Yopp & Yopp, 2000). Further, it involves the recognition that words are composed of constituent sounds and the ability to manipulate those sounds at the word, syllable, and phoneme level.

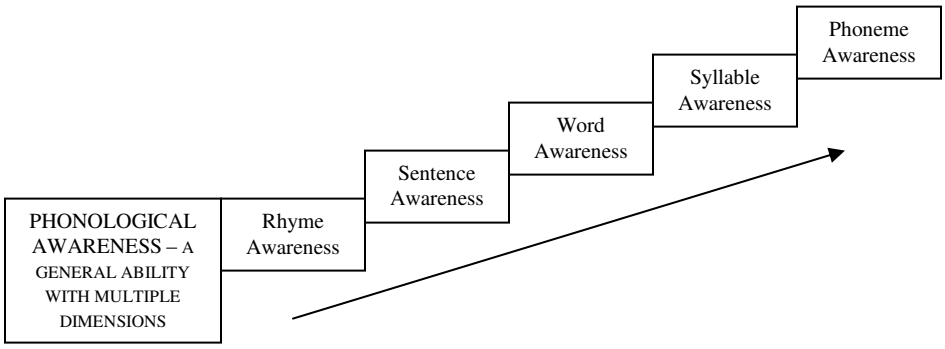


Figure 1. Developmental sequence of Phonological Awareness Abilities.

Phonological awareness at the phoneme level is one of the five key skills that are instrumental in the acquisition of beginning reading identified by the NRP (2000). Further, it is an underlying skill necessary in order for phonics skills to develop. Deficits in this skill area have been shown to impede the acquisition of fluent reading (Foorman et al., 1997) by impeding the acquisition of word recognition skills (Blachman, 1997). Research on the persistence of phonological awareness deficits has shown that they are stable over time (Felton & Wood, 1992). However, research has also shown that phonological awareness can be developed through instruction (Adams, 1990; Pressley, 1998). As a result, research on preventive models of reading instruction has focused on phonological awareness, especially at the phoneme level, and decoding skills.

According to Torgesen and Davis (1996) the level of phonological awareness prior to training strongly predicts response to treatment because students who start with higher levels of phonological awareness will have a greater ability to benefit from training in phonological awareness. Intervention research studies have found varied response to classroom instruction in phonological awareness skills (Al Otaiba & Fuchs, 2002; 2005; Hatcher & Hulme, 1999; Mathes, et al., 1998; Torgesen, Alexander, Wagner, Rashotte, Voeller, Conway, & Rose, 2001; Torgesen, Morgan, & Davis, 1992). For example, Lundberg, Frost, and Peterson (1988) reported students in the lowest quartile on pretest measures showed minimal progress on phonological awareness skills. Torgesen, Morgan, and Davis (1992) reported that 30% of at-risk kindergarten students did not appear to benefit from training in phonological awareness skills. More recently, in a review of direct instruction intervention studies, Torgesen (2005) concluded that given the right level of intensity and teacher skill, it may be possible to obtain strong positive rates of growth in reading, but fluency in reading may be more resistant to remediation even with intensive interventions, especially for students beyond the early elementary grades.

In summary, despite great strides in phonology-based research, some aspects of reading difficulty continue to elude theoretical explanations. Some researchers believe that the phonological core deficit hypothesis is only a part of the picture. Therefore, using only the phonological lens to study reading problems may be limiting the scope of interventions (Wolf & Bowers, 1999).

Contributions of Rapid Naming to Early Reading Skills

The second deficit subtype, Rapid Naming is defined as the automatic retrieval of phonological information when presented with visual stimuli such as orthographic input

(Bowers, 1995). Rapid naming focuses on an individual's information retrieval ability as demonstrated by Rapid Automatized Naming (RAN) tests and is therefore a measure of fluency. In order to be a fluent reader, an individual needs fully developed orthographic, phonologic, semantic, and syntactic representational systems. Further, there needs to be rapid retrieval of information from each system (Foorman, 2005). Fluency develops from reading practice (NRP, 2000) and is the result of the development of accuracy and "automaticity in underlying sublexical processes, lexical processes, and their integration in single-word reading and connected text" (Wolf & Katzir-Cohen, 2001, p. 219). When fully developed, fluent reading is accurate with appropriate rate and prosody (NRP, 2000) and requires little attention to decoding therefore freeing attention to focus on meaning (Wolf & Katzir-Cohen, 2001).

Rapid naming research began in the field of neuroscience with the work of Norman Geschwind (1965) who predicted that developmental dyslexia might be associated with deficits in color naming. Denckla (1972) and Denckla and Rudel (1974) tested Geschwind's hypothesis and established that rapid naming speed for familiar visual symbols (e.g., colors) was an effective predictor of reading ability. Based on their research they developed a series of continuous naming-speed tasks that became the prototype for measuring rapid serial naming. For these tasks, participants are asked to name a series of 50 (10 randomly repeated) letters, numbers, objects, or colors as rapidly as possible. Individuals who take much longer than average to complete the task are said to have a rapid naming deficit. According to Torgesen (2005), rapid naming is the reading skill that is most resistant to intervention beyond the early grades. This is an especially important finding because current reading assessment batteries typically do not access fluency. For students experiencing difficulty

acquiring early reading skills due to a deficit in rapid naming or a double-deficit, current instructional models may not address their specific area of need. Therefore, these students are likely to lose important opportunities to interact with text.

While rapid naming studies have not found a correlation with IQ, multiple studies have found robust differences between good readers and poor readers (Denckla & Rudel, 1976; Torgesen, 2005; Torgesen et al., 1997) with speed of naming letters predicting concurrent and future reading ability (Bowers & Swanson, 1991; Denckla & Rudel, 1976; Speer & Lamb, 1976). Additionally, rapid naming has been found to influence development of word identification skills, speed, and accuracy of passage reading (Meyer, Wood, Hart, & Felton, 1998a) and comprehension (Bourassa, Levy, Dowin, & Casey, 1998; Fuchs et al., 2001; NRP, 2000). Researchers have found deficits in rapid naming to be identifiable in kindergarten, persistent over time (Felton & Wood, 1992), and resistant to intervention beyond the early grades (Torgesen, 2005; Torgesen et al., 2001). Since the acquisition of fluent reading skills depends on the development of orthographic representations for words in long-term memory (Ehri, 1992; Torgesen et al., 1997), unexplained variability in word identification skill (orthographic skill) may be due to an information processing ability that directly affects the rate at which orthographic representations are formed (Torgesen et al., 1997). Therefore, some students' reading problems may be due to speed or fluency with retrieval of phonological information (Blachman, 1984).

The double-deficit hypothesis that views rapid naming as a separate source of reading difficulty has generated great debate among researchers. For example, Vukovic and Siegel (2006) reviewed the evidence for the double-deficit hypothesis and concluded that variability in methodology (i.e., classification of subtypes and definition of reading difficulty) limits

conclusions that can be drawn regarding the double-deficit hypothesis. As a result of methodological limitations, these researchers found little support for rapid naming as a separate area of difficulty for students with early reading difficulty. Yet in a twin study, Petrill, Deater-Deckard, Thompson, DeThorne, and Schatschneider (2006) found that both phonological awareness and rapid naming contributed uniquely to word recognition outcomes. While researchers on both sides of the debate recognize that rapid naming makes an independent contribution to reading (Blachman, 1984; McBride-Chang & Manis, 1996), many researchers, especially reading researchers, subsume rapid naming under phonological processing along with phonological awareness (Wagner & Torgesen, 1987). These researchers view rapid naming as one type of phonological awareness; therefore they do not consider rapid naming to be a separate area of deficiency. Their view is based on the fact that rapid naming tasks are used to assess phonological memory (an individual's ability to code information phonologically for storage in short-term memory) and require coding of information in terms of its phonological features (Baddeley, 1986).

On the other side of the debate, neuroscience researchers view rapid naming as a separate area of deficiency (Meyer et al., 1998a, 1998b; Wolf, 1997). Wolf, Bowers, and Biddle (2000) conceptualize rapid naming as a complex group of subprocesses, only one of which is phonological, that places "heavy emphasis on precise timing requirements within each component and across all components" (p. 395). These researchers have argued that rapid naming represents functions separate from the phonological processing domain for two reasons. First, rapid naming makes a unique contribution to reading beyond phonological awareness because it involves arbitrary associations between print and sound (Ackerman & Dykman, 1993) and taps nonphonological processes important in reading, such as processing

speed (Manis, Seidenberg, & Doi, 1999). Second, readers can be subtyped according to the presence of a rapid naming deficit only (accurate, slow decoders), phonological awareness deficit only (poor decoders), or double-deficits (slow and poor decoders) (Denckla & Cutting, 1999). Bowers and Wolf (1993) focus on the visual and speed components of rapid naming tasks and posit that these tasks may assess the functioning of a temporal processing or timing mechanism. This timing mechanism is important in the automatic processes required for rapid word recognition. Therefore, a significant implication of a rapid naming deficit concerns fluency and automaticity in the acquisition of early reading skills. In order to remediate a deficit in rapid naming, intervention needs to address fluency and automaticity. Since rapid naming is a measure of fluency, a deficit in this area cannot be remediated directly; rather, intervention needs to remediate the impact of a rapid naming deficit on reading (e.g., difficulty developing automaticity and fluency in reading) (Rebecca Felton, personal communication, June 4, 2008).

In summary, rapid naming studies have found robust differences between good and poor readers with speed of naming letters predicting reading ability. Additionally, rapid naming has been found to impact development of word identification skills, speed, and accuracy of passage reading and comprehension. Further, research indicates that slow rapid naming is difficult to remediate beyond the elementary grades and is especially difficult to remediate for students with identified reading disabilities (O'Connor, White, & Swanson, 2007), thus suggesting urgency in identifying students at-risk for difficulty acquiring early reading skills due to a deficit in rapid naming. Researchers continue to debate whether or not rapid naming is a reflection of phonological competence or a separate and independent process, yet both

sides acknowledge that rapid naming is an important predictor of word-level reading growth in the early grades (Brown & Felton, 1990; Wagner, Torgesen & Rashotte, 1994).

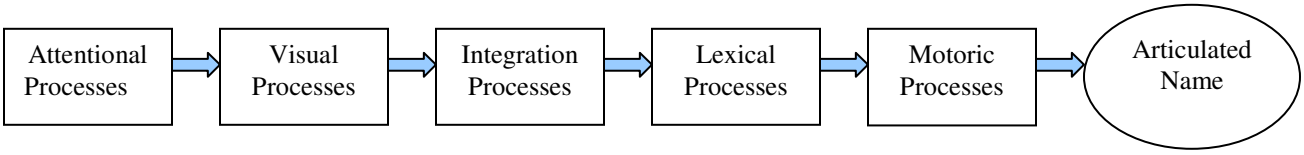


Figure 2. Simplified Model of Wolf & Bowers (1999) Simultaneously Occurring Rapid Automatized Naming Processes

Contributions of Double-Deficits to Early Reading Skills

Research indicates that some struggling readers may display a double-deficit involving deficits in both phonological awareness and rapid naming processes. Wolf and Bowers (1993, 1999) argue that "phonological deficits and the processes underlying naming speed are separable sources of reading dysfunction, and their combined presence leads to profound reading impairment" (p. 416; see Figure 3).

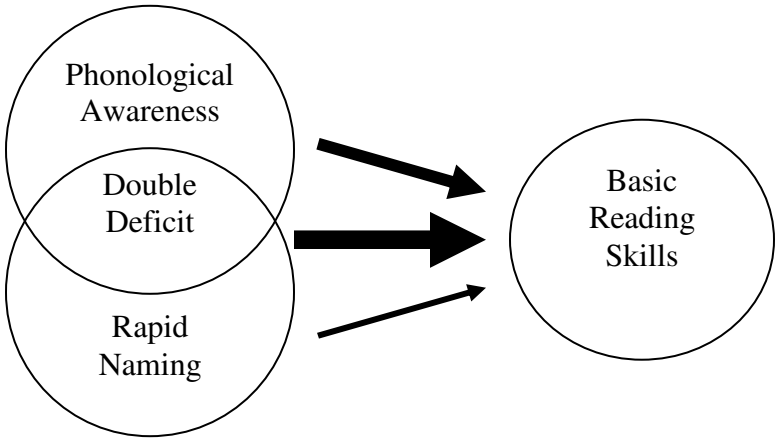


Figure 3. Model of Hypothesized Relationships Among Variables

These researchers further argue that students experiencing early reading difficulty may fall into one of three subtypes. The first subtype is defined as having a phonological

awareness deficit with average rapid naming ability. The second subtype is defined as having a rapid naming deficit with average phonological awareness ability. The third subtype is defined as deficient in both phonological awareness and rapid naming. According to Wolf and Bowers (1999) individuals with a single deficit in rapid naming are the least impaired, individuals with a single deficit in phonological awareness are moderately impaired, and individuals with a double-deficit are the most severely impaired.

Wolf and Bowers (1999) offer two types of evidence in support of their hypothesis. First, research indicates a weak correlation between phonological awareness and rapid naming. Second, independent, differential contributions exist for phonological awareness and rapid naming to variance in word identification. For example, Manis, Seidenberg, and Bhadha (2000) found rapid naming to be more strongly related to fluency, whereas phonological awareness was more strongly related to decoding skills. Research supports independent roles for phonological awareness and rapid naming in explaining early growth of word-reading skills (Badian, 1993; Felton & Brown, 1990). Converging research from longitudinal studies beginning in kindergarten identifies phonological awareness and rapid naming in combination as significant predictors of later reading ability (Meyer et al., 1998). In a longitudinal study of the contributions of phonological awareness and rapid naming to reading, Torgesen, Wagner, Rashotte, Burgess, and Hecht (1997) found that both phonological awareness and rapid naming make unique contributions to the growth of word-reading ability from kindergarten to second grade and from first to third grades. Implications are significant for poor readers with rapid naming deficits and double-deficits because they may be misclassified or given ineffective intervention that does not address the specific nature of their area of deficit (Manis & Freedman, 2001; Wolf & Bowers, 1999).

Gender Ratio

The most recent National Assessment of Educational Progress (NAEP, 2007; Grigg, Donahue, & Dion, 2007; Lee, Grigg, & Donahue, 2007) results showed fourth- and eighth-grade girls scored higher, on average, in reading than boys. Historically, researchers believed the incidence of boys experiencing reading difficulties was higher than girls experiencing reading difficulties (Fletcher et al., 2007; Rutter, Caspi, Fergusson, Horwood, Goodman, Maughan, Moffitt, Meltzer, & Carroll, 2004; Snow et al., 1998). However, recent research findings indicate that the distribution of boys and girls experiencing difficulty acquiring early reading skills may be less disparate than previously believed (DeFries & Gillis, 1991; Fletcher et al., 2007; Flynn & Rahbar, 1994; Wood & Felton, 1994). In a longitudinal study in Connecticut, Shaywitz, Shaywitz, Fletcher, and Escobar (1990) found no significant differences in gender ratios for research-identified reading disability at Grades 2 and 3. Badian (1999), in a school wide study of reading ability for Grades 1 through 8, found significantly more boys than girls were classified as having a reading disability at Grades 2 and 3. In a large-scale study of kindergartners, no mean differences were found between boys and girls in reading achievement, but nearly twice as many boys as girls fell in the lowest 10% on reading achievement scores (Vellutino, Scanlon, Clark, Small, Fanuele, & Pratt, 1992). Due to lack of consistent findings in this area of study, further research is needed.

Accuracy of Teacher Judgment Issues

Teachers make day-to-day educational decisions based on their judgment of students' abilities. These judgments are influenced by many factors including their beliefs about education, the nature of the instructional task, and estimates of their students' cognitive abilities (Coladarci, 1986). Early estimates of students' cognitive abilities are based on

gender, ethnicity, and socioeconomic status (Entwisle et al., 2007). Teacher judgments play a pivotal role in students' early school experiences that lay the foundation for subsequent academic achievement. Research suggests that teachers' ability judgments can launch students into achievement trajectories early on and that these trajectories have a lasting influence (Alexander, Entwisle, & Dauber, 2003).

Teachers are not only called on to make judgments about day-to-day occurrences, but they are also responsible for identifying students at-risk for academic difficulties. Of debate is the accuracy of teachers' judgments of students' level of risk for early reading difficulty. Feinberg (2003), in a study of the accuracy of teacher judgments of students' oral reading fluency, concluded that teachers may be less accurate at predicting specific levels of oral reading fluency. Further, Hoge and Coladarci (1989), in a review of empirical research on teacher judgments of students' academic achievement, concluded that teachers are less accurate in their judgments about low achieving students than they are about middle and high achieving students. Research on the accuracy of teacher judgments in differentiating groups of students at-risk for academic difficulties versus students not at-risk for academic difficulty indicates that teacher judgments tend to be accurate (Demaray & Elliott, 1998; Gresham, MacMillian, & Bocian, 1997), but this research has focused on broad reading achievement skills of students beyond the earliest grades. Little research is currently available that examines the accuracy of teacher judgments in differentiating students at-risk for early reading difficulty as students begin school. More importantly, for purposes of early identification and early intervention, the accuracy of teacher judgments of risk for reading difficulty may be more crucial than teacher judgment of reading ability (Gijsel, Bosman, & Verhoeven, 2006). Early identification researchers disagree on the best means of identifying

students at-risk for reading difficulty. Some favor screening tests (Fletcher & Satz, 1984; LaTorre, Hawkhead, Kawahira, & Billow, 1982) citing high false positive rates for teachers while others favor teacher ratings (Adelman, 1982; Algonzzine & Ysseldyke, 1986) for their cost-effectiveness.

In summary, research suggests that teachers are fairly accurate in judging the general ability of students, especially in the later grades. However, less is known about the accuracy of teachers' judgment of early reading abilities and the skills needed to become a successful reader.

Rural: Why Study Rural?

To date, research studies looking at single and double-deficits have focused on urban and suburban students. Much less is known about the prevalence or gender ratio of double-deficits in students in low-wealth, rural communities. Vernon-Feagans et al. (in press) have argued that very little is known about the early reading skills of these populations. Vernon-Feagans et al. (in press) further argue that reading difficulties may be more prevalent among rural populations due to a number of family and community factors. For example, rural parents work longer hours but earn less than their urban counterparts; longer hours mean that parents are less available to spend time with children. Moreover, a high percentage of low-wealth, rural children live in single parent families (Dill, 1999). Additionally, rural parents have less access to community resources, less access to high quality preschool child care (Early et al., 2007), and have less time to engage in meaningful conversations with their children. Home influences are especially important because children's vocabulary at school entry is related to their later reading performance (Hart & Risley, 1995). These various

family and community factors combine to place rural students at considerable risk for experiencing early reading difficulty as they begin school.

In addition to family and community factors, school factors may increase the level of risk for rural students, especially students who begin school already at a higher risk of experiencing academic problems than their peers. As noted previously, further complications for students at-risk in rural schools are teacher qualifications and lack of adequate resources to address learning problems early on. For example, while rural teachers may have more years experience (14.5 years) than their urban and suburban counterparts (13.6 years; Provasnik, KewalRamani, Coleman, Gilbertson, Herring, & Xie, 2007; National Center for Education Statistics, 2007), they may not be certified, and may not have the specialized training in pedagogical approaches that consensus reports on reading such as the National Reading Panel (NRP, 2000) and *Preventing Reading Difficulties in Young Children* (Snow et al., 1998) have shown to be effective for at-risk students. Knowledge of current best practices has the potential to aid teachers in accurately making judgments regarding the needs of students at-risk for early reading difficulty. Lacking such training, teachers may misdiagnose or over identify students, particularly boys, as at risk for early reading difficulty. Research demonstrates that oftentimes, students are referred for reading problems based on gender, poverty status, and behavior (Entwisle et al., 2007).

In summary, due to inadequate resources and lack of professional development opportunities, it is possible that teachers in rural schools are less prepared than their urban and suburban counterparts to make accurate judgments about levels of early reading difficulty. This condition is a cause for concern because students experiencing difficulty learning to read need early and intensive intervention (NRP, 2000). In order to provide this

intervention for at-risk students, it is important for teachers to be able to accurately judge the level of early reading difficulty in order to make the best instructional decisions for each student. Thus the current study will examine the distribution of deficits in phonological awareness, rapid naming, or both across groups of students identified by their teacher to be at lower or higher levels of risk for reading difficulty.

Purpose of Study

The primary purpose of this study was to examine the double-deficit hypothesis in predicting first-grade reading achievement for students attending schools in low-wealth, rural communities. Two indicators alone and in combination of first-grade reading achievement were examined: (1) phonological awareness and (2) rapid naming. Phonological awareness (PA) is defined as the awareness of the sound structure of language in general (Yopp & Yopp, 2000). Rapid naming or Rapid Automatized Naming (RAN) is defined as the ability to accurately recognize and efficiently retrieve phonological information when presented with visual symbols such as objects, colors, letters, or numbers. Double-deficit is defined as a deficit in phonological awareness and a deficit in rapid naming existing co-morbidly.

This study compared entry level reading skills among four groups of first grade students attending schools in low-wealth, rural communities: a group with no early deficits; a group with a single deficit in rapid naming; a group with a single deficit in phonological awareness, and a group with double-deficits. These comparisons were made to explore the hypothesis that deficits in two single deficit subtypes have greater impact and are more profound than a deficit in a single subtype or no deficit.

A second purpose of this study was to examine two issues related to gender. This study examined whether gender would emerge as a predictor of mean reading levels and mean

reading levels within groups. Next, because research on gender differences in early reading difficulty is mixed, one goal of these analyses was to explore whether there was an association between gender and subtype status. While research has shown that boys and girls enter school with comparable scores in reading, over the elementary grades a gap develops (Entwisle et al., 2007). According to Entwisle et al. (2007), the gender gap in reading seems to be most prevalent in students from more "disadvantaged" backgrounds and can be traced to low ratings from teachers and low expectations in school performance from parents. To date, no studies have focused on the gender ratio across levels of deficit status in rural populations. Therefore, little is known about gender ratio in this population.

A final purpose of this study was to examine teachers' ability to accurately group students according to risk status. Since research has established that for students experiencing difficulty learning to read, early and intensive intervention is especially important (NRP, 2000; Torgesen, Rashotte, & Alexander, 2001), it is imperative that teachers have the skills to accurately judge each student's level of risk for early reading difficulty.

Examination of the above hypotheses involved a secondary analysis of data from the Targeted Reading Intervention: A Rural Early Literacy Initiative, under the direction of Dr. Lynne Vernon-Feagans. These data provided a sample of 140 first grade students in two low-wealth, rural counties in North Carolina. For the purposes of the intervention the sample was divided into two categories: 1) students identified by their classroom teacher as high risk, indicated as "Focal" students, and 2) students identified as low risk for reading problems, indicated as "Non-Focal" students. Teachers were not specifically asked to place students in deficit subtype groups as that was not the focus of the study. Included in the data were three measures of Phonological Awareness, one measure of Rapid Naming, and two measures of

early reading skills which were combined to form a composite measure of Basic Reading Skills (BRS). Information was also collected on students' gender and mother's level of education.

In summary, careful examination of the occurrence of deficits in disparate subgroups and combined subgroups of early reading difficulty has the potential to increase understanding and provide salient information necessary to inform teachers working with at-risk students in low-wealth, rural communities. Further, examination of teachers' ability to accurately identify at-risk students within their classroom has the potential to increase understanding and provide salient information necessary to inform administrators organizing early identification and early intervention professional development opportunities for teachers working with at-risk students in low-wealth, rural communities.

Research Questions and Hypotheses

After reviewing the literature and considering what is known about student's acquisition of early reading skills, a number of questions remain unanswered. For the purposes of this study, four questions were addressed. These questions centered on the prevalence and rate of occurrence of deficits in subtypes of early reading difficulty for students in low-wealth, rural communities and the accuracy of teachers' judgment of early reading abilities.

Research Question Related to Subtype Group Status

Are there single- and double-deficits in early reading skills of low wealth, rural elementary students? Based on Wolf and Bowers' double-deficit hypothesis, it was expected that there would be four groups of students in this sample: students with no deficit, students with a deficit in rapid naming only, students with a deficit in phonological awareness only, and students with a double-deficit.

Research Question Related to Gender Ratio

Is there a statistically significant association between gender and subtype groups? Are boys over represented in the double-deficit group?

Due to mixed research findings related to early reading difficulty, no hypothesis was offered; analyses were exploratory.

Research Question and Hypothesis Related to Gender

Will there be subtype by gender differences in basic reading skills?

Hypothesis:

There is some evidence that boys have greater difficulty acquiring early reading skills. Therefore it was expected that boys would have lower mean reading skills scores than girls. Also, it was expected that within single and double-deficit groups boys would have lower mean reading scores than girls.

Research Question and Hypothesis Related to Teachers' Judgment of Risk Status

Will teachers accurately differentiate students at-risk for early reading difficulty from those not at-risk for early reading difficulty?

Hypothesis:

A higher incidence of single and double-deficits would be found among Focal students, those judged by their teachers to be at high risk for reading difficulty, than among Non-Focal students, those judged by their teachers to be low risk for reading difficulty.

CHAPTER III

METHOD

Context of Study

This study involved a secondary analysis of the Targeted Reading Intervention: A Rural Early Literacy Initiative data. The study was part of a larger intervention study being carried out by the National Research Center for Rural Education Support (NRCRES) and funded by the Institute of Education Science (IES) of the U. S. Department of Education. Rural school districts in low-wealth counties with limited access to professional development opportunities were recruited to participate in a two year early literacy intervention study. The districts and participating schools serve economically and ethnically diverse communities composed predominately of African American and European American families. Within each county, schools were randomly selected as Intervention or Control. Although this is not a nationally representative sample, ethnic-minority, single parent, and low socio-economic families are included in the sample.

Data collection for the Targeted Reading Intervention began in the fall of 2005 prior to implementation of the intervention and ended in the spring of 2007 for the first cohort which included three non-Reading First schools. A second cohort which included two Reading First schools was added in year two of the Targeted Reading Intervention study. For the second cohort, entry level data were collected at the beginning of school prior to implementation of the intervention. Only entry level data were included in the analysis because the current

study's foci were the relations among phonological awareness, rapid naming, double-deficit, and entry level reading achievement for students in low-wealth, rural communities. At each school, all kindergarten and first-grade teachers participated in the study.

At the beginning of the school year, each teacher was asked to complete a participant screening form (See Appendix A) for all students in their class. Teachers were asked to bring their literacy assessments to a meeting conducted by a UNC graduate student in which they were directed in the proper procedure for filling out the screening instrument (See Appendix B). They were allowed to use assessments conducted in the first weeks of school, or they could use assessments completed by the student's kindergarten teacher. The form included expectations that the state of North Carolina has identified as appropriate for students in first grade. Teachers were prompted to think about each student in their class and rank all students from lowest to highest performing in literacy based on their literacy assessment. Teachers were further asked to classify each student as to whether the student exceeded, met, or performed below expectations. Teachers were also prompted to identify students who were "challenging," "not English proficient," likely to make "rapid progress," likely to move during the school year, or previously identified for "special education services." Teachers were not asked to place students in one of the deficit subtype groups as this was not a focus of the intervention. Based on information from these screeners, students were dichotomized into Focal (high-risk) or Non-Focal (low-risk) for reading problems. From these dichotomized groups, five high-ranking and five low-ranking students were randomly selected by researchers at the Frank Porter Graham Child Development Institute to participate in the Targeted Reading Intervention study. Teachers were notified to send consent packets home with these children. Additional students were originally selected in the

event a student was not able to obtain parental consent to participate in the study. If one of the original five focal/non-focal students did not return their signed consent form, a consent packet was sent home with one of the additional students from the focal or non-focal pool of potential participants until there were five focal and five non-focal students in each classroom. Only students with a signed parental consent form were able to participate in the study. In Year 2, the same selection procedures were followed for two Reading First schools from a second rural county in North Carolina. As described below, data for the present study were collected prior to any intervention services.

Participants

Targeted Reading Intervention Participants

In Year 1 of the study, 187 kindergarten and first grade students participated in the study. From this group, 94 were first grade students; 39 of these students were focal and 55 were non-focal students, 49 were male and 47 were female students. In Year 2 of the study, 317 students participated in the study, including 130 of the students from the second cohort. From this group, 46 were first grade students, 23 were Focal and 23 were Non-Focal students, 27 were male and 19 were female students. The original sample for this study included 140 first grade students.

Dissertation Study Participants

For the purposes of this study, participants included two cohorts of first grade students from two school districts who participated in a larger intervention study of at risk students in low-wealth, rural communities. The Rural Early Literacy Initiative (RELI)[3] Screener (See Appendix A) was used to identify students participating in the Targeted Reading Intervention

[3] Rural Early Literacy Intervention was the name used in the beginning stages of the study; the name was subsequently changed to Targeted Reading Intervention: A Rural Early Literacy Initiative.

study. A Targeted Reading Intervention staff person conducted a meeting with all participating teachers at each school during the first month of the school year. At this meeting, the Targeted Reading Intervention staff person led the teachers through a step-by-step procedure for completing the screener. Teachers were instructed to list all students in their class from lowest to highest performing in the area of literacy. At the end of the meeting, the Targeted Reading Intervention staff person collected the screeners and brought them back to Chapel Hill for processing.

Using information obtained from the Targeted Reading Intervention screeners all students were dichotomized into one of two groups. Students who the classroom teacher identified as lowest performing in the area of literacy were assigned to the Focal group. Students who the classroom teacher identified as highest performing in the area of literacy were assigned to the Non-Focal group. Targeted Reading Intervention participants were randomly selected from these two dichotomized cohorts of first grade students resulting in a stratified sample.

Although there were 140 first grade students in the Targeted Reading Intervention study not all first grade students were included in the current study. After screening the data, it was observed that six students were not able to complete all of the CTOPP subtests. According to the CTOPP administrator's instructions, testing is discontinued and no score is recorded if the student cannot answer any of the practice items. If the student is able to correctly answer one practice item, then the administrator may begin to administer the test items. Students who the CTOPP administrator determined were not able to complete the subtest after appropriate practice were coded as "N." After consulting with Dr. Vernon-Feagans, it was agreed that students with only one "N" subtest would be included in the study and that these

students would be assigned the lowest possible subtest score. This resulted in a sample of 134 students. On further screening, it was observed that a number of students were at least two standard deviations above the mean for age, and it was determined that these outliers would be eliminated from the sample as well. This left a final sample of 126 students. Thus, participants included all first grade students (N = 83) from all participating schools in Year 1 and all new first grade students (N = 43) from Year 2. Of the 126 participating students, 52% were boys, 48% were girls (See Table 1), 68% were ethnic-minority students (See Table 2) and 32% were non-minority. Students ranged in age from 5.8 to 7.4 years with a mean age of 6.57 years.

Table 1

Summary of Gender of Student

Gender of Student		
Gender	Frequency	Percent
Boy	66	52
Girl	60	48

Table 2

Summary of Race of Student

Race/Ethnic Background of Student		
Gender	Frequency	Percent
American Indian	19	13.57
Black/AA	65	46.43
White/EA	43	30.71
Other	13	9.29

Note. AA = African American; EA = European American.

Measures

The Family Information Questionnaire (See Appendix E) was used to provide demographic information. Multiple measures were used to differentiate deficient students from students who did not exhibit deficiencies. Assessment data from three subtests of the *Comprehensive Test of Phonological Processing (CTOPP)* were used to measure phonological awareness (Wagner, Torgesen, & Rashotte, 1999). The Rapid Naming – Colors subtest of the *CTOPP* was used to measure rapid naming. Assessment data from two subtests of the *Woodcock-Johnson III - Diagnostic Reading Battery (W-JIII-DRB)* was used to measure basic reading skills (Woodcock, Mather, & Scrank, 2004).

Demographics

The Family Information Questionnaire provided information on personal background of child and parent/guardian, including gender, date of birth, ethnicity, and the educational history of parents.

Phonological Awareness measures

The *Elision, Blending Words,* and *Sound Matching* subtests of the *Comprehensive Test of Phonological Processing (CTOPP)* were administered to measure Phonological Awareness (Wagner et al., 1999).

- The *Elision* subtest examines the ability of an individual to hear and manipulate the sounds in spoken words. The student is presented with a word, asked to repeat the word, and then asked to say the word again omitting a specific sound. For example, "Say the word *cat*. Now say it without the /k/." The correct response is *at*.
- The *Blending Words* subtest examines the ability of an individual to integrate and then say whole words after hearing parts (syllables and/or phonemes) of the words. An audiotape is used to present isolated word parts in their proper order. The student is asked to blend the phonemes into a word and then say the word. For example, "What word do these sounds make: /t/-/oi/?" The correct response is *toy*.
- The *Sound Matching* subtest examines the ability of an individual to match sounds. The student is presented with a word and is then asked to identify a word with the same beginning or ending sound from a group of four orally presented

words. For example, “Which word starts with the same sound as *pan*? *Pig, hat,* or *cone*?” The correct response is *pig*.

- *Phonological Awareness Composite Score:* The Elision, Blending Words, and Sound Matching subtests’ scores were combined to create a composite score which was used to measure phonological awareness. The score was derived by adding the three subtest standard scores and converting the sum to a composite score using the table provided in Appendix B of the Examiner’s Manual. Deficiency in phonological awareness was determined by a composite score that fell at or below the 35% for national norms.

The CTOPP Phonological Awareness Composite Score (PACS) provides an assessment of children's phonological awareness capabilities. It measures an individual's awareness and access to the phonological structure of oral language. Wagner et al., (1999) reported test-retest reliability for elision, blending words, sound matching, and PACS of .88, .88, .83, and .79 respectively for students aged 5 to 7.

Rapid Naming Measure

One measure of rapid naming was used, the *Rapid Color Naming* subtest of the *Comprehensive Test of Phonological Processing (CTOPP)* (Wagner et al., 1999). The CTOPP provides an assessment of children's rapid naming capabilities. It measures an individual's efficient retrieval of phonological information from long-term or permanent memory, as well as the examinee's ability to execute a sequence of operations quickly and repeatedly. The *Rapid Color Naming* task uses a continuous naming paradigm in which students are presented with a printed page with randomly arrayed colors in rows or columns and asked to name the colors as quickly as possible while the examiner times the

performance. Rapid naming measures rate of access for phonological information in long term memory. Higher scores on rapid naming tasks represent poorer rapid naming ability. Conversely, lower scores on rapid naming tasks represent stronger rapid naming ability, which might contribute to an ability to acquire more knowledge of the phonological structure of words. Assessment of the construct of rapid naming was completed using the Color Naming (CN) subtest of the CTOPP. Wagner, et al. (1999) reported test-retest reliability of .78 for rapid color naming for students aged 5 to 7.

Reliability Information on CTOPP

The CTOPP was normed on a stratified sample of 1,656 individuals, reflecting the demographic status of the US population in 1997. Age and grade equivalents are provided for individuals aged 5 to 24. There are two versions of the CTOPP, one for students in kindergarten and first grade (ages 5 and 6) and the second for students in second grade through college (ages 7 through 24).

The internal consistency reliability of the items on the CTOPP subtests, except rapid naming, was investigated using Cronbach's (1951) coefficient alpha. The internal consistency reliability of the rapid naming subtest was investigated using alternate-form reliability because other measures of internal consistency, such as Cronbach's (1951) coefficient alpha and split-half coefficients, may artificially inflate the reliability estimate and, therefore, are inappropriate for speeded tests (Wagner et al., 1999). Coefficient alphas for the CTOPP subtests, except for the rapid naming subtest where alternate-form coefficients were used, are presented in Table 3 below.

Table 3

Summary of CTOPP Reliability Estimates

	Source of Test Error				Coefficient Alphas	
CTOPP Score	Test/ Retest	Coefficient Alphas Age 5	Age 6	Age 7	Male	Female
Subtests						
Elision	.88	.90	.92	.91	.95	.94
Blending Words	.88	.88	.89	.86	.92	.91
Sound Matching	.83	.93	.93	.92	.94	.93
Rapid Color Naming	.78	.74	.80	.76	.89	.91
Composites						
Ages 5—7 Years						
PA	.79	.95	.96	.95	.96	.96

Note. CTOPP = Comprehensive Test of Phonological Processing; PA = CTOPP phonological awareness composite.

Validity Information on CTOPP

The developers of the CTOPP provide three demonstrations of validity: (1) a detailed discussion of the rationale employed in item selection and subtest format, (2) conventional item analysis and response theory modeling and (3) differential item functioning analysis to detect bias in test items (Wagner et al., 1999). Rathvon (2004) reported that median item

difficulty coefficients were in the acceptable range for all subtests except for the Elision subtest for ages 5 and 6 (R^2 = .03 and .10, respectively). This would indicate that the Elision subtest is too difficult for examinees at these ages and therefore provides minimal useful information. Although the CTOPP developers note that based on information provided in the Examiner's Manual it is reasonable to conclude that the CTOPP is a valid measure of phonological processing, floors[4] for Sound Matching, Elision, and Blending Words are inadequate below ages 7 years, 7 years 6 months, and 7years 6 months respectively. For the Phonological Awareness Composite score, the floor is inadequate below age 6 years 6 months.

Reading outcome measures

The Letter-Word Identification and Word Attack subtests of the *Woodcock-Johnson III - Diagnostic Reading Battery (W-JIII-DRB)* were administered to measure word reading and decoding ability (Woodcock, Mather, & Scrank, 2004).

- The *Letter-Word Identification* (LWID) subtest examines the ability of an individual to decode isolated words of varying difficulty. The first five LWID items involve symbolic learning, or the ability to match a rebus (pictographic representation of a word) with an actual picture of the object. The remaining items measure reading identification skills in identifying isolated letters and words that appear in large type.

[4] Test *floor* refers to the lowest range of standard scores that can be obtained when an examinee answers a few or no items correctly. Tests with adequate floors include a sufficient number of easy items to differentiate effectively among individuals performing in the average, low average, and low ranges and to identify accurately very low performance in the skill being assessed. Tests with inadequate floors yield standard scores that overestimate examinees' level of competency on the skill being assessed and thus fail to indicate the presence of deficits and the need for intervention (Rathvon, 2004).

- The *Word Attack* (WA) subtest examines ability of individuals to decode phonetically regular nonsense words of varying difficulty. This subtest requires the individual to pronounce visually presented words in isolation. The examinee may use decoding skills or sight recognition skills for the task. For both LWID and WA, the words are presented in order of increasing difficulty.
- *Composite Score:* The LWID and WA subtests of the W-J III-DRB comprise the Basic Reading Skills (BRS) composite score and measure sight vocabulary, phonics, and structural analysis. The composite standard score is computer generated using the *W-J III DRB Scoring and Reporting Program.* The use of composite scores for interpretation of W-J III results in higher validity because scores are based on a broad, multifaceted picture of each ability as opposed to a single, narrow ability (Woodcock et al., 2004).

The W-J III uses continuous-year norms to yield normative data at 10 points in each grade. It provides age-based norms by month from ages 24 months to 19 years and by year from ages 2 to 90+ years. The W-J III DRB provides grade-based norms for kindergarten through 12th grade, 2-year College, and 4-year College, including graduate school. Test-retest reliability for LWID and WA for age range 5-18 was .94 and .91 respectively, based on a national sample of 8,818 subjects in over 100 geographically diverse communities in the United States.

Analysis Plan

There were several steps needed to construct an analysis data set from the data available in the Targeted Reading Intervention data sets. First, assessment data from the Woodcock-Johnson III Diagnostic Reading Battery (W-J III DRB; Woodcock et al., 2004) were

converted to a composite score. Second, assessment data from the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999) were converted to a composite score. Third, following the guidelines set out in the Examiner's Manual, students who were able to complete two or more subtests were included in the analyses. Students, who were unable to complete one or more subtest, as determined by the test administrator, were coded as "N" for the incomplete subtest(s). Data were handled as follows:

1. If the student completed all of the three subtests, the three scores were used to compute a composite score as directed in the Examiner's Manual.
2. If the student completed two subtests, but received an "N" for the third subtest (indicating the student was not able to complete the test), then the subtest with the "N" score was included by estimating the third score as the lowest possible standard score available. The composite score was based on the sum of the three scores. This procedure for representing missing data was developed by the University of North Carolina-Chapel Hill research team (personal communication Vernon-Feagans, 2007).

Fourth, because double-deficit status is characteristic of a small percentage of the student population in general, the double-deficit group in this sample was expected to be the smallest group. Further, given that the sample size was not sufficiently large to analyze separately, Cohort 1 and Cohort 2 were combined into a single cohort for purposes of analysis. Analyses were performed to determine the comparability of first grade students in Cohort 1 and Cohort 2 based on demographic characteristics. The Chi-Square test was used

to compare the categorical variables gender, race, and mother's level of education. One-Way ANOVA was used to compare the continuous variable age.

For continuous data, the mean, median, standard deviation, range, skewness and kurtosis were used to describe the distribution. Histograms with normal distributions imposed and measures of skewness and kurtosis were used to assess normality. For categorical data, frequency distributions and bar charts were used.

Analytic Strategy for Hypotheses Testing

The goal of this dissertation study was to explore four research questions and three research hypotheses regarding the prevalence of deficits in subtypes of early reading difficulty for students in rural, low-wealth communities and the accuracy of teachers' judgment of students' early reading ability. Multiple statistical analyses were necessary to explore the different questions addressed in this study. Explanations of the planned analyses are discussed independently for each hypothesis.

CHAPTER IV

RESULTS

Preliminary Analyses

The results of the preliminary analysis indicated that the two cohorts were not significantly different with regard to age F (1, 125) = 0.498, p = 0.482 and gender χ^2 (1, N = 126) = 1.710, p = 0.191, Φ = -0.12. However, Cohort 1 and Cohort 2 were different with regards to Ethnicity χ^2 (3, N = 126) = 13.68, p = 0.003, Cramér's V = 0.33, and Mother's Level of Education χ^2 (7, N = 123) = 15.07, p = 0.035, Cramér's V = 0.35. Follow-up pairwise comparisons were conducted to evaluate the difference among the category proportions for Ethnicity and Mother's Level of Education, respectively. The Holm's Sequential Bonferroni Method (Holm, 1979) was used to control for Type I Error for all pairwise comparisons. The Holm procedure, which is considered more powerful than the Bonferroni, uses a graduated form of the Bonferroni method. *Probability-values* are ranked from smallest to largest with the smallest p-value representing the most significant test result. Starting with the smallest p-value, each value is tested until a non-significant result is obtained. Thus, the current test and any subsequent test are not significant while all previous tests are considered statistically significant.

For Ethnicity, since Cohort 1 had 17 American Indian students and Cohort 2 did not have any American Indian students, the only pairwise comparisons that were significantly different were between the American Indian group and the African American group $p_{1<} \alpha_1$ (.000 < .008), the American Indian group and the European American group $p_2 < \alpha_2$ (.002 <

.01), and the American Indian group and the Other group $p_3 < \alpha_3$ (.005 < .012). Pairwise comparisons for all other Ethnicity groups were not significant. For Mother's Level of Education, the first comparison was not significant, $p_{1>} \alpha_1$ (.007 > .002) (p_1 = .007, α_1 = .002) therefore, there is no evidence that there are differences between means at the .05 level. As a result, the null hypothesis cannot be rejected and all comparisons are nonsignificant (See Appendix C). A summary of the demographic characteristics of Cohort 1 and Cohort 2 is available in Table 4.

Table 4

Demographic Characteristics of Cohort 1 and Cohort 2

Characteristic		Cohort 1 (n = 83) % within cohort	Cohort 2 (n = 43) % within cohort	Total
Gender				
	Boys	48%	60%	66
	Girls	52%	40%	60
Race				
	Nonminority	28.9%	37.2%	40
	Minority	71.1%	62.8%	86
Ethnicity				
	American Indian	20.5%	0%	17
	African American	46%	46.5%	58
	European American	29%	37.2%	40

Demographic Characteristics of Cohort 1 and Cohort 2

Characteristic	Cohort 1 (n = 83) % within cohort	Cohort 2 (n = 43) % within cohort	Total
Other	05%	16.3%	11
Mother's Level of Education			
Less than 8th Grade	1%	7%	4
8th Grade Graduate	0%	7%	3
Some High School	19%	12%	20
High School Diploma/GED	20%	33%	30
Some College	37%	29%	42
Associate's Degree	12%	10%	14
Bachelor's Degree	9%	2%	8
Graduate Degree	2%	0%	2
Cohort Total	83	43	126

Note. GED = General Educational Development (tests).

Descriptive Analyses

Descriptive analyses (SPSS 15.0) were conducted for the dissertation sample and are available in Table 5. All scores reported are standard scores except for Letter-Word Identification and Word Attack where *W Scores* are reported. Means, standard deviations, medians, skewness, and kurtosis of deficit groups are reported in Table 6.

Table 5

Means, Standard Deviations, and Medians

Variable	N	Mean	Standard Deviation	Median
Elision	126	8.52	3.29	9.00
Blending Words	126	10.68	3.73	11.00
Sound Matching	126	9.13	2.17	9.00
Rapid Color Naming	126	9.38	2.87	10.00
Basic Reading Skills	126	108.66	14.59	110.50
Composite	126	28.51	7.47	29.00
Age	126	6.56	.35	6.54
Letter Word ID*	126	412.79	23.10	410.00
Word Attack*	126	451.19	23.044	459.00

Note. Letter Word ID = Woodcock-Johnson Diagnostic Reading Battery Letter Word Identification subtest.

*W scores are reported.

Table 6

Means, Standard Deviations, Medians, Skewness, and Kurtosis of Deficit Groups

Variable	N	Mean	Standard Deviation	Median	Skewness	Kurtosis
ND	62	116.39	10.983	.650	.033	116.50
RAN	13	111.85	12.368	1.452	-.107	112.00
PA	26	104.00	12.156	-.094	-.102	102.00
DD	25	92.68	11.123	-.162	-.286	94.00
Total	126	108.66	14.599	.004	-.245	110.50

Note. ND = No Deficit; RAN = Rapid Automatized Naming; PA = Phonological Awareness; DD = Double-Deficit.

Research Question One: Within the Targeted Reading Intervention sample, are there single- and double-deficits in early reading skills of low wealth rural elementary students? Based on Wolf and Bowers' double-deficit hypothesis, it was expected that there would be four groups of students in this sample: students with no deficit, students with a deficit in rapid naming only, students with a deficit in phonological awareness only, and students with a double-deficit. To determine whether patterns of deficits varied across students in the sample, I divided the sample into mutually exclusive subgroups. The four deficit conditions were (1) no deficit (ND); (2) deficit in rapid naming (RAN); (3) deficit in phonological awareness (PA); and (4) double-deficit (DD). For the phonological awareness group, the composite score for first grade students for the Blending Words, Sound Matching, and Elision subtests was used to determine deficit status. Students were identified as deficient if their

performance on the CTOPP phonological awareness composite score fell at or below the 35th percentile as compared to national norms as reported in the CTOPP manual. For the rapid naming group the CTOPP rapid naming subtest score was used to determine deficit status. Students were identified as deficient if their performance on the CTOPP Rapid Naming-Colors subtest score fell at or below the 25th percentile as compared to national norms as reported in the CTOPP manual. The 25th percentile was used for rapid naming due to the fact that a score of "8" for this subtest fell at the 25th percentile whereas a score of "9" fell at the 37th percentile. For the double-deficit group, students identified as deficient in phonological awareness and rapid naming were moved to the double-deficit group. This process resulted in the creation of four mutually exclusive subgroups. Table 7 shows the distribution of the four groups within the sample.

Table 7

Distribution of Students by Deficit Groups

Deficit Status	Frequency	Percent
ND	62	(49.2%)
RAN	13	(10.3%)
PA	26	(20.6%)
DD	25	(19.8%)

Note. ND = No Deficit; RAN = Rapid Automatized Naming; PA = Phonological Awareness; DD = Double-Deficit.

Research Question Two: Is there a significant association between gender and subtype groups? To determine whether a significant difference in the distribution of the subtypes across gender existed, a two-way contingency table analysis was conducted. The two

variables were gender with two levels (boys and girls) and deficit status with four levels (ND, RAN, PA, and DD). Deficit status and gender were not found to be significantly related, Pearson χ^2 (3, N = 126) = 1.474, p = .688, Cramér's V = 0.11. Since the analysis yielded a non-significant chi-square (See Table 8), the data were collapsed across deficit groups and an analysis was run to test for differences in proportions. Results of the analysis indicated that 54.5 % of boys exhibited deficits, compared with 46.7 % of the girls were in the deficit group. This difference was not statistically significant, Pearson χ^2 (1, N = 126) = .781, p = .377, Φ = .079.

Table 8

Chi-square Analysis of Deficit Status among Boys and Girls

		Deficit Status					
Variable	*n*	ND	RAN	PA	DD	χ^2	*p*
						1.47	.688
Gender							
Boys	66	30	6	15	15		
Girls	60	32	7	11	10		
Totals	126	62	13	26	25		

Note. ND = No Deficit; RAN = Rapid Automatized Naming; PA = Phonological Awareness; DD = Double-Deficit.

Table 9 shows results for the follow-up test for differences in proportions.

Table 9

Chi-square Analysis of Two Category Deficit Status among Boys and Girls

	Deficit Status				
Variable	*n* (%)	ND (%)	Deficit (%)	χ^2	*p*
				.781	.377
Gender					
Boys	66 (100)	30 (45.5)	36 (54.5)		
Girls	60 (100)	32 (53.3)	28 (46.7)		
Totals	126	62	64		

Note. ND = No Deficit.

Research Question Three: Will there be subtype by gender differences in basic reading skills? It was expected that compared to girls, boys would have lower mean reading scores and lower mean reading scores within single- and double-deficit groups. A 2 x 2 x 2 ANOVA was conducted to evaluate the effects of gender and the four deficit conditions on entry level Basic Reading Skills (BRS) for students in the sample. The dependent variable was BRS and the independent variables were Phonological Awareness and Rapid Naming. The means and standard deviations for entry level BRS as a function of the three factors are presented in Table10.

Table 10

Means and Standard Deviations for Basic Reading Skills as a Function of Gender and Deficit Status

	Boys			Girls			Total	
Deficit Status	*n*	M	SD	*n*	M	SD	M	SD
ND	30	114.83	11.60	32	117.84	10.34	116.39	10.98
RAN	6	109.50	10.88	7	113.86	16.71	111.85	12.36
PA	15	99.47	11.46	11	110.18	10.61	104.00	12.15
DD	15	91.00	12.37	10	95.20	8.95	92.68	11.12

Note. ND = No Deficit; RAN = Rapid Automatized Naming; PA = Phonological Awareness; DD = Double-Deficit.

The results for the Factorial ANOVA (See Table 11) indicated statistically significant main effects for gender $F(1, 118) = 5.66$, $p = .02$, partial $\eta^2 = .04$, phonological awareness subtype $F(1, 118) = 41.3$, $p < .001$, partial $\eta^2 = .26$, and rapid naming subtype $F(1, 118) = 12.24$, $p = .001$, partial $\eta^2 = .09$, but no significant interaction between gender and phonological awareness $F(1, 118) = .649$, $p = .422$, partial $\eta^2 = .00$, no significant interaction between gender and rapid naming $F(1, 118) = .305$, $p = .58$, partial $\eta^2 = .00$, no significant interaction between phonological awareness and rapid naming $F(1, 118) = 2.27$, $p = .13$, partial $\eta^2 = .02$, and no significant interaction between gender, phonological awareness, and rapid naming, $F(1, 118) = .705$, $p = .40$, partial $\eta^2 = .01$. The main effect for phonological awareness indicated that students without this deficit tended to have higher BRS scores than students with a deficit in phonological awareness. The rapid naming main effect indicated that students without this deficit tended to have higher BRS scores than students with a

deficit in rapid naming. The gender main effect indicated that girls tended to have higher entry level BRS scores than boys. The lack of a significant interaction between phonological awareness and rapid naming indicates that the double-deficit group was not significantly more impaired than was expected given the additive influence of the main effects. The finding of significant main effects for phonological awareness and rapid naming indicates that the two types of impairment are separate sources of reading dysfunction.

Table 11

Analysis of Variance for the Effects of Gender and the Four Deficit Conditions on Basic Reading Skills

Source	*df*	F	η	*P*
Corrected Model	7	13.442	.444	.000
Intercept	1	8273.140	.986	.000
Gender	1	5.660*	.046	.019
Phonological	1	41.295*	.259	.000
Rapid_nam	1	12.241*	.094	.001
gender x phonological	1	.649	.005	.422
Gender x rapid_nam	1	.305	.003	.582
phonological x rapid_nam	1	2.276	.019	.134
gender x phonological x rapid_nam	1	.705	.006	.403
Error	118			
Total	126			
Corrected Total	125			

*p < .05.

The primary purpose of this dissertation study was to examine the association of the double-deficit hypothesis with first-grade reading achievement for students attending schools in low-wealth, rural communities. The Bonferroni-Holm Correction was used to control for

Type I error across the pairwise comparisons. The results of this analysis indicate that the deficit groups did indeed follow the hierarchy laid out by Wolf and Bowers (1999) in that the No Deficit group had the highest mean BRS score at the beginning of the school year. The rapid naming group had the second highest mean BRS score. The phonological awareness group had the third highest mean score and the double-deficit group had the lowest mean BRS score.

Research Question Four: Will teachers accurately differentiate students at-risk for early reading difficulty from those not at-risk for early reading difficulty? It was expected that a statistically significantly higher incidence of single and double-deficits would be found among Focal students than among Non-Focal students.

To determine whether a significant difference in the distribution of the deficit subtypes across group status existed, a two-way contingency table analysis was conducted. The two variables were deficit status with four levels (ND, RAN, PA, and DD) and group status with two levels (Focal and Non-Focal). Deficit status and group status were significantly related, Pearson χ^2 (3, N = 126) = 13.119, p = .004, Cramér's V = 0.32. This finding reflects the fact that when teachers identified a student as Non-Focal (low risk), 60% did not have a deficit; however 13% had a deficit in rapid naming, 16% had a deficit in phonological awareness, and 10% had double-deficits. In contrast, when a student was identified as Focal (high risk), 36% did not have a deficit, 7% had a deficit in rapid naming, 26% had a deficit in phonological awareness, and 31% had double-deficits. Therefore, we can conclude that risk status (Focal vs. Non-Focal) was significantly associated with subtype deficit. This would indicate that teachers were not significantly far off in their assessments of students' entry level reading abilities. Table 12 shows the residuals for group status by deficit status.

Table 12

Residuals for Group Status by Deficit Status

Deficit	Non-Focal			Focal		
	Count	Expected	Residual	Count	Expected	Residual
ND	41	33.5	7.5	21	28.5	-7.5
RAN	9	7	2	4	6	-2
PA	11	14	-3	15	12	3
DD	7	13.5	-6.5	18	11.5	6.5

Note. ND = No Deficit; RAN = Rapid Automatized Naming; PA = Phonological Awareness; DD = Double-Deficit.

The largest residuals were found in the No Deficit group and the Double-Deficit group. More Non-Focal students were observed in the No Deficit group than expected if group status and deficit status were unrelated. Similarly, more Focal students were observed in the Double-Deficit group than expected. Therefore, students are being classified by teachers, as should be the case given their deficit status.

CHAPTER V

DISCUSSION

In recent years, the double-deficit hypothesis has gained growing support as a promising marker of early reading disability. Despite an increasing number of studies focusing on the double-deficit hypothesis in various populations none have specifically focused on the low-wealth, rural population. Therefore, using a stratified sample, this study examined the status of entry level reading skills of students in low-wealth, rural communities in order to determine the contribution of single- and double-deficits to early reading ability. Overall, results indicated support for Wolf and Bower's (1999) double-deficit hypothesis in that this study did find Wolf and Bowers' four subgroups in the sample of students from rural, low-wealth communities. Moreover, the four subgroups followed Wolf and Bowers' hierarchical order in that the No Deficit group had the highest Basic Reading Skills mean score, the rapid naming group had the next highest Basic Reading Skills mean score, the phonological awareness group followed the rapid naming group, and the double-deficit group had the lowest Basic Reading Skills mean score. Additionally, this study examined two issues related to gender. First, this study examined whether gender would emerge as a predictor of mean reading levels and mean reading levels within groups. Second, this study examined whether there was an association between gender and subtype status. Finally, this study examined teacher judgment in differentiating students who were at-risk from those not at-risk for early reading difficulty. There has been relatively little empirical research on teacher judgment of

early reading ability as children begin their academic careers. Given the importance of early identification and early intervention, this is an area in need of further research. This study was meant to be exploratory in nature.

Using information obtained from the Rural Early Literacy Initiative (RELI) screening instrument (See Appendix A) all students in the Targeted Reading Intervention (TRI) sample were dichotomized into one of two groups. Students who the classroom teacher identified as lowest performing in the area of literacy were assigned to the Focal group and students identified as highest performing in the area of literacy were assigned to the Non-Focal group. Targeted Reading Intervention participants were randomly selected from these two dichotomized cohorts of kindergarten and first grade students. Five Focal and five Non-Focal students were selected from each kindergarten and first grade classroom to participate in the intervention study.

The first goal of this study was to determine if students in the sample could be sorted into the four deficit groups as stipulated by Wolf and Bowers (1999). Three indicators of first-grade reading achievement were examined: (a) phonological awareness, (b) rapid naming, and (c) double-deficit in phonological awareness and rapid naming. Using data from assessments administered by graduate assessors and based on criteria discussed previously, I was able to sort the students in the sample into the four groups identified by Wolf and Bowers (1999): a group with no early deficits; a group with a single deficit in rapid naming; a group with a single deficit in phonological awareness, and a group with deficits in both skill areas (double-deficits). Of the 126 students in the sample, 49% did not have a deficit, 10% were deficient in rapid naming, 21% were deficient in phonological awareness, and 20% had double-deficits. These findings are similar to previous reports. For example,

Bowers (1995) was able to divide her sample of kindergarten through fourth grade students into the four subgroups. Powell et al. (2007) found similar results in a large sample of typically developing British 7- to 10-year olds. In a replication study of the double-deficit hypothesis, Lovette (1995) found 79% of her sample of reading disabled students fit in a deficit subgroup. In her sample, there were 17 students with phonological awareness deficits, 18 with rapid naming deficits, and 41 with double-deficits. Goldberg, Wolf, Cirino, Morris, & Lovett (1998) in a sample of severely disabled readers found 14% of students had a phonological awareness deficit, 29% had a rapid naming deficit, and 49% had double-deficits.

Consistent with Wolf and Bowers (1999) double-deficit hypothesis and others testing this hypothesis (Jiménez, Hernández-Valle, Rodríguez, Guzmán, Díaz, & Ortiz, 2008; Lovett et al., 2000; McCardle, Scarborough, & Catts, 2001; Vukovic & Siegel, 2006;), students with no deficits demonstrated the highest mean level of performance on entry level reading ability, with a Basic Reading Skills mean score of 116. For students with a single deficit, students with a rapid naming deficit demonstrated the highest mean level of performance on entry level reading ability with a BRS mean score of 112, and students with a phonological awareness deficit demonstrated a lower mean level of performance on entry level reading ability with a score of 104. Students with double-deficits demonstrated the overall lowest mean level of performance on entry level reading ability with a BRS mean score of 93.

As previously discussed, the sample was relatively evenly distributed among boys and girls across all subgroups, and therefore a significant association between gender and subtype status was not found. While not statistically significantly different, there was an upward trend for number of boys as compared to number of girls per group as the level of performance by

subtype decreased. For example, in the No Deficit group 48% were boys and 52% were girls whereas in the double-deficit group 60% were boys and 40% were girls. These findings may reinforce the need for further research focusing on gender differences in the distribution of students across subgroups with larger sample sizes. The small sample of this study restricted power to find statistically significant differences.

Consistent with recent National Assessment of Educational Progress (NAEP) findings, gender did play a significant role in predicting mean reading levels at the entry to school (NAEP, 2007). Across all types of deficit, girls outperformed boys in entry level reading ability. Accordingly, girls in this sample of students from low-wealth, rural communities began school better prepared to learn to read than boys. Previous studies looking at deficit status have failed to consider gender differences within subtype groups. Results of this study suggest that further research looking at gender differences in subprocesses of early reading ability may have the potential to add to our understanding of gender differences in the early stages of reading development.

With regard to teacher judgment, it is important to remember that teachers were not attempting to place students in specific deficit subtype groups as this was not the focus of the larger study from which these data were derived. As previously discussed, teachers were required to complete a screening instrument (See Appendix A) in which they were instructed to rank all students in their class from lowest to highest performing in the area of literacy. These screening instruments were used to identify a sample of students for participation in the intervention study. Low performing students (Focal) were considered the most at-risk and high performing students (Non-Focal) were considered the least at-risk for early reading difficulty.

Theoretically, if teachers were completely accurate in judgment of their students' ability levels, then the No Deficit group would be composed of only Non-Focal students and the three deficit groups (rapid naming, phonological awareness, and double-deficit) would be composed of only Focal students. Results of this study found the composition of all subtype groups to be heterogeneous. Within the No Deficit group 66% were Non-Focal as would be expected; however, 34% were Focal students which would not be expected. Within the rapid naming group 31% were Focal as would be expected; but in this subgroup 69% were Non-Focal which would not be expected. Similarly, within the phonological awareness group 58% were Focal students as would be expected; however, 42% were Non-Focal students which would not be expected.

The high percentage of Non-Focal students in the rapid naming subtype group suggests that teachers did not recognize the potential problems associated with slow rapid naming skills and therefore did not view these students as individuals who might be in need of extra help or who might be at-risk for early reading difficulty. This mistake is easily made especially when the student is an accurate but slow decoder (Wolf, 1999). This finding is particularly important in light of the impact fluency has on comprehension and academic achievement. Therefore, further research is needed in this area.

Additionally, teachers missed 42% of the students with weak phonological awareness skills. This result suggests that teachers in rural, low-wealth communities perhaps lack sufficient knowledge of the foundational skills of early reading especially in the area of phonics (Moats, 1998), because teachers may not have learned to read using phonics and may have been inadequately prepared to teach phonological awareness and phonics in their teacher training program (Lerner & Johns, 2009). To be able to analyze children's confusions

and errors, teachers need to know sounds, spellings, and syllables. The teachers in the rural schools included in this study had a mean of 18 years teaching experience. It is quite possible that the teachers may not have been trained in the most recent approaches to teaching reading.

The double-deficit subtype group included twenty-five students and was composed of 72% Focal students and 28% Non-Focal students. Teachers were best at appropriately identifying students with the greatest need. This finding may be a function of the low ability levels of these students. However, 28% of the students in the double-deficit group were students who the teachers identified as their better students, those they considered to be not at-risk for early reading difficulty. Because all of the students in the double-deficit subtype group were students with a deficit in rapid naming and phonological awareness, it is possible that teachers' lack of knowledge with regard to the role of rapid naming skills may have implications for teachers' ability to recognize who is in the greatest need of assistance and who is not.

In summary, the percentage of students with deficits who were overlooked by the teachers is of concern given the importance of establishing a solid foundation in early reading skills, particularly because research has shown that once students fall behind in reading they rarely catch up (Clay, 1979; Juel, 1988; Snow et al., 1998; Torgesen, 1998; Torgesen & Hudson, 2006) especially in the area of fluency (Schatschneider, et al., 2004). For example, in a study of Florida's Comprehensive Assessment Test (FCAT) Schatschneider, et al., (2004) reported third grade oral reading rate was the "dominant factor in accounting for individual differences in performance on the FCAT" (p. 131; Torgesen & Hudson, 2006). According to Torgesen and Hudson (2006) fluency is especially difficult to remediate in

older struggling readers. For example, in an intensive intervention study of 3rd through 5th grade impaired readers, students made significant gains in decoding, reading accuracy, and reading comprehension. However, reading fluency scores increased by only two percentile points (Torgesen et al., 2001). Further research is needed to replicate these results.

Practical Implications

This study addresses questions that are relevant to early identification and early intervention for students in low-wealth, rural communities. Students who do not appear to benefit from good core instruction have been termed "nonresponders" (McMasters, Fuchs, Fuchs, & Compton, 2003) or "treatment resisters" (Blachman, Ball, Black, & Tangel, 1994; Torgesen et al., 1994). If "nonresponders" or "treatment resisters" are those students impeded by double-deficits in phonological awareness and rapid naming skills, what are the implications for researchers developing assessments to diagnose early reading difficulty? What are the implications for researchers developing interventions and for classroom teachers working with these students?

There are two important implications of this study. First, implications for early identification are significant in that research has shown that early intervention is critical to preventing reading disabilities (NRP, 2000; Snow et al., 1998; Torgesen, 1998; Torgesen et al., 2001). With regard to early identification of students with phonological awareness deficits, over the last three decades researchers have made excellent progress in developing assessments and instructional models that address this area of difficulty (Wolf & Bowers, 1999; Torgesen, 2005; Foorman, 2005). As a result, a wide range of programs designed to address phonological awareness are available. For example, *Early Intervention in Reading,*

Stepping Stones to Literacy, DaisyQuest, and the *Lindamood Phonemic Sequencing (LiPS) Program* are a few of the more widely used programs designed for this purpose. Typically programs are available for purchase and require training which may make them less accessible for teachers in low-wealth, rural communities.

Regarding early identification of students with a rapid naming deficit and students with double-deficits, because current diagnostic assessments do not typically include naming speed measures (Wolf, Miller, & Donnelly, 2000), students with rapid naming deficits may go undetected and thus miss important early intervention. Students with double-deficits will benefit from instructional and intervention models focusing on phonological awareness, but due to the double nature of their deficit status, remediation may be less successful. Therefore it is important to add rapid naming measures to kindergarten and first grade assessment batteries as recommended by Wolf and Bowers (1999). Further, researchers have established that a combination of rapid naming measures in addition to phonological awareness measures provides a stronger prediction for reading ability than phonological awareness measures alone (Catts, 1996). For students with double-deficits, adding rapid naming measures in kindergarten and first grade will facilitate early identification of the students who may be the most difficult to remediate and may need the most intense and earliest intervention available. It is especially important for teachers to understand that students with slow processing and phonological awareness deficits may be their neediest students and may need different types of instruction to address their specific needs.

Research on the nature of remediation of deficits in rapid naming is mixed, with some researchers finding that students continue to improve in fluency (Meyers et al., 1998a) while others finding that fluency is more difficult to remediate in older readers (i.e., third grade;

Torgesen et al., 2001). Because of these inconsistent findings, further research is needed. However, research has demonstrated that early intervention is both more efficient and more effective than later remediation, early identification is especially important for students with rapid naming deficits and double-deficits. Therefore, remediation efforts need to begin as early as possible in order to be the most effective (Shaywitz & Shaywitz, 2004). Currently in North Carolina, fluency is not assessed until January of first grade. Clearly, waiting until midyear of first grade reduces the optimal window of opportunity for remediation for students with deficits in rapid naming and double-deficits.

Second, implications for remediation are important because current interventions focused on the single lens of phonological awareness do not address the specific needs of a rapid naming deficit. More specifically, students with a deficit in rapid naming need interventions that address fluency and automaticity. With regard to early intervention for students with a rapid naming deficit, intervention research needs to focus on the development of fluency in reading subskills and the development of fluency-based models of instruction and intervention. Before interventions can be designed, further research will need to tease out these various sources of naming speed deficits. Wolf and Bowers (1999) conceptualize deficits in rapid naming as "one manifestation of a cascading system of more general processing speed deficits that may affect visual, auditory, and possibly motoric and phonological processing systems." (p. 432). This emphasis on multiple processes in combination with the integration of an array of lower level visual perceptual processes and higher level cognitive and linguistic subprocesses indicate the complexity of rapid naming and the need for further research. Research will need to determine if it is sufficient for fluency instruction to focus on the word level, or if some students may need fluency

instruction at the phoneme level or with the underlying subprocesses of rapid naming such as visual recognition, auditory recognition, or orthographic pattern recognition.

With regard to early intervention for students with double-deficits, because of the rapid naming component in this profile, students with double-deficits need instruction and interventions that address the dual nature of their deficit status and incorporate fluency and automaticity as well as phonological awareness and decoding. Wolf, Miller, and Donnelly (2000) are in the process of developing a fluency-based approach to reading intervention that is designed to supplement phonological awareness instruction. Moreover, due to the focus on the National Reading Panel's five key skills necessary for early reading development, a number of programs designed to address phonological awareness have incorporated fluency instruction into their design. For example, *Reading Recovery* is one program that incorporates work on fluency and automaticity. Other programs incorporating a fluency component include *Ladders to Literacy, PALS, Corrective Reading, Kaplan SpellRead,* and *Start Making a Reader Today* (What Works Clearinghouse: Intervention Report, 2007). All of these programs have been found to have potentially positive effects on fluency. However, several of the programs including a fluency component were found to have no discernible effects on fluency. For example, *Read Naturally* is another program designed to improve reading fluency nevertheless, according to the reading intervention review on the Institute of Education Sciences' What Works Clearinghouse, this program was found to have no discernible effects on fluency. Additionally, a number of activities have been recommended to improve reading fluency such as Repeated Reading where the student re-reads the same passage several times, Supported Reading where the student reads along with a more fluent reader in such activities as Paired Reading (reading same text simultaneously) and Shared

Reading where the teacher reads first then student reads with the teacher, followed by student reading to the teacher. Tape recorded passages provide an alternative to paired-reading (Rasinski & Padak, 2001).

With regard to teacher judgment, if 100% of all students are to be proficient in reading by 2014 as mandated by the No Child Left Behind Act (2001), then all teachers need to be very accurate in their judgment of students' early reading ability. In order to achieve this goal, teachers must have the resources and knowledge to accurately identify not only those students in need of extra help with phonological awareness, but also those students who are dysfluent and therefore in need of extra help with fluency and automaticity. This can only be accomplished if teachers have the means to assess all areas of early reading ability and the knowledge of empirically-based early reading instructional models that are designed to remediate an array of skill deficits. Further, teachers will need assistance in matching the deficit with the most appropriate instructional model. Using only the phonological lens to assess students and employing instructional models that only focus on remediating phonological awareness deficiencies will continue to miss students who are deficient in rapid naming and will only partially remediate students with double-deficits.

It is particularly important to study this population with regard to the double-deficit in order to see how students in low-wealth, rural communities compare to their peers nationwide. It was expected that in low-wealth, rural communities, the percentage of students experiencing difficulties learning to read would exceed the NRP's estimate of 17% of the population (NRP, 2000). Because this sample was not representative of a national sample, it was not possible to compare the results of this study to national percentiles. However, it is important to note that the results of this study indicated that 10% of the sample had a deficit

in rapid naming, 21 % had a deficit in phonological awareness, and 20% had double-deficits. Future research needs to further investigate the reading status of students in rural communities, especially those in low-wealth, rural communities.

Limitations and Future Directions

Limitations

There are a number of limitations that need to be discussed. These limitations center on instrumentation and method of sample selection. There are at least two limitations related to instrumentation. First, as part of a larger intervention study, only one measure of rapid naming was available, the CTOPP Rapid Naming – Colors subtest. Therefore, while a widely used and reliable instrument, this study was hindered by a lack of multiple measures of rapid naming to assess the entry- level fluency ability of students. Using multiple measures to assess rapid naming might aid in developing a more comprehensive conceptualization of at-risk students in low-wealth, rural communities especially those at-risk of being deficient in rapid naming and also those at-risk of double-deficits. Moreover, color naming has been shown to be less robust in predicting reading ability than letter naming (Wolf, Bally, & Morris, 1986).

Second, floor[5] effects for the CTOPP subtests resulted in a loss of eight students from the sample, and also may have led to distortions in the distribution of students by subtype groups that would affect interpretation of results. Floors for Sound Matching have been found to be inadequate for students below the age of 7 years and floors for Elision and Blending Words

[5] Test *floor* refers to the lowest range of standard scores that can be obtained when an examinee answers a few or no items correctly. Tests with adequate floors include a sufficient number of easy items to differentiate effectively among individuals performing in the average, low average, and low ranges and to identify accurately very low performance in the skill being assessed. Tests with inadequate floors yield standard scores that overestimate examinees' level of competency on the skill being assessed and thus fail to indicate the presence of deficits and the need for intervention (Rathvon, 2004).

were found to be inadequate below the age of 7 years 6 months. Further, for the Phonological Awareness Composite Score floors were found to be inadequate below the age of 6 years 6 months (Rathvon, 2004). Phonological awareness measures with a lower floor that sampled earlier emerging phonological skills might be more appropriate for students in low-wealth, rural communities particularly in light of the fact that previous studies have suggested that students from low-wealth families arrive at school less well prepared to learn to read (Hart & Risley, 1995). For example, the *Phonological Awareness Literacy Screening* (Invernizzi & Meier, 2002) is a screening, diagnostic, and progress monitoring tool that might be more appropriate.

With regard to limitations due to the method of sample selection, this study employed secondary data; therefore, I was not able to exert any control over the method of selection. However, cutoff scores may have led to an over identification of students for deficit groups especially students in the phonological awareness group and the double-deficit group. Further, parental consent was a condition of participation in the study; therefore, it is possible that students who were the neediest were also those students who were not able to participate due to lack of a signed consent form. Another limitation due to method of sample selection is demographics. Sixty-eight percent of the sample were minority students; therefore the students in this sample represent a group who are not generalizable to the larger population or even to other rural populations due to the nature of the selection process and the distribution of students by minority status.

Additionally, there may be methodological consequences of grouping students into categories on the basis of correlated predictor variables. Specifically, categorizing students into groups based on correlated predictor variables may be associated with distortions in the

distributions of mean scores for each subgroup that affect the interpretation of results. For example, if phonological awareness and rapid naming are positively correlated, then the group with the double-deficit will have lower phonological awareness than the group identified as having just a single deficit in phonological awareness. Therefore, the difference between the double-deficit group and the phonological awareness deficit group might be attributable to the double-deficit group's more profound deficits in phonological awareness instead of their naming speed deficit alone. Stated differently, because of assessment using co-normed measures, results may be due to method bias.

Future Directions

While very little research has focused on students in low-wealth, rural communities, the results of this study indicate the need for further research in this area. This study provides multiple directions for future research. First, consensus reports and researchers typically report the most severely impaired students to be in the two to five percent of the population, yet results of this study indicate that students with double-deficits comprised 20% of this sample. Thus, the rate of incidence of students with double-deficits in this sample of low-wealth rural students is higher than would be expected by chance. Future studies with larger samples might be able to delineate the reading profile of students in low-wealth, rural communities and further determine the rate of incidence of students with double-deficits in this population. Future longitudinal research with low-wealth, rural samples should look at the persistence of double-deficits. Frequent monitoring of student progress over time could provide salient information regarding intensity and type of instruction for students challenged with double-deficits. Second, while teachers were fairly accurate in their judgment of students' abilities, the fact that reading ability provides the foundation for future academic

success and has implications for long term well-being both socially and economically suggests the need for a high rate of accuracy. Early identification of students at risk for reading difficulty as they begin school and early intervention may help level the playing field for students who arrive at school with biologically and experientially based causes of early reading difficulty. One solution that might be beneficial to teachers in low-wealth, rural communities is progress monitoring (a scientifically-based practice used to assess students performance and evaluate the effectiveness of instruction). If teachers were prepared through professional development to implement progress monitoring from the beginning, perhaps fewer students would experience difficulty acquiring early reading skills. This early warning system would alert the teacher that a student might be in need of more intensive instruction; in other words, this could aid teachers in catching students before they fall behind.

Third, this study did not address causes of these deficit subtypes. Future research might consider exploring causal factors such as medical or experiential factors that contribute to the early reading difficulty of students in low-wealth, rural communities. Future studies should include measures of SES as well as measures of contextual factors such as health history (i.e., frequent or prolonged ear infections), attendance data, family literacy environment, and community resources such as access to public libraries and high quality child care. Finally, recent research on the multicomponential nature of rapid naming has begun to shed light on the various component skills involved in rapid naming and how rapid naming is related to reading. However, the many ways in which rapid naming influences reading are still not clear and have been rarely examined over time (Kirby, Parrila, & Pfeiffer, 2003); therefore, additional research is needed on the role of rapid naming abilities in early reading development.

Conclusion

As a model of reading achievement in general, Wolf and Bowers' double-deficit hypothesis has been well documented, however no studies have focused specifically on students in low-wealth, rural communities. In this study all participants were students in low-wealth, rural communities. Results of this study suggest that phonological awareness and Rapid Naming play a significant role in the early reading ability of students in low-wealth, rural communities. Additionally, this study provides support for Wolf and Bowers'(1999) recommendation to include fluency as a measure of early reading ability. Further, the results of this study support previous studies suggesting that there is a group of students who experience difficulty with reading due to a single deficit in rapid naming.

If early identification and early intervention are to be maximally effective, it is important for teachers to have professional development and training not only in identifying students at risk, but also in research based instructional models that target component weaknesses and are effective for students who are struggling with early reading skills. It is important to study teacher judgment of early reading ability in low-wealth, rural communities because of the pivotal role teachers play in meeting the instructional needs of their students. Additionally, this line of research informs researchers of the risk associated with limited access to professional development. Further, administrators need to provide professional development opportunities that address the need for understanding how to administer and interpret assessments and that are founded on evidence-based reading practices such as the Targeted Reading Intervention. Additionally, incorporating progress monitoring, especially for at-risk students, may aid teachers in recognizing when a student is not maintaining appropriate progress with early reading skills.

In summary, based on the results of this study, it appears that low-wealth status and rural status converge to place students at considerable risk of early reading difficulty and the accompanying academic difficulty. It is especially important for teachers, educators, researchers and policy makers to be aware of this fact in order to take appropriate steps to begin to address these issues. Therefore, it is important to continue this line of investigation to determine if these results can be replicated and to begin to develop a more comprehensive conceptualization of students at-risk in low-wealth, rural communities.

APPENDIX A

Participant Screening for First Grade

Below are some of the expectations that the state of North Carolina has listed as appropriate for students in first grade. In thinking about the students in your class, please classify all students in your class that are performing **above** these expectations, those who **meet** these expectations and those performing **below** these expectations.

- Demonstrates effective listening and speaking skills.
- Exhibits letter-sound knowledge.
- Recognizes high-frequency words.
- Uses decoding strategies.
- Uses writing to communicate meaning.
- Spells three and four letter words.
- Demonstrates appropriate letter formation.
- Follows directions.
- Participates in class discussions.
- Exhibits self-control.
- Works independently.
- Seeks help when needed.

Instructions for completing the Participant Screening for Kindergarten:

1. **From your class list, please copy the first and last names of ALL of the students in your class.**
2. **In the column to the right of the child's name please circle as many of the following options that may apply to the particular child:**
   "Ch" if you find the child to be particularly challenging to engage and instruct.
   "NE" if the child does not speak <u>ANY</u> English.
   "S" if the child receives special education services that prevent him/her from participating in classroom assessments.
3. **In the Kindergarten Skills column, please mark an X to indicate whether that child performs BELOW expectations, the child MEETS expectations, or the child performs ABOVE expectations.**

How many students are in your class? _____ In this column, please list the <u>first and last names</u> of ALL students in your class.	**Ch =** This child is **challenging.** **NE =** This child does not speak any English**.** **R =** This child will make **rapid progress.** **M =** This child will **move** during the school year. **S =** This child does not participate in assessments**.**	**First Grade Skills**		
		Below Expectations	**Meets expectations**	**Above expectations**
1.	Ch NE R M S			
2.	Ch NE R M S			
3.	Ch NE R M S			
4.	Ch NE R M S			
5.	Ch NE R M S			
6.	Ch NE R M S			
7.	Ch NE R M S			
8.	Ch NE R M S			
9.	Ch NE R M S			
10.	Ch NE R M S			

		Below expectations	Meets expectations	Above expectations
11.	Ch NE R M S			
12.	Ch NE R M S			
13.	Ch NE R M S			
14.	Ch NE R M S			
15.	Ch NE R M S			
16.	Ch NE R M S			
17.	Ch NE R M S			
18.	Ch NE R M S			
19.	Ch NE R M S			
20.	Ch NE R M S			
21.	Ch NE R M S			
22.	Ch NE R M S			
23.	Ch NE R M S			
24.	Ch NE R M S			
25.	Ch NE R M S			
26.	Ch NE R M S			
27.	Ch NE R M S			
28.	Ch NE R M S			
29.	Ch NE R M S			
30.	Ch NE R M S			

APPENDIX B

RELI Screener Completion

*** Make sure teachers have completed RELI consent forms before beginning the screener. This is generally done during the Summer Institute at experimental schools, but may not have been done in control schools. Teachers must complete consent before filling out the screener.**

The RELI Screener will be used to identify students participating in the RELI study. This screener is used in both experimental and control schools. Teachers will follow the step-by-step procedure outlined below. The RELI staff person conducting the meeting will be responsible for collecting screeners at the end of the meeting. They should be returned to Peg Burchinal or Charity Rogers for immediate processing.

Procedure

*** Teachers should bring literacy assessment data with them to the meeting. Data can be from assessments they have already conducted since the start of school or assessments from the children's previous teacher. Teachers were notified to bring assessment data to this meeting, but may benefit from a gentle reminder to have it with them, before you start the meeting.**

Step One: Introduction and explanation of purpose.

Introduce yourself and explain the purpose of the meeting.
Say:

> **"We are glad to have you participating in our study this year. Today, we would like to have you complete our screener. This screener will be used to identify struggling readers in your class, based on the literacy assessment information you have on your students. We will lead you through the process of completing this screener one step at a time. Please wait to begin completing each step until I have asked you to do so. We anticipate this meeting will take no more than 30 minutes. Once the screeners are completed, our research team will use them to randomly select children we would like to participate in our study. Once they have been selected, we will send home consent forms to request the parents' permission for their child to participate.**
>
> Say this in experimental schools only**…Once consent has been attained, your TRI school consultant, (insert name) will notify you with the names of the five students we would like you to use the TRI with. "**

Step Two: Rank students from lowest to highest.

Pass out blank pieces of scrap paper (perhaps, a NRCRES notepad) to each teacher, along with a pencil. Ask teachers to have their assessment data ready. Teachers will be asked to rank the students in their class from lowest to highest in terms of their literacy knowledge.

Say:

"Now we would like for you to look at data from the most recent literacy assessments you have. These may be assessments conducted in the first weeks of school or, in the case of first grade, may be assessments completed by the child's kindergarten teacher. Using these assessments, on your scrap paper, we would like for you to list <u>all</u> students in your class from <u>lowest to highest performing in the area of literacy</u>.

"In kindergarten, please use information on whether children are able to write their name, identify letters and sounds, and identify rhyming words. In first grade, please base your decisions off of children's letter sound knowledge and tests of blending and segmenting."

"At the top of your paper should be the name of the child in your class who performed <u>the poorest</u> on these assessments. At the bottom of the list should be the name of child who performed <u>the highest</u> on these assessments."

"Please make sure to list children's first and last names."

"Please begin. Let me know if you have questions or need assistance."

Step Three: Transfer list to screener and fill out "Skills" column.
Pass out the screener, with the last column folded over. Teachers will now transfer their class list, with students ranked from lowest to highest onto the screener. They will then check "below", "meets", or "exceeds" expectations next to each child's name.

Say:

"First, please put your name and school's name on the cover page or make sure it is correct if it has already been written for you."

"At the top of the first column, you should see a question that states 'How many students are in your class?' Please answer that question now by writing the number on the small space to the right of the question."

"Now we would like for you to transfer your list of students ranked from lowest to highest onto the screener. Make sure that your children are listed in order from lowest performing to highest performing. Therefore, the lowest performing child should be listed in the space labeled with a number one. PLEASE make sure to include first and last names and make sure to include ALL students in your class. Please transfer your list now."

"Now, next to each child's name, put a check in the box that reflects whether they are performing below grade-level expectations, whether they meet expectations, or are performing "above" grade level expectations. For example, we would expect children listed on <u>lines 1 through 10 or fewer</u>, to have checks indicating they are performing "below" expectations for this time of year. The rest of the class may have checks indicating they "<u>meet</u>" expectations for this time of year. Please do this now. Let me know if you have questions or need assistance."

Step Four: Fill out final column, indicating special characteristics that may help in selecting participants.
Ask teachers to un-fold their screeners to reveal the last column.

Say:

"Now, we will fill out the final column, in which we will ask you to indicate additional information about children in your class that will help us decide whether they would make a good participant for our study. Looking down your list of students, please circle "Ch" next to any student you think is particularly challenging, in terms of behavior. These may be children that have difficulty controlling their behavior during large group instruction or children that have difficulty in getting along with their peers or with adults. You may circle as many children as is applicable. Please do this now."

"Now, looking down your list of students, circle "NE" next to any child that does not speak English. These should be children that have little to no English-speaking ability and have difficulty communicating basic needs in the classroom. You may circle as many children as is applicable. Please do this now."

"Now, looking down your list of students, circle "R" next to any child that you think will make rapid progress in learning to read this year. We can anticipate that many children will make adequate progress in learning to read simply with exposure to the general classroom activities provided. Circle "R" for any child you believe will make rapid progress and will likely <u>not need extra attention or instruction in reading</u>. You may circle as many children as is applicable. Please do this now."

"Now, looking down your list of students, circle "M" next to any child that will move away during the course of the year and will thus not be in your class for the remainder of the year. Only circle "M" for a child if you know <u>for sure</u> they are moving. Please do this now."

"Now, looking down your list of students, circle "S" next to any child who does not complete regular assessments given by your school. For example, circle "S" for a child who does not complete state testing due to requirements stated in the child's IEP. Please do this now."

Step Five: Teachers will check for mistakes and give their screeners to the RELI staff.

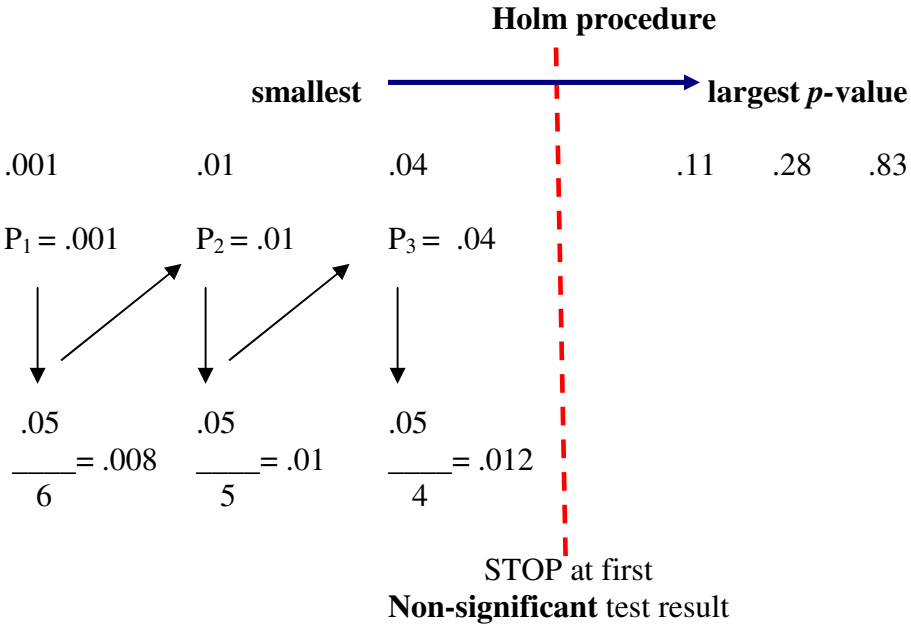
Say:

"That brings us to the end of this process. Please check to make sure you have listed the <u>first and last name</u> of all children in your class. Count to make sure you haven't forgotten any students. Please also make sure you indicated each child's skill level, as well as any of the special characteristics that may apply to them. Once, finished please give your screener to me."

"Thank you for taking the time to complete the screeners. This is very helpful to us."

APPENDIX C

Holm's Sequential Bonferroni Method



If $P_1 \leq \alpha_1$, reject the null hypothesis

Ethnicity:

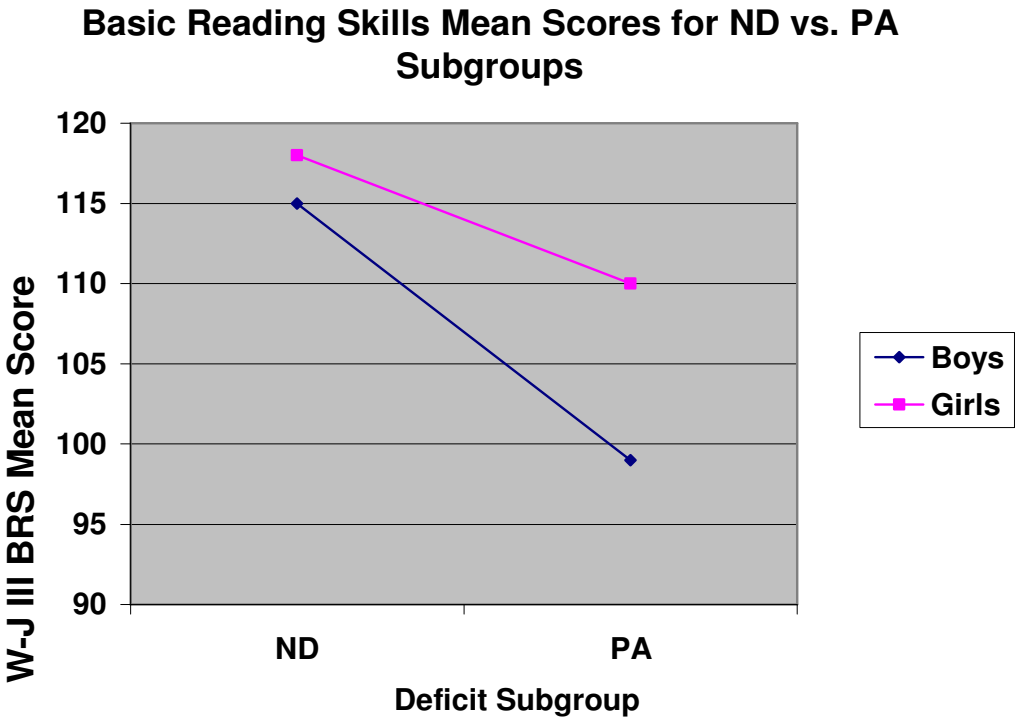
If $P_1 \leq \alpha_1$, reject the null hypothesis

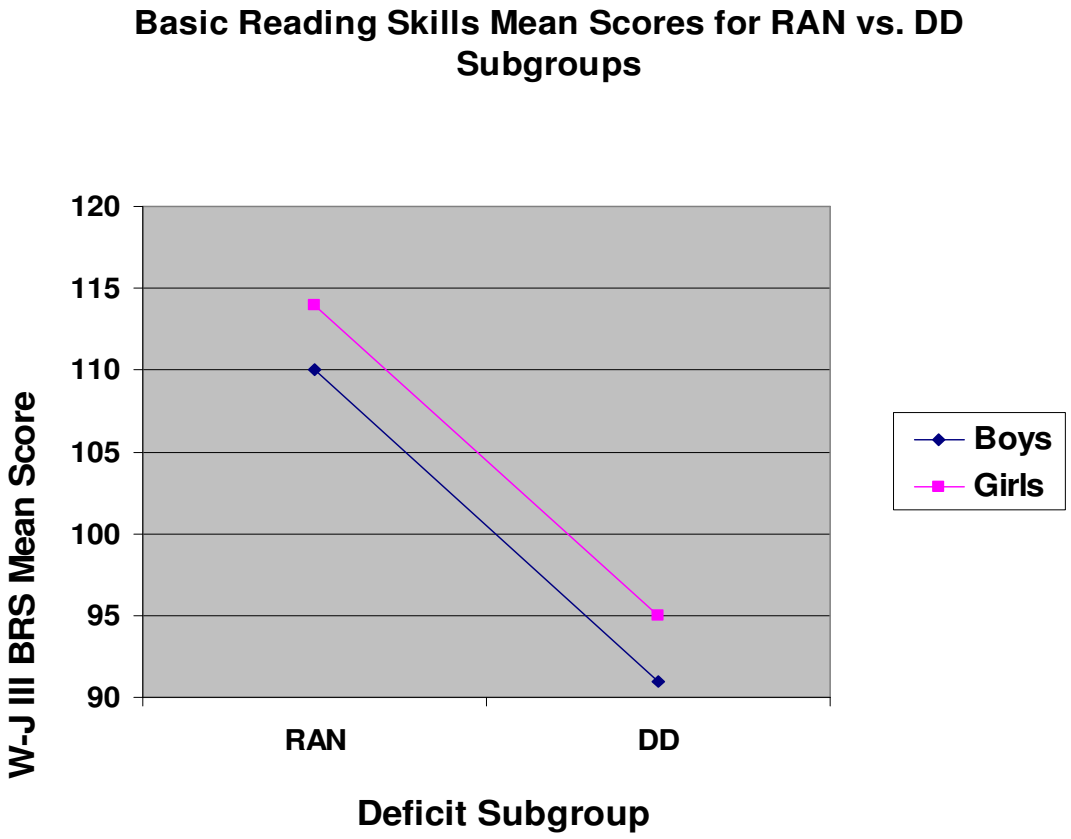
P_1		α_1
.000	$\leq$	.008
P_2		α_2
.002	$\leq$	.01
P_3		α_3
.005	<	.012
P_4		α_4
.069	>	.016

Mother's Level of Education:

P_1		α_1
.007	>	.002

APPENDIX D


Basic Reading Skills Mean Scores for ND vs. PA Subgroups
120
115
110
105
100
95
90
W-J III BRS Mean Score
ND
PA
Deficit Subgroup
Boys
Girls


Basic Reading Skills Mean Scores for RAN vs. DD Subgroups
120
115
110
105
100
95
90
W-J III BRS Mean Score
RAN
DD
Deficit Subgroup
Boys
Girls

APPENDIX E

Family Information Questionnaire

1. **Is this the correct and complete spelling of the study child's name?**

_____

(CIRCLE ONE) 1. Yes 2. No

***If <u>NO</u>, please write the study child's correct and complete name on the line below:**

_____

2. **What is the study child's birth date?** _____/_____/_____
MM DD YYYY

3. **What is your name?**

_____

4. **What is your relationship to this child? (CIRCLE ONE)**

1. Biological Mother 2. Adoptive Mother 3. Biological Father
4. Adoptive Father 5. Foster Mother 6. Foster Father
7. Grandmother 8. Grandfather
9. Other (SPECIFY) _____

5. Please provide contact information so that we can keep you updated on your child's participation.

Phone: _____

Cell Phone: _____

Mailing Address: _____

_____

_____

Email: _____

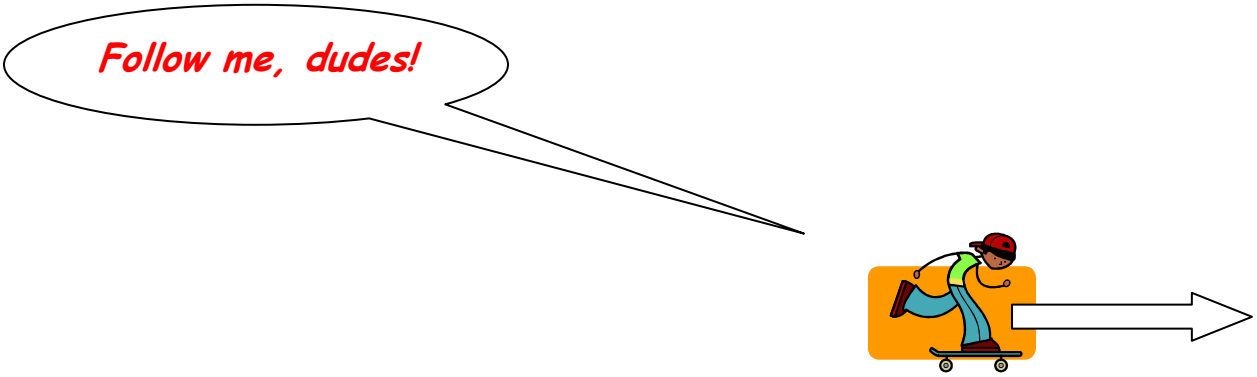
6. **Please provide the name and phone number of someone who might help us get a hold of you in case you move.**

Name: _____

Phone: _____

Relationship to you: _____

THIS INFORMATION WILL BE STORED IN A LOCKED CABINET AT THE UNIVERSITY OF NORTH CAROLINA IN CHAPEL HILL



7. **Is the study child a Boy or Girl? (CIRCLE ONE)**

1. Boy  2. Girl 

8. **How would you describe the study child's race? (CIRCLE ONE)**

1. American Indian
2. Black/African American
3. Asian
4. White/European American
5. Other (SPECIFY) _____

9. **Circle all of the people who live in the same home as the study child.**

1. Mother
2. Father
3. Adoptive Mother
4. Adoptive Father
5. Stepmother
6. Stepfather
7. Grandmother (how many)____
8. Grandfather (how many) ____
8. Aunt (how many) _____
9. Uncle (how many) _____
10. Sisters (how many) _____
11. Brothers (how many) _____
12. Other female adult (how many) _____
13. Other male adult (how many) _____

10. **Are the study child's parents married? (CIRCLE ONE)**

1. YES
2. NO

Just one more to go!

11. **What is the highest education level you have completed? (CIRCLE ONE)**

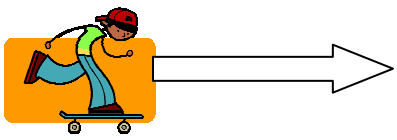
1. Less than 8th Grade
2. Some college
3. 8th Grade Graduate
4. Associates degree
5. Some high school
6. Bachelor's degree
7. High school diploma or GED
8. Graduate degree
9. Not Sure
10. Other (specify) _____

12. **If you *<u>are not</u>* the study child's mother, then what is the highest education level the study child's MOTHER completed? (CIRCLE ONE)**

1. Less than 8th Grade
2. Some college
3. 8th Grade Graduate
4. Associates degree
5. Some high school
6. Bachelor's degree
7. High school diploma or GED
8. Graduate degree
9. Not Sure
10. Other (specify) _____

13. **If you *<u>are not</u>* the study child's father, then what is the highest education level the study child's FATHER completed? (CIRCLE ONE)**

1. Less than 8th Grade
2. Some college
3. 8th Grade Graduate
4. Associates degree
5. Some high school
6. Bachelor's degree
7. High school diploma or GED
8. Graduate degree
9. Not Sure
10. Other (specify) _____



Thank You!!!

Please return to your child's teacher in the envelope provided.

APPENDIX F

Glossary

Definition of Reading Terms

Alphabetic Principle

The understanding that speech can be separated into phonemes and phonemes can be mapped onto graphemes (Blachman, 1997).

Automaticity

The ability to translate letters-to-sounds-to-words fluently, effortlessly (LaBerge and Samuels, 1974).

Comprehension*

The active and intentional thinking in which the meaning is constructed through interactions between the text and the reader (Durkin, 1973). Comprehension is also viewed as the "essence of reading" (Durkin, 1993).

Decoding

The use of individual phonemes to identify and combine constituent sounds to read words in text. Fluent decoding is considered a hallmark of skilled reading (Moats, 1998).

Fluency*

Automaticity of underlying subskills of reading (LaBerge & Samuels, 1974) which allows the reader to read a text accurately, quickly, and with proper expression and comprehension. Because fluent readers do not have to concentrate on decoding words, they can focus their attention on gaining meaning from text.

Lexical processes

Semantic processes, phonological access and retrieval processes. Thought to involve mapping orthographic-to-phonological whole word representations.

Motor commands

Translate phonological information into an articulated name or label.

Orthographic Skill

The ability to represent linguistic information in writing.

Orthography

A method of representing a language or the sounds of language by written symbols.

Phonemic Awareness*

The ability to hear and manipulate the sounds in spoken words and the understanding that spoken words and syllables are made up of sequences of speech sounds (Yopp, 1992). For example, a beginning reader with phonemic awareness is able to blend the separate sounds of a word to say the word (*/c/ /a/ /t/ – cat*.)

Phonics*

The term "phonics" represents the manner in which individuals use letters to represent speech sounds. Phonics is a form of instruction to cultivate the understanding and use of the alphabetic principle. It emphasizes the predictable relationship between phonemes (the sounds in spoken language) and graphemes (the letters that represent those sounds in written language) and shows how this information can be used to read or decode words.

Phonological Awareness

The awareness of the sound structure of language in general (Yopp & Yopp, 2000).

Phonological Memory

Coding information phonologically for temporary storage in working memory (Wagner et al., 1999).

Phonological Processing

The process of identifying the individual phonemes in words and combining those sounds to identify words (Wagner & Torgesen, 1987).

Rapid Automatized Naming (RAN)

Automatic retrieval of phonological information when presented with visual stimuli (Bowers, 1995).

Semantic representational systems

Semantic representational systems are modeled in terms of semantic knowledge which is knowledge about relations among several types of elements, including words, concepts, and percepts. Processing language requires the retrieval of concepts from memory in response to an ongoing stream of information (Griffiths, Steyvers, & Tenenbaum, 2007). Examining the time that people take to read words and sentences has been one of the most widely used methods for evaluating the contributions of semantic representation to linguistic processing.

Sublexical processes

Grapheme-to-phoneme conversion, phoneme assembly and underlying verbal working memory processes.

Syntactic representational systems

Patterns of formation of sentences or phrases in a language.

Vocabulary*

Word knowledge. Vocabulary refers to the words a reader knows. Listening vocabulary refers to the words a person knows when hearing them in oral speech. Speaking vocabulary refers to the words we use when we speak. Reading vocabulary refers to the words a person knows when seeing them in print. Writing vocabulary refers to the words we use in writing. The ability to understand (receptive) and use (expressive) words to acquire and convey meaning

*National Reading Panel (2000) key component of early reading instruction.

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