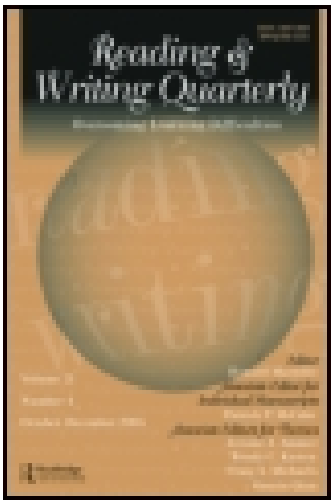

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Single and Double Deficits in Early Readers in Rural, Low-Wealth Communities

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This study used secondary data to test the double-deficit hypothesis that rapid automatized naming (RAN) deficits and phonological awareness (PA) deficits are 2 core reading-related deficits and that students exhibiting deficits in both areas would be the most severely impaired in entry-level reading ability. Specifically, this study investigated the contribution of deficits in RAN and PA separately and in combination to the entry-level reading skills of 126 first-grade students in 2 rural, low-wealth school districts. Deficit subgroup comparisons indicated that students with deficits in RAN and PA existing comorbidly were the most severely impaired in entry-level reading skills. The results of this study support and extend the research on the double-deficit hypothesis and have implications for the early identification of students who may have a learning disability and early intervention to prevent reading disabilities.

Success in school is largely dependent on the ability to read and comprehend text. Research has established that the first few years of school are critical (Adams, 1990; Juel, 1988) for learning to read. Successfully learning to read requires the 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, Burns, & Griffin, 1998). Unfortunately, these high scores are not uniform across all groups of students and regions of America. Longitudinal studies indicate that more than 17% of students will experience reading problems in the first 3 years of school (National Institute of Child Health and Human Development

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[NICHHD], 2000). Students who do not receive early and effective intervention are at risk for future reading disabilities.

Throughout America, a disproportionate number of poor readers are found in rural towns, low-wealth communities, male samples, and minority groups (e.g., Snow et al., 1998). In a study on school readiness, Durham and Smith (2006) found rural status to be associated with lower initial reading scores, especially for certain levels of socioeconomic status. This is likely the case because there are proportionately more poor children in rural areas, with minority children having double the rates of poverty than nonminority children (O'Hare, 2009). Rural students make approximately 20% of the student population nationwide (Beeson & Strange, 2003), and roughly 65% of all rural schools receive Title I funds (Nagle, Hernandez, Embler, McLaughlin, & Doh, 2006). These figures suggest that many children attending rural schools are likely to be at risk for reading disabilities, especially in high-poverty rural areas that are geographically isolated. Early education research indicates that children from low-wealth families are at greater risk of beginning school less well prepared to learn to read (Hart & Risley, 1995; Lee & Burkam, 2002). For children in low-wealth, rural areas, this may be due in part to the fact that rural parents have less access to high-quality preschool child care (Early et al., 2007) and 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). Once in school, these students lag behind in more advanced reading skills (Entwisle, Alexander, & Olson, 2007) and lose more reading skills over the summer than higher wealth peers (Alexander & Entwisle, 1996). For boys from low-wealth families, a significant gender gap in reading ability develops over the elementary grades (Entwisle et al., 2007).

A further complication for students in rural communities is the lower levels of education of teachers (Provasnik et al., 2007), which may contribute to lower academic achievement (Darling-Hammond, 2000). Teacher education is especially challenging for schools in rural communities because of limited resources, difficulty attracting and retaining qualified teachers (Reeves, 2003; Skiba et al., 2008), and limited access to professional development (Vernon-Feagans, Gallagher, & Kainz, 2010). 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., 2010). More important, because of limited access to professional development, teachers in rural communities may lack training in current best practices that would aid them in accurately assessing students' level of early reading difficulty and providing appropriate instruction. 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 (Juel, 1988; Snow et al., 1998).

RECENT RESEARCH ON LEARNING TO READ

Over the past 20 years researchers have gained much knowledge about the process of learning to read. From reading research, it has been well established that phonological awareness (PA), rapid automatized naming, and oral language proficiency mediate success in learning to read (Snow et al., 1998). The National Research Council (1998) and the NICHHD (2000) have identified five domains of reading and related skills instrumental in the acquisition of early reading proficiency: phonemic awareness, phonics, fluency, vocabulary, and comprehension. Thus, skilled reading is the coordination of an array of word reading and comprehension processes that include oral language comprehension and word recognition (Scarborough, 2001). Language comprehension (e.g., background knowledge, vocabulary), which becomes more strategic over time, and word recognition (e.g., PA, decoding), which becomes more automatic with practice, come together to create a knowledge and strategy base that skilled readers use to read fluently. Converging research in early reading has identified poor single-word decoding as a major impediment in learning to read (Shaywitz & Shaywitz, 2004). The basis for single-word decoding is awareness of the phonological structure of the language (Fletcher, Lyon, Fuchs, & Barnes, 2007). Therefore, once PA develops, and the student understands the alphabetic principle, speech can be separated into phonemes and phonemes can be mapped onto graphemes (Blachman, 1997), and then word recognition is often mastered. For students who do not master these concepts early in the reading process, word recognition is delayed, which may result in reading difficulty due to a deficit in PA.

Phonological deficits (Stanovich, 1988) have been identified as the most consistent source of widespread reading problems (Hulme, Snowling, Caravolas, & Carroll, 2005). Accordingly, phonologically based difficulties have been linked to single-word decoding difficulties, which result in reading difficulties. As a result, models of reading instruction that include PA training have been used for students who struggle with early reading. Results indicate that such instruction has improved many at-risk students' skills and early reading (Mathes et al., 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; Torgesen, 2000). For example, O'Connor (2000), in an intervention study designed to improve reading outcomes for students at risk for reading problems entering kindergarten, reported 7% of students with sustained reading problems after intervention. Other investigators have reported that as many as 30% of students at risk for reading disability may not benefit from current instructional models in PA 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 et al., 2002) and contribute to the development of a reading disability. Reading researchers have begun to look at rapid automatized naming (RAN) as another source of difficulty because comprehension is dependent on the ability to decode rapidly and recognize single words automatically (Fletcher et al., 2007). Rapid automatized naming focuses on an individual's information retrieval ability as demonstrated by RAN tasks 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. Furthermore, there needs to be rapid retrieval of information from each system (Foorman, 2005). Fluency develops from reading practice (NICHHD, 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 (NICHHD, 2000), and requires little attention to decoding, therefore freeing attention to focus on meaning (Wolf & Katzir-Cohen, 2001).

A substantial body of research has established that fluent naming of visually presented alphanumeric stimuli is strongly associated with reading achievement (Clarke, Hulme, & Snowling, 2005; Georgiou, Papadopoulos, Fella, & Parrila, 2012; Georgiou, Parrila, & Liao, 2008; Kirby, Parrila, & Pfeiffer, 2003; Lepola, Poskiparta, Laakkonen, & Niemi, 2005; Papadopoulos, Georgiou, & Kendeou, 2009; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004), whereas slow naming speed is characteristic of struggling readers (Heikkilä, Närhi, Aro, & Ahonen, 2009). Furthermore, nonalphabetic stimuli have been shown to predict later reading ability (Lervåg & Hulme, 2009).

THE DOUBLE-DEFICIT HYPOTHESIS (DDH)

Until recently, processes underlying naming speed have been subsumed under PA (Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997) by many reading researchers because of the relationship between decoding and speed. Wolf and Bowers (1999) argued 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). Therefore, students with a double deficit (DD) are likely to be those in the 2% to 5% of students found to be the least responsive to interventions and

most resistant to remediation in the early grades (O'Connor, 2000; Vellutino, Scanlon, Small, & Fanuele, 2006).

Wolf, Bowers, and Biddle (2000) conceptualized RAN 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 RAN represents functions separate from the phonological processing domain for two reasons. First, RAN makes a unique contribution to reading beyond PA because it involves arbitrary associations between print and sound (Ackerman & Dykman, 1993) and taps non-phonological processes important in reading, such as processing speed (Georgiou et al., 2012). Second, readers can be subtyped according to the presence of a single deficit in RAN (accurate, slow decoders) or PA (poor decoders). Furthermore, readers with a deficit in RAN and PA are considered to be in the DD (slow and poor decoders) subtype (Denckla & Cutting, 1999). Bowers and Wolf (1993) focused on the visual and speed components of RAN tasks and posited 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 RAN deficit concerns fluency and automaticity in the acquisition of early reading skills. In order to remediate a deficit in RAN, intervention needs to address fluency and automaticity. Because RAN is a measure of fluency, a deficit in this area cannot be remediated directly; rather, intervention needs to remediate the impact of the RAN deficit on reading (e.g., difficulty developing automaticity and fluency in reading). Although no large-scale studies have tried to explicitly train RAN, repeated reading studies have shown generalizable increases in the speed and accuracy of decoding, especially for younger students (Meyer & Felton, 1999; Ring, Barefoot, Avrit, Brown, & Black, 2012).

This DDH (Wolf & Bowers, 1999), which views RAN as a separate source of reading difficulty, has generated great debate among researchers. For example, Vukovic and Siegel (2006) reviewed the evidence for the DDH and concluded that variability in methodology (i.e., classification of subtypes and definition of reading difficulty) limits conclusions that can be drawn regarding the DDH. As a result of methodological limitations, these researchers found little support for RAN as a separate area of difficulty for students with early reading difficulty. Conversely, Petrill, Deater-Deckard, Thompson, DeThorne, and Schatschneider (2006) in a twin study found that both PA and RAN contributed uniquely to word recognition outcomes. Swanson, Trainin, Necoechea, and Hammill (2003) found similar results in a meta-analysis of the correlational literature on measures of PA, RAN, reading, and related abilities. More recently, Torppa, Georgiou, Salmi, Eklund, and Lyytinen (2012) followed 105 Finnish children with high familial risk for dyslexia and 90 children with low risk from age 3.5 until third grade and found that RAN and PA were separable deficits with different effects on reading outcomes. In another study of 1,006

non-reading Finnish kindergarten students, Torppa et al. (2013) examined the DDH and literacy development and found that PA and RAN were only moderately correlated. Researchers continue to debate whether RAN is a reflection of phonological competence or a separate and independent process, yet both sides acknowledge that RAN is an important predictor of word-level reading growth in the early grades (Brown & Felton, 1990; Compton, 2003; Landerl & Wimmer, 2008; Wagner, Torgesen, & Rashotte, 1994).

Wolf and Bowers (1999) offered two types of evidence in support of their DDH. First, research indicates a weak correlation between PA and RAN. Second, independent, differential contributions exist for PA and RAN to variance in word identification. For example, Manis, Doi, and Bhadha (2000) found RAN to be more strongly related to fluency, whereas PA was more strongly related to decoding skills. Research supports independent roles for PA and RAN in explaining early growth in word reading skills (Lervåg & Hulme, 2009; Wolf et al., 2002). Converging research from longitudinal studies beginning in kindergarten identified PA and RAN in combination as significant predictors of later reading ability (Meyer, Wood, Hart, & Felton, 1998b). In a longitudinal study of the contributions of PA and RAN to reading, Torgesen et al. (1997) found that both PA and RAN make unique contributions to growth in word reading ability from kindergarten to second grade and from first to third grades. Implications are significant for poor readers with RAN deficits and a DD because these readers 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). Research studies looking at single deficits and DDs have focused on urban and suburban students. Much less is known about the prevalence of DDs in students in low-wealth, rural communities.

THE GENDER RATIO

The most recent National Assessment of Educational Progress (2011) results showed that fourth- and eighth-grade girls scored higher, on average, in reading than boys. Researchers historically believed that the incidence of boys experiencing reading difficulties was higher than that of girls (Rutter et al., 2004; Snow et al., 1998). Recent research continues to document weaker early reading skills for boys (Robinson & Lubienski, 2011; Torppa et al., 2013). For example, in a study examining the DDH (Wolf & Bowers, 1999) and literacy development, Torppa et al. (2013) followed the same Finnish students from kindergarten through second grade and found differences in mean levels favoring girls. In addition, these researchers found significant group differences in the gender distribution, with a larger proportion of boys classified with a PA deficit and DD but a larger proportion of girls classified with a RAN deficit or no deficit (ND). Robinson and Lubienski (2011)

investigated gender gaps in reading achievement using data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999, and found that when entering kindergarten, girls have an advantage at all points in the test score distribution. Over the course of the elementary grades, the reading gap shrinks for all except the lowest performing students. Other research findings indicate that the distribution of boys and girls experiencing difficulty acquiring early reading skills may be less disparate than previously believed (Fletcher et al., 2007). 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. Jiménez et al. (2011) conducted a cross-national comparison of dyslexia examining the gender ratio in a transparent orthography but did not find significant cross-national patterns of gender-related significant differences in reading skills among children with dyslexia. 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 et al., 1992). Because of the lack of consistent findings in this area, further research is needed.

PURPOSE OF THE STUDY

The purpose of this study was to examine the DDH in predicting first-grade reading achievement for students attending schools in low-wealth, rural communities. Two indicators of first-grade reading achievement were examined alone and in combination: (a) PA and (b) RAN. *PA* is defined as awareness of the sound structure of language in general (Yopp & Yopp, 2000). *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. *DD* is defined as a deficit in PA and a deficit in RAN existing comorbidly. This study compared entry-level reading skills among four groups of first-grade students: a group with ND, a group with a single deficit in RAN, a group with a single deficit in PA, and a group with DD. These comparisons were made to explore the hypothesis that deficits in two single-deficit subtypes have a greater impact and are more profound than a deficit in a single subtype or ND.

In addition, this study examined whether gender would emerge as a predictor of mean reading levels and mean reading levels within groups. 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. Although 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 the gender ratio in this population.

RESEARCH QUESTIONS AND HYPOTHESES

Three questions were addressed in this study: (a) Are there single deficits and DDs in early reading skills of low-wealth, rural elementary students? Based on Wolf and Bowers's (1999) DDH, it was expected that there would be four groups of students in this sample: students with ND, students with a deficit in RAN only, students with a deficit in PA only, and students with a DD. (b) Is there a statistically significant association between gender and subtype group? Are boys overrepresented in the DD group? Because of mixed research findings related to early reading difficulty, no hypothesis was offered; analyses were exploratory. (c) What are the Subtype×Gender differences in basic reading skills? There is some evidence that boys have greater difficulty acquiring early reading skills. Therefore, it was expected that boys would have lower mean reading scores than girls. Also, it was expected that within single-deficit and DD groups boys would have lower mean reading scores than girls.

METHOD

This study involved a secondary analysis of Targeted Reading Intervention (TRI) entry-level data. The TRI was a 2-year early literacy intervention study conducted by the National Research Center for Rural Education Support. Rural school districts in persistently poor counties with limited access (e.g., due to geographical isolation) to professional development opportunities were recruited to participate in the study. Within each district, schools that were willing to participate were randomly selected as intervention or control schools. The districts and participating schools served economically and ethnically diverse communities composed predominantly of African American and Euro-American families. All schools were Title I schools with greater than 75% of students eligible for free and reduced lunch. School sizes ranged from 357 to 402 students, and minority enrollment ranged from 50% to 75%. Schools were paired and matched based on demographic characteristics (free and reduced lunch, school size, and minority enrollment). In Year 1, four schools were originally in the study; however, after random assignment, changes in administration led to the withdrawal of one school, leaving three schools that included 10 classrooms. In Year 2, there were two new schools from a second school district that included 12 classrooms.

At each school, all first-grade teachers participated in the study. Only entry-level data were included in the analysis because the current study's foci were the relations among PA, RAN, DD, and entry-level reading achievement for students in low-wealth, rural communities.

Participants

Participants included two cohorts of first-grade students (N=126) from two school districts. In Year 1, the first cohort included 83 first-grade students from all participating schools, and in Year 2, the second cohort included 43 new first-grade students from the second school district. Of the 126 participating students, 52% were boys (n=66), 48% were girls (n=60), 68% were ethnic minority students (n=86), and 32% were nonminority students (n=40). Students ranged in age from 5.8 to 7.4 years, with a mean age of 6.57 years. The students came from diverse ethnic backgrounds. Mothers' education averaged just beyond a high school education, with Cohort 2 having a higher percentage of mothers with limited education. Preliminary analysis indicated that the two cohorts were not significantly different with regard to mothers' level of education. Students' demographic information is summarized in Table 1.

TABLE 1 Demographics

Characteristic	Cohort 1	Cohort 2	Total
N	83	43	126
Gender (%)			
Boys	48.00	60.00	66
Girls	52.00	40.00	60
Race (%)			
Nonminority	28.90	37.20	40
Minority	71.10	62.80	86
Ethnicity (%)			
American Indian	20.50	0.00	17
African American	46.00	46.50	58
Euro-American	29.00	37.20	40
Other	0.05	16.30	11
Mothers' level of education (%)			
Less than 8th grade	1.00	7.00	4
8th grade graduate	0.00	7.00	3
Some high school	19.00	12.00	20
High school diploma/GED	20.00	33.00	30
Some college	37.00	29.00	42
Associate's degree	12.00	10.00	14
Bachelor's degree	9.00	2.00	8
Graduate degree	2.00	0.00	2
Age			
M	6.58	6.53	
SD	0.36	0.34	

Note. GED=General Educational Development (tests).

All first-grade students from all participating schools were eligible to participate in the TRI study if they (a) were not diagnosed with a learning disability and (b) spoke English at home. Further eligibility to participate in the TRI study was determined by a two-step process. First, in September, teachers administered the state-mandated literacy assessment in one-on-one sessions with each student in the class. This assessment included PA, phonics, print awareness, and fluency skills. Second, using data from these assessments and their knowledge of their students' reading progress over the first 6 to 8 weeks of school, teachers completed the TRI Screening Instrument for all students in their class. A TRI staff person provided training and led teachers through a step-by-step process for completing the TRI screener. Teachers used the results of their literacy assessments to create a rank-ordered list of all eligible students from lowest to highest performing in literacy. Next, teachers rated students according to whether they were benefitting from regular classroom reading instruction and whether they were below, at, or above grade level. Researchers used information from these screeners to sort students into one of two groups: struggling or not struggling with early reading skills. Students whom the teacher identified as below grade level and as not benefitting from classroom reading instruction were assigned to the struggling group. Students whom the teacher identified as at or above grade level and as benefitting from reading instruction were assigned to the non-struggling group. Researchers randomly selected 10 students per classroom, which included 5 students from the struggling group and 5 students from the non-struggling group, to participate in the study, resulting in a stratified sample. Only those with a signed parental consent form were able to participate.

Procedures

All participating students in Cohort 1 (n=83) and Cohort 2 (n=43) were administered a battery of standardized assessments in early October prior to implementation of the intervention. Assessments were completed in a quiet room at each school by trained graduate students. All assessors had previous experience administering assessments and also participated in a 2-day training that provided the opportunity to practice administering assessments to students not participating in the study. For the purposes of analysis, Cohort 1 and Cohort 2 were combined into a single cohort. Analyses were performed to determine the comparability of students in the two cohorts based on demographic characteristics.

Measures

Phonological processing measures

The Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was designed to evaluate an individual's phonological abilities in three areas: phonological and phonemic awareness,

phonological short-term memory, and rapid automatized naming. The Elision, Blending Words, and Sound Matching subtests were administered (Wagner et al., 1999). The Elision subtest measures the ability to remove phonological segments from spoken words to form other 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. The Blending Words subtest measures the ability to integrate and say whole words after hearing parts (syllables and/or phonemes) of the words. The student is asked to blend phonemes into a word and say the word. The Sound Matching subtest measures the ability to match sounds. The student is presented with a word and asked to identify a word with the same beginning or ending sound from a group of four orally presented words.

The Elision, Blending Words, and Sound Matching subtest scores were combined to create a composite score that was used to measure PA. The CTOPP Phonological Awareness Composite Score provides an assessment of students' PA capabilities. It measures awareness of and access to the phonological structure of oral language. Wagner et al. (1999) reported test–retest reliability for elision, blending words, sound matching, and the CTOPP Phonological Awareness Composite Score of .88, .88, .83, and .79, respectively, for students ages 5 to 7.

Rapid automatized naming measure

The Rapid Color Naming subtest of the CTOPP (Wagner et al., 1999) provides an assessment of RAN capabilities. It measures the retrieval of phonological information from long-term memory, as well as the 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. Higher scores on RAN tasks represent poorer RAN ability. Wagner et al. (1999) reported test–retest reliability of .78 for rapid color naming for students ages 5 to 7.

The internal consistency reliability of the items on the CTOPP subtests, except Rapid Color Naming, was investigated using Cronbach's (1951) coefficient alpha. Coefficient alpha reliabilities for the CTOPP Elision subtest are .92 for males and .91 for females. For Blending Words, the coefficients are .89 for males and .86 for females. Coefficient alpha reliabilities for Sound Matching are .93 for males and .92 for females. Alternate-forms coefficients for the Rapid Color Naming subtest are .80 for males and .76 for females. All phonological tasks have demonstrated predictive validity with measures of reading (Torgesen & Wagner, 1998).

A standard score falling below the 25th percentile for national norms has been recommended by Siegel (2003) and used in other studies of reading disability (e.g., Bowers & Swanson, 1991; McBride-Chang & Manis, 1996;

Shany & Share, 2011) to categorize students into Wolf and Bowers's (1999) subtypes. Using this cutpoint, students were placed into one of the four subtypes. For the PA group, the CTOPP Phonological Awareness Composite Score for the Blending Words, Sound Matching, and Elision subtests was used to determine deficit status. For the RAN group, the CTOPP Rapid Color Naming subtest score was used, and students identified as deficient in PA and RAN were moved into the DD group.

Reading outcome measures

The Letter-Word Identification (LWID) and Word Attack (WA) subtests of the Woodcock–Johnson III Diagnostic Reading Battery were administered to measure word reading and decoding ability (Woodcock, Mather, & Scrank, 2004). The LWID and WA subtests of this battery make up the Basic Reading Skills (BRS) composite score and measure sight vocabulary, phonics, and structural analysis. The 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 with a picture of an object. The remaining items measure reading identification skills in identifying isolated letters and words that appear in large type. The WA subtest examines the ability to decode phonetically regular nonsense words of varying difficulty. This subtest requires the individual to pronounce visually presented words in isolation. Test–retest reliabilities for LWID and WA for the 5–18 age range were .94 and .91, respectively.

RESULTS

Descriptive analyses were conducted and are shown in Table 2. All scores reported are standard scores except for LWID and WA, for which *W* scores are used. Means and standard deviations for the BRS of the deficit groups are reported in Table 3. As was expected, students with ND demonstrated

TABLE 2 Means and Standard Deviations

Variable	*M*	*SD*
Elision	8.52	3.29
Blending Words	10.68	3.73
Sound Matching	9.13	2.17
Rapid Color Naming	9.38	2.87
Basic Reading Skills	108.66	14.59
Composite	28.51	7.47
Letter-Word Identification	412.79	23.10
Word Attack	451.19	23.04

Note. N=126.

TABLE 3 Means and Standard Deviations for Basic Reading Skills of the Deficit Groups

Deficit group	*n*	*M*	*SD*
No deficit	62	116.39	10.983
Rapid automatized naming	13	111.85	12.368
Phonological awareness	26	104.00	12.156
Double deficit	25	92.68	11.123
Total	126	108.66	14.599

the highest mean level of performance on entry-level reading ability, with a mean BRS score of 116. For students with a single deficit, those with a RAN deficit demonstrated the highest mean level of performance, with a BRS score of 112, and students with a PA deficit demonstrated a lower mean level of performance, with a score of 104. Students with a DD demonstrated the overall lowest mean level of performance on entry-level reading ability, with a BRS score of 93.

Based on Wolf and Bowers's (1999) DDH, it was expected that there would be four groups of students in this sample. To determine whether patterns of deficits varied across students in the sample, I divided students into mutually exclusive subgroups using the 25th percentile as a cutoff score. The ND group included 62 students (30 boys, 32 girls). For the deficit subtypes, the RAN group included 13 students (6 boys, 7 girls), the PA group included 26 students (15 boys, 11 girls), and the DD group included 25 students (15 boys, 10 girls).

To determine whether a significant difference existed in the distribution of subtypes across gender, I conducted a two-way contingency table Pearson chi-square analysis. 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 significantly related, $\chi^2(3, N=126)=1.474, p=.688$, Cramér's V=0.11. Because the analysis yielded a nonsignificant chi-square (see Table 4), the data were collapsed across deficit groups and an analysis was run to test for differences in proportions. The two variables were gender

TABLE 4 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		
Total	126	62	13	26	25		

Note. ND=no deficit; RAN=rapid automatized naming; PA=phonological awareness; DD=double deficit.

TABLE 5 Chi-Square Analysis of Two-Category Deficit Status Among Boys and Girls

		Deficit status			
Variable	*n* (%)	No deficit (%)	Deficit (%)	χ^2	*p*
				0.781	.377
Gender					
Boys	66 (100)	30 (45.5)	36 (54.5)		
Girls	60 (100)	32 (53.3)	28 (46.7)		
Total	126	62	64		

(with two levels: boys and girls) and deficit status (with two levels: ND and deficit). Results of the follow-up Pearson chi-square analysis (see Table 5) indicated that 54.5% of boys exhibited deficits compared with 46.7% of girls. This difference was not statistically significant, Pearson $\chi^2(1, N=126)=0.781$, $p=.377$, $\Phi=.079$.

To evaluate the effects of gender and the four deficit conditions on entry-level BRS for students in the sample, I conducted a 2×2×2 analysis of variance. The dependent variable was BRS and the independent variables were PA and RAN. Table 6 shows the means and standard deviations for entry-level BRS as a function of the three factors.

The results for the factorial analysis of variance (see Table 7) indicated statistically significant main effects for gender, PA subtype, and RAN subtype: gender, $F(1, 118)=5.66$, $p=.02$, partial $\eta^2=.04$; PA subtype, $F(1, 118)=41.3$, $p<.001$, partial $\eta^2=.26$; RAN subtype, $F(1, 118)=12.24$, $p=.001$, partial $\eta^2=.09$. However, there was no significant interaction between gender and PA; gender and RAN; PA and RAN; or gender, PA, and RAN: gender and PA, $F(1, 118)=0.649$, $p=.422$, partial $\eta^2=.00$; gender and RAN, $F(1, 118)=0.305$, $p=.58$, partial $\eta^2=.00$; PA and RAN, $F(1, 118)=2.27$, $p=.13$, partial $\eta^2=.02$; gender, PA, and RAN, $F(1, 118)=0.705$, $p=.40$, partial $\eta^2=.01$. The main effect for PA indicated that students without this deficit tended to have higher BRS scores than students with a deficit in PA. The RAN main effect indicated that students without this deficit tended to have higher BRS scores than students with a

TABLE 6 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*
No deficit	30	114.83	11.60	32	117.84	10.34	116.39	10.98
Rapid automatized naming	6	109.50	10.88	7	113.86	16.71	111.85	12.36
Phonological awareness	15	99.47	11.46	11	110.18	10.61	104.00	12.15
Double deficit	15	91.00	12.37	10	95.20	8.95	92.68	11.12

TABLE 7 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	8,273.140	.986	.000
Gender	1	5.660*	.046	.019
Phonological awareness	1	41.295*	.259	.000
Rapid automatized naming	1	12.241*	.094	.001
Gender×Phonological Awareness	1	0.649	.005	.422
Gender×Rapid Automatized Naming	1	0.305	.003	.582
Phonological Awareness× Rapid Automatized Naming	1	2.276	.019	.134
Gender×Phonological Awareness× Rapid Automatized Naming	1	0.705	.006	.403
Error	118			
Total	126			
Corrected total	125			

*$p<.05$.

deficit in RAN. The gender main effect indicated that girls tended to have higher entry-level BRS scores than boys. The lack of a significant interaction between PA and RAN indicated that the DD group was not significantly more impaired than would be expected given the additive influence of the main effects. The finding of significant main effects for PA and RAN indicated that the two types of impairment were separate sources of reading dysfunction.

The primary purpose of this study was to examine the DDH's association 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 indicated that the deficit groups did indeed follow the hierarchy laid out by Wolf and Bowers (1999) in that the ND group had the highest mean BRS score at the beginning of the school year. The RAN group had the second highest mean score. The PA group had the third highest mean score, and the DD group had the lowest mean BRS score. Although the *N*s were small, Levene's test of equality of error variances, which tests the null hypothesis that the error variance of the dependent variable is equal across groups, was not significant, $F(7, 118)=1.14$, $p=.34$.

DISCUSSION

The goal of this study was to contribute to the research literature on students experiencing early reading difficulty in two of the five domains of reading skills instrumental in the acquisition of early reading proficiency. Although researchers continue to debate whether RAN is a reflection of phonological

competence or a separate and independent process, both sides of the debate recognize that RAN makes an independent contribution to reading (McBride-Chang & Manis, 1996). In recent years, the DDH has gained growing support as a promising marker of early reading disability in these two domains of reading skills. Despite an increasing number of studies focusing on the DDH in various populations, no studies have focused on the low-wealth, rural population specifically. Therefore, using a stratified sample, this study examined the status of the entry-level reading skills of students in low-wealth, rural communities in order to determine the contribution of single deficits and DDs to early reading ability. Results indicated support for Wolf and Bowers's (1999) DDH in that this study did find Wolf and Bowers's four subgroups in the sample of students. In addition, 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.

Based on data from assessments, students in the sample were sorted into Wolf and Bowers's (1999) four subtypes. Of the 126 students in the sample, 49% did not have a deficit, 10% were deficient in RAN, 21% were deficient in PA, and 20% had a DD. These findings are similar to previous reports (Kirby et al., 2003; Papadopoulos et al., 2009; Torppa et al., 2013). For example, Torppa et al. (2013) found four subgroups in their sample, which included students with PA deficits (20.1% of the sample), a single RAN deficit (12.1%), DD (9%), and ND (58.7%). Powell, Stainthorp, Stuart, Garwood, and Quinlan (2007) found similar results in a large sample of typically developing British 7- to 10-year olds. Lovett (1995), in a replication study of the DDH, found that 79% of her sample of reading disabled students fit in a deficit subgroup. In her sample, there were 17 students with a PA deficit, 18 with a RAN deficit, and 41 with a DD. Consistent with Wolf and Bowers's DDH and others that have tested this hypothesis (Jiménez et al., 2008; Katzir, Kim, Wolf, Morris, & Lovett, 2008; McCardle, Scarborough, & Catts, 2001), the four subgroups in the present study followed Wolf and Bowers's hierarchical order in that the ND group had the highest BRS mean score, the RAN group had the next highest BRS mean score, the PA group followed the RAN group, and the DD group had the lowest BRS mean score.

As previously discussed, the sample was relatively evenly distributed among boys and girls across all subgroups; therefore, a significant association between gender and subtype status was not found. Although it was not statistically significantly different, there was an upward trend for the number of boys as compared to the number of girls per group as the level of performance by subtype decreased. For example, in the ND group 48% were boys and 52% were girls, whereas in the DD 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 (2011) findings, gender did play a significant role in predicting mean reading levels at school entry. Across all deficit types, girls outperformed boys in entry-level reading ability. Accordingly, girls in this sample began school better prepared to learn to read than boys. Until recently, 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 researchers' understanding of gender differences in the early stages of reading development.

Implications for Practice

This study focuses on two of the five domains of reading skills instrumental in the acquisition of early reading proficiency and addresses questions relevant to early identification and early intervention for students at risk for reading disability. Students who do not appear to benefit from good core instruction have been termed "nonresponders" (McMaster, Fuchs, Fuchs, & Compton, 2003) or "treatment resisters" (Blachman, Ball, Black, & Tangel, 1994) and ultimately may be identified as having a learning disability. There are two important implications of this study. First, if nonresponders or treatment resisters are those students impeded by the most profound deficits, implications for early identification are significant in that research has shown that early intervention is critical to preventing reading disabilities (NICHHD, 2000; Snow et al., 1998; Torgesen, 1998). With regard to the early identification of students with PA deficits, over the past three decades researchers have made excellent progress in developing assessments and instructional models that address this area of difficulty (Torgesen, 2005; Wolf & Bowers, 1999). As a result, a wide range of programs designed to address PA are available. Typically programs are available for purchase and require training, which may make them less accessible for teachers in low-wealth, rural communities.

As for students with a RAN deficit and students with a DD, because current diagnostic assessments do not typically include naming speed measures (Wolf, Miller, & Donnelly, 2000) in early grades, students with RAN deficits may go undetected (Meisinger, Bloom, & Hynd, 2010) and thus miss important early intervention. Students with a DD will benefit from instructional and intervention models focusing on PA, but because of the double nature of their deficit status, remediation may be less successful. Therefore, it is important to add RAN measures to kindergarten and first-grade assessment batteries, as recommended by Wolf and Bowers (1999). Furthermore, researchers have established that a combination of RAN measures and PA measures provides a stronger prediction of reading ability than PA measures alone (Catts, 1996).

For students with a DD, adding RAN measures in kindergarten and first grade will facilitate the early identification of students who may have a learning disability and therefore may be the most difficult to remediate. As a result, these students may need the most intense and earliest intervention available. It is especially important for teachers to understand that students with RAN and PA deficits existing comorbidly may be their neediest students and may need different types of instruction to address their specific needs.

Research on the nature of remediation of RAN deficits is mixed, with some researchers finding that students continue to improve in fluency (Georgiou et al., 2012; Meyer, Wood, Hart, & Felton, 1998a) but others finding that fluency is more difficult to remediate in older readers (i.e., third graders; Ring et al., 2012; Scheltinga, Van Der Leij, & Struiksma, 2010; Torgesen et al., 2001). Because of these inconsistent findings, further research is needed. However, research has demonstrated that because early intervention is both more efficient and more effective than later remediation, early identification is especially important for students with a RAN deficit and DDs. Therefore, remediation efforts need to begin as early as possible in order to be the most effective (Shaywitz & Shaywitz, 2004).

Second, implications for remediation are important because current interventions focused on the single lens of PA do not address the specific needs of a RAN deficit. More specifically, these students need interventions, such as the TRI, that address fluency and automaticity. With regard to early intervention for students with a RAN 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) conceptualized deficits in RAN 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 indicates the complexity of RAN and the need for further research. Research will need to determine whether it is sufficient for fluency instruction to focus on the word level, or whether some students may need fluency instruction at the phoneme level or with the underlying subprocesses of RAN, such as visual recognition, auditory recognition, or orthographic pattern recognition.

With regard to early intervention for students with a DD, because of the RAN component in this profile, students with a DD need instruction and interventions that address the dual nature of their deficit status and incorporate fluency and automaticity as well as PA and decoding. It is particularly important to study this population with regard to the DD in order to see how students in low-wealth, rural communities compare to their peers nationwide. It was expected that in such communities, the percentage of students

experiencing difficulties learning to read would exceed the NICHHD's estimate of 17% of the population (NICHHD, 2000). The results of this study indicated that 10% of the sample had a deficit in RAN, 21% had a deficit in PA, and 20% had a DD. As discussed previously, a disproportionate number of poor readers are found in rural communities. Students living in low-wealth, rural communities appear to be at greater risk for early reading difficulty because of limited access to services and a lack of access by their schools and teachers to professional development opportunities (Provasnik et al., 2007). Future research needs to further investigate the reading status of students in rural communities, especially those living in poverty in rural communities.

Study Limitations

There are a number of limitations that need to be discussed. These limitations center on the method of sample selection and instrumentation. First, because these data were part of a larger study, it was not possible to exert control over the method of sample selection. As a result, minority students made up 68% of the sample; therefore, the students in this sample represent a group that is not generalizable to the larger population or even to other rural populations because of the nature of the selection process and the distribution of students by minority status. Second, one measure of RAN was available, the CTOPP Rapid Naming–Colors subtest, which measures non-alphanumeric stimuli. Alphanumeric naming has been shown to be more robust in predicting reading ability than non-alphanumeric naming (Wolf, Bally, & Morris, 1986). Using alphanumeric and non-alphanumeric measures to assess RAN might aid in developing a more comprehensive conceptualization of at-risk students in low-wealth, rural communities, especially those at risk for being deficient in RAN and also those at risk for DD. Third, there may be methodological consequences of grouping students into categories on the basis of correlated predictor variables (Schatschneider et al., 2004). 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 PA and RAN are positively correlated, then the group with a DD will have lower PA than the group identified as having just a single PA deficit. Therefore, the difference between the DD group and the PA deficit group might be attributable to the DD group's more profound deficits in PA instead of its RAN deficit alone.

Future Directions and Conclusion

Although 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 2%–5% of the population, yet the results of this study indicate that students with a DD made up 20% of this sample. Thus, the rate of incidence of students with a DD in this sample 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 a DD in this population. Future longitudinal research with low-wealth, rural samples should look at the persistence of DDs. Frequent monitoring of student progress over time could provide salient information regarding the intensity and type of instruction for students challenged with a DD. Second, 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 socioeconomic status as well as measures of contextual factors, such as health history (e.g., frequent or prolonged ear infections); attendance data; family literacy environment; and community resources, such as access to public libraries and high-quality child care. Third, recent research on the multicomponential nature of RAN has begun to shed light on the various component skills involved in rapid automatized naming and how it is related to reading. However, the many ways RAN influences reading are still not clear and have rarely been examined over time (Kirby et al., 2003). Therefore, additional research is needed on the role of RAN abilities in early reading development.

As a model of reading achievement in general, Wolf and Bowers's (1999) DDH has been well documented; however, no studies have focused specifically on students in low-wealth, rural communities. Results of this study suggest that PA and RAN play a significant role in the early reading ability of students in such communities. In addition, this study provides support for Wolf and Bowers's recommendation to include fluency as a measure of early reading ability. Furthermore, the results of this study support previous studies (e.g., Araújo, Pacheco, Faísca, Petersson, & Reis, 2010; Torppa et al., 2012) that suggest that there is a group of students who experience difficulty with reading due to a single deficit in RAN.

If the early identification of students with reading disabilities and early intervention are to be maximally effective, then it is important for teachers to have professional development and training in research-based instructional models that target component weaknesses and have been shown to be effective for students who are struggling with early reading skills. In addition, administrators need to provide professional development opportunities that address the need to understand how to administer and interpret assessments, and also in evidence-based reading practices such as the TRI, which focuses on an array of early reading skills, including PA and fluency. Furthermore, 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 for early reading difficulty and the accompanying academic difficulty. It is especially important for teachers, educators, researchers, and policymakers 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 whether these results can be replicated and to begin to develop a more comprehensive conceptualization of students at risk for reading disability in low-wealth, rural communities.

REFERENCES

Ackerman, P. T., & Dykman, R. A. (1993). Phonological processes, confrontational naming, and immediate memory in dyslexia. *Journal of Learning Disabilities, 26*, 597–609.

Adams, M. J. (1990). *Beginning to read*. Cambridge, MA: MIT Press.

Al Otaiba, S., & Fuchs, D. (2002). Characteristics of children who are unresponsive to early literacy intervention—A review of the literature. *Remedial and Special Education, 23*, 300–316.

Al Otaiba, S., & Fuchs, D. (2005). Who are the young children for whom best practices in reading are ineffective? An experimental and longitudinal study. *Journal of Learning Disabilities, 39*, 414–431.

Alexander, K., & Entwisle, D. (1996). Schools and children at risk. In A. Booth & J. F. Dunn (Eds.), *Family-school links: How do they affect educational outcomes?* (pp. 67–89). Mahwah, NJ: Erlbaum.

Araújo, S., Pacheco, A., Faísca, L., Petersson, K., & Reis, A. (2010). Visual rapid naming and phonological abilities: Different subtypes in dyslexic children. *International Journal of Psychology, 45*, 443–452.

Beeson, E., & Strange, M. (2003). *Why rural matters*. Washington, DC: Rural School and Community Trust.

Blachman, B. A. (1997). *Foundations of reading acquisition and dyslexia: Implications for early intervention*. Mahwah, NJ: Erlbaum.

Blachman, B., Ball, E., Black, R., & Tangel, D. (1994). Kindergarten teachers develop phoneme awareness in low-income, inner-city classrooms: Does it make a difference? *Reading and Writing, 6*, 1–17.

Bowers, P., & Swanson, L. (1991). Naming speed deficits in reading-disability: Multiple measures of a singular process. *Journal of Experimental Child Psychology, 51*, 195–219.

Bowers, P. G., & Wolf, M. (1993). Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Reading and Writing, 5*, 69–85.

Brown, I., & Felton, R. (1990). Effects of instruction on beginning reading-skills in children at risk for reading-disability. *Reading and Writing, 2*, 223–241.

Catts, H. W. (1996). Defining dyslexia as a developmental language disorder: An expanded view. *Topics in Language Disorders, 16*, 14–29.

Clarke, P., Hulme, C., & Snowling, M. (2005). Individual differences in ran and reading: A response timing analysis. *Journal of Research in Reading, 28*, 73–86.

Compton, D. L. (2003). Modeling the relationship between growth in rapid naming speed and growth in decoding skill in first-grade children. *Journal of Educational Psychology, 95*, 225–239.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334.

Darling-Hammond, L. (2000). Teacher quality and student achievement. *Education Policy Analysis Archives, 8*(1). Retrieved from http://epaa.asu.edu/ojs/article/view/392/515

Denckla, M. B., & Cutting, L. E. (1999). History and significance of rapid automatized naming. *Annals of Dyslexia, 49*, 29–42.

Durham, R. E., & Smith, P. J. (2006). Nonmetropolitan status and kindergarteners' early literacy skills: Is there a rural disadvantage? *Rural Sociology, 71*, 625–661.

Early, D. M., Maxwell, K. L., Burchinal, M., Alva, S., Bender, R. H., Bryant, D., & Zill, N. (2007). Teachers' education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development, 78*, 558–580.

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (2007). Early schooling: The handicap of being poor and male. *Sociology of Education, 80*, 114–138.

Fletcher, J. M., Lyon, G. R., Fuchs, L. S., & Barnes, M. A. (2007). *Learning disabilities: From identification to intervention*. New York, NY: Guilford.

Foorman, B. (2005, March). *Reading fluency: A cause or consequence of comprehension?* Presentation at the North Carolina Branch of the International Dyslexia Association, Cary, NC.

Georgiou, G., Papadopoulos, T., Fella, A., & Parrila, R. (2012). Rapid naming speed components and reading development in a consistent orthography. *Journal of Experimental Child Psychology, 112*, 1–17.

Georgiou, G., Parrila, R., & Liao, C.-H. (2008). Rapid naming speed and reading across languages that vary in orthographic consistency. *Reading and Writing, 21*, 885–903.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes.

Heikkilä, R., Närhi, V., Aro, M., & Ahonen, T. (2009). Rapid automatized naming and learning disabilities: Does RAN have a specific connection to reading or not? *Child Neuropsychology, 15*, 343–358. doi:10.1080/09297040802537653

Hulme, C., Snowling, M., Caravolas, M., & Carroll, J. (2005). Phonological skills are (probably) one cause of success in learning to read: A comment on Castles and Coltheart. *Scientific Studies of Reading, 9*, 351–365.

Jiménez, J., de la Cadena, C., Siegel, L., O'Shanahan, I., García, E., & Rodríguez, C. (2011). Gender ratio and cognitive profiles in dyslexia: A cross-national study. *Reading and Writing, 24*, 729–747.

Jiménez, J., Hernandez-Valle, I., Rodríguez, C., Guzmán, R., Díaz, A., & Ortiz, R. (2008). The double-deficit hypothesis in Spanish developmental dyslexia. *Topics in Language Disorders, 28*, 46–60.

Juel, C. (1988). Learning to read and write: A longitudinal-study of 54 children from 1st through 4th grades. *Journal of Educational Psychology, 80*, 437–447.

Katzir, T., Kim, Y.-S., Wolf, M., Morris, R., & Lovett, M. (2008). The varieties of pathways to dysfluent reading: Comparing subtypes of children with dyslexia at letter, word, and connected text levels of reading. *Journal of Learning Disabilities, 41*, 47–66.

Kirby, J., Parrila, R., & Pfeiffer, S. (2003). Naming speed and phonological awareness as predictors of reading development. *Journal of Educational Psychology, 95*, 453–464.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8-year follow-up. *Journal of Educational Psychology, 100*, 150–161.

Lee, V., & Burkam, D. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Washington, DC: Economic Policy Institute.

Lepola, J., Poskiparta, E., Laakkonen, E., & Niemi, P. (2005). Development of and relationship between phonological and motivational processes and naming speed in predicting word recognition in Grade 1. *Scientific Studies of Reading, 9*, 367–399.

Lervåg, A., & Hulme, C. (2009). Rapid automatized naming (RAN) taps a mechanism that places constraints on the development of early reading fluency. *Psychological Science, 20*, 1040–1048.

Lovett, M. W. (1995, April). *Remediating dyslexic children's word identification deficits: Are the core deficits of developmental dyslexia amenable to treatment?* Symposium paper presented at the Society for Research in Child Development, Indianapolis, IN.

Manis, F. R., Doi, L. M., & Bhadha, B. (2000). Naming speed, phonological awareness, and orthographic knowledge in second graders. *Journal of Learning Disabilities, 33*, 325–333, 374.

Manis, F. R., & Freedman, L. (2001). The relationship of naming speed to multiple reading measures in disabled and normal readers. In M. Wolf (Ed.), *Dyslexia, fluency, and the brain* (pp. 65–92). Timonium, MD: York.

Mathes, P. G., Denton, C. A., Fletcher, J. M., Anthony, J. L., Francis, D. J., & Schatschneider, C. (2005). The effects of theoretically different instruction and student characteristics on the skills of struggling readers. *Reading Research Quarterly, 40*, 148–182.

Mathes, P. G., Howard, J. K., Allen, S. H., & Fuchs, D. (1998). Peer-assisted learning strategies for first-grade readers: Responding to the needs of diverse learners. *Reading Research Quarterly, 33*, 62–94.

McBride-Chang, C., & Manis, F. R. (1996). Structural invariance in the associations of naming speed, phonological awareness, and verbal reasoning in good and poor readers: A test of the double deficit hypothesis. *Reading and Writing, 8*, 323–339.

McCardle, P., Scarborough, H., & Catts, H. (2001). Predicting, explaining, and preventing children's reading difficulties. *Learning Disabilities Research & Practice, 16*, 230–239.

McMaster, K. L., Fuchs, D., Fuchs, L. S., & Compton, D. L. (2003, December). *Responding to nonresponders: An experimental field trial of identification and intervention methods*. Paper presented at the National Research Center on Learning Disabilities Responsiveness-to-Intervention Symposium, Kansas City, MO.

Meisinger, E. B., Bloom, J. S., & Hynd, G. W. (2010). Reading fluency: Implications for the assessment of students with reading disabilities. *Annals of Dyslexia, 60*, 1–17.

Meyer, M. S., & Felton, R. H. (1999). Repeated reading to enhance fluency. *Annals of Dyslexia, 49*, 283–306.

Meyer, M. S., Wood, F. B., Hart, L. A., & Felton, R. H. (1998a). Longitudinal course of rapid naming in disabled and nondisabled readers. *Annals of Dyslexia, 48*, 91–114.

Meyer, M. S., Wood, F. B., Hart, L. A., & Felton, R. H. (1998b). Selective predictive value of rapid automatized naming in poor readers. *Journal of Learning Disabilities, 31*, 106–117.

Nagle, K. M., Hernandez, G., Embler, S., McLaughlin, M. J., & Doh, F. (2006). Characteristics of effective rural elementary schools for students with disabilities. *Rural Special Education Quarterly, 25*, 3–12.

National Assessment of Educational Progress. (2011). *The nation's report card*. Retrieved from http://nces.ed.gov/nationsreportcard/

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (National Institutes of Health Publication No. 00-4769). Washington, DC: U.S. Government Printing Office.

National Research Council. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academies Press.

O'Connor, R. E. (2000). Increasing the intensity of intervention in kindergarten and first grade. *Learning Disabilities Research & Practice, 15*, 43–54.

O'Hare, W. P. (2009). *The forgotten fifth: Child poverty in rural America*. Durham, NH: The Carsey Institute.

Papadopoulos, T. C., Georgiou, G., & Kendeou, P. (2009). Investigating the double-deficit hypothesis in Greek: Findings from a longitudinal study. *Journal of Learning Disabilities, 42*, 528–547.

Petrill, S. A., Deater-Deckard, K., Thompson, L. A., DeThorne, L. S., & Schatschneider, C. (2006). Genetic and environmental effects of serial naming and phonological awareness on early reading outcomes. *Journal of Educational Psychology, 98*, 112–121.

Powell, D., Stainthorp, R., Stuart, M., Garwood, H., & Quinlan, P. (2007). An experimental comparison between rival theories of rapid automatized naming performance and its relationship to reading. *Journal of Experimental Child Psychology, 98*, 46–68.

Provasnik, S., KewalRamani, A., Coleman, M., Gilbertson, L., Herring, W., & Xie, Q. (2007). *Status of education in rural America* (National Center for Education Statistics Publication No. 2007-040). Washington, DC: National Center for Education Statistics.

Reeves, C. (2003). *Implementing the No Child Left Behind Act: Implications for rural schools and districts*. Napperville, IL: North Central Regional Educational Library.

Ring, J., Barefoot, L., Avrit, K., Brown, S., & Black, J. (2012). Reading fluency instruction for students at risk for reading failure. *Remedial and Special Education, 34*, 102–112.

Robinson, J. P., & Lubienski, S. T. (2011). The development of gender achievement gaps in mathematics and reading during elementary and middle school: Examining direct cognitive assessments and teacher ratings. *American Educational Research Journal, 48*, 268–302.

Rutter, M., Caspi, A., Fergusson, D., Horwood, L., Goodman, R., & Maughan, B. (2004). Sex differences in developmental reading disability: New findings from 4 epidemiological studies. *Journal of the American Medical Association, 291*, 2007–2012.

Scarborough, H. (2001). Connecting early language and literacy to later reading (dis) abilities: Evidence, theory, and practice. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy* (pp. 97–110). New York, NY: Guilford.

Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C. D., & Foorman, B. R. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology, 96*, 265–282.

Scheltinga, F., Van Der Leij, A., & Struiksma, C. (2010). Predictors of response to intervention of word reading fluency in Dutch. *Journal of Learning Disabilities, 43*, 212–228.

Shany, M., & Share, D. (2011). Subtypes of reading disability in a shallow orthography: A double dissociation between accuracy-disabled and rate-disabled readers of Hebrew. *Annals of Dyslexia, 61*, 64–84.

Shaywitz, S. E., & Shaywitz, B. A. (2004). Reading disability and the brain. *Educational Leadership, 61*, 6–11.

Shaywitz, S. E., Shaywitz, B. A., Fletcher, J. M., & Escobar, M. D. (1990). Prevalence of reading disability in boys and girls: Results of the Connecticut longitudinal study. *Journal of the American Medical Association, 264*, 998–1002.

Siegel, L. (2003). Basic cognitive processes and reading disabilities. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 158–182). New York, NY: Guilford.

Skiba, R. J., Simmons, A. B., Ritter, S., Gibb, A. C., Rauch, M. K., Cuadrado, J., & Chung, C. (2008). Achieving equity in special education: History, status, and current challenges. *Exceptional Children, 74*, 264–288.

Snow, C., Burns, M., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academies Press.

Stanovich, K. E. (1988). Explaining the differences between the dyslexic and the garden-variety poor reader: The phonological-core variable-difference model. *Journal of Learning Disabilities, 21*, 590–604.

Swanson, H. L., Trainin, G., Necoechea, D. M., & Hammill, D. D. (2003). Rapid naming, phonological awareness, and reading: A metaanalysis of the correlation evidence. *Review of Educational Research, 73*, 407–440.

Torgesen, J. K. (1998). Catch them before they fall: Identification and assessment to prevent reading failure in young children. *American Educator, 22*, 32–39.

Torgesen, J. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research & Practice, 15*, 55–64.

Torgesen, J. K. (2005). Remedial interventions for students with dyslexia: National goals and current accomplishments. In S. Richardson & J. Gilger (Eds.), *Research-based education and intervention: What we need to know* (pp. 103–124). Boston, MA: International Dyslexia Association.

Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34*, 33–58.

Torgesen, J., & Wagner, R. (1998). Alternative diagnostic approaches for specific developmental reading disabilities. *Learning Disabilities Research & Practice, 13*, 220–232.

Torgesen, J., Wagner, R., Rashotte, C., Burgess, S., & Hecht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth

of word-reading skills in second-to fifth-grade children. *Scientific Studies of Reading, 1*, 161–185.

Torppa, M., Georgiou, G., Salmi, P., Eklund, K., & Lyytinen, H. (2012). Examining the double-deficit hypothesis in an orthographically consistent language. *Scientific Studies of Reading, 16*, 287–315.

Torppa, M., Parrila, R., Niemi, P., Lerkkanen, M., Poikkeus, A., & Nurmi, J. (2013). The double deficit hypothesis in the transparent Finnish orthography: A longitudinal study from kindergarten to Grade 2. *Reading & Writing Quarterly,* 26, 1353–1380.

Vellutino, F. R., Scanlon, D. M., Clark, R., Small, S., Fanuele, D., & Pratt, A. (1992, April). *Gender differences in early reading, language and arithmetic abilities in kindergarten children*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Vellutino, F. R., Scanlon, D. M., Small, S., & Fanuele, D. P. (2006). Response to intervention as a vehicle for distinguishing between children with and without reading disabilities: Evidence for the role of kindergarten and first-grade interventions. *Journal of Learning Disabilities, 39*, 157–169.

Vernon-Feagans, L., Gallagher, K., & Kainz, K. (2010). The transition to school in rural America: A focus on literacy. In J. Eccles & J. Meece (Eds.), *Schooling and development* (pp. 163–184). Mahwah, NJ: Erlbaum.

Vukovic, R. K., & Siegel, L. S. (2006). The double-deficit hypothesis: A comprehensive analysis of the evidence. *Journal of Learning Disabilities, 39*, 25–47.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1994). Development of reading-related phonological processing abilities: New evidence of bidirectional causality from a latent variable longitudinal study. *Developmental Psychology, 30*, 73–87.

Wagner, R., Torgesen, J., & Rashotte, C. (1999). *Examiner's manual the Comprehensive Test of Phonological Processing*. Austin, TX: PRO-ED.

Wolf, M., Bally, H., & Morris, R. (1986). Automaticity, retrieval processes, and reading: A longitudinal study in average and impaired readers. *Child Development, 57*, 988–1000.

Wolf, M., & Bowers, P. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology, 91*, 415–438.

Wolf, M., Bowers, P. G., & Biddle, K. (2000). Naming-speed processes, timing, and reading: A conceptual review. *Journal of Learning Disabilities, 33*, 387–407.

Wolf, M., Goldberg O'Rourke, A., Gidney, C., Lovett, M., Cirino, P., & Morris, R. (2002). The second deficit: An investigation of the independence of phonological and naming-speed deficits in developmental dyslexia. *Reading and Writing, 15*, 43–72.

Wolf, M., & Katzir-Cohen, T. (2001). Reading fluency and its intervention. *Scientific Studies of Reading, 5*, 211–238.

Wolf, M., Miller, L., & Donnelly, K. (2000). Retrieval, Automaticity, Vocabulary, Elaboration, Orthography (RAVE-O): A comprehensive, fluency-based reading intervention program. *Journal of Learning Disabilities, 33*, 375–386.

Woodcock, R. W., Mather, N., & Scrank, F. A. (2004). *Woodcock Johnson III: Diagnostic Reading Battery.* Itasca, IL: Riverside.

Yopp, H. K., & Yopp, R. H. (2000). Supporting phonemic awareness development in the classroom. *Reading Teacher, 54*, 130–143.