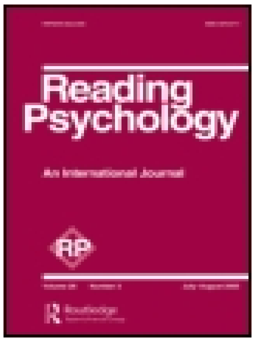

Reading Psychology

ISSN: 0270-2711 (Print) 1521-0685 (Online) Journal homepage: http://www.tandfonline.com/loi/urpy20

Oral Reading Skills of Children with Oral Language (Word-Finding) Difficulties

Diane J. German & Rochelle S. Newman

To cite this article: Diane J. German & Rochelle S. Newman (2007) Oral Reading Skills of Children with Oral Language (Word-Finding) Difficulties, Reading Psychology, 28:5, 397-442, DOI: 10.1080/02702710701568967

To link to this article: http://dx.doi.org/10.1080/02702710701568967

Published online: 06 Nov 2007.

Reading Psychology, 28:397–442, 2007

ISSN: 0270-2711 print / 1521-0685 online
DOI: 10.1080/02702710701568967

ORAL READING SKILLS OF CHILDREN WITH ORAL LANGUAGE (WORD-FINDING) DIFFICULTIES

DIANE J. GERMAN
National-Louis University, Chicago, Illinois, USA
ROCHELLE S. NEWMAN
University of Maryland, College Park, Maryland, USA

We examined how children with and without oral language (word-finding) difficulties (WFD) perform on oral reading (OR) versus silent reading recognition (SRR) tasks when reading the same words and how lexical factors influenced OR accuracy, error patterns, and nature of miscues. Primary-grade students were administered an experimental reading measure. Words were controlled for lexical factors known to influence oral language, such as frequency, lexical neighborhood, familiarity, and phonotactic probability. For learners with WFD, SRR was superior to OR; lexical factors predicted OR success; WF error-patterns emerged in OR; and miscues were higher in frequency, more familiar, and from denser neighborhoods than targets.

The ability to read aloud depends upon both reading/decoding skills and on speaking skills. Despite this fact, much of the research investigating oral reading has focused only on aspects of decoding and has been done in isolation from research on oral language more generally. Yet recent research suggests that it would be appropriate to consider the impact of oral language on oral reading. First, oral language competencies are considered necessary for successful reading (Betourne & Friel-Patti, 2003; Catts & Kamhi, 1999). Second, 50% of the reading-disabled population is thought to have language-based reading problems (Catts, Fey, & Tomblin, 1997). And third, learners with reading difficulties often exhibit oral language difficulties as well, particularly naming or word-finding difficulties (Faust, Dimitrovsky, & Shacht, 2003; Messer, Murphy, & Dockrell, 2004; Murphy, Pollatsek, & Well, 1988; Roth, Speece, & Cooper, 2002; Snyder & Downey, 1995; Swan & Goswami, 1997; Wiig, Zureich, & Chan, 2000; Wolf &

Address correspondence to Diane J. German, 1000 Capital Drive, Wheeling, IL 60090. E-mail: dgerman@nl.edu

Obregón, 1992). Therefore, it seemed meaningful to further study oral language and reading to better understand the language and literacy connection. To this end, the present study investigates one area of oral language, word finding, and its relationship to one specific type of reading, oral reading.

Most investigations of the relationship between oral language and reading have focused on the language skills of learners with reading difficulties (Denckla, 1976). Findings have suggested that many children with reading disorders have difficulties with phonological retrieval (the ability to retrieve stored phonological information; Catts & Hogan, 2003) or have depressed rapid automatic naming skills (Catts, 1989; Denckla & Cutting, 1999; Denckla & Rudel, 1976; Katz, 1986; Manis, Doi, & Bhadha, 2000; Snowling, Wagtendonk, & Stafford, 1988; Wagner, Torgeson, & Rashotte, 1994; Wolf, 1997, 1999). These may in some cases predict developmental dyslexia (Badian, 1998; Wolf, Bally, & Morris, 1986). Further, a "double deficit" reading subtype in which naming-speed deficits and phonological deficits co-occur in children with reading difficulties has been identified, suggesting that lexical access or word-finding may be related to reading disorders in these children (Wolf & Bowers, 1999).

But while many studies have examined the language skills of children with reading difficulties, few have examined the oral reading skills of learners with expressive language difficulties. Yet it would be just these students who may have difficulties when reading orally because of their challenges in oral language. We thus examined the oral reading (OR) skills of learners with known expressive language difficulties, namely word-finding difficulties (WFD). However, we switched the focus from a study of the underlying skills necessary for decoding (phonological awareness and naming speed) to a study of the underlying oral language demands inherent in OR tasks (lexical and phonological retrieval). We ask if learners with word-finding difficulties, because of their oral language challenges, will have difficulty fulfilling the oral retrieval demands inherent in the OR task. In doing so, we contrasted the reading skills of typical learners (TL) and students with word-finding difficulties (WFD) when reading the same words in tasks that do and do not require oral language (oral reading vs. silent reading recognition, SRR). Of interest was to determine if there would be a discrepancy between students' OR and SRR skills of the same words in single-word and story contexts.

We also investigated whether these learners' OR performance would parallel patterns observed in earlier oral language production studies (German & Newman, 2004). If so, it might suggest that children's oral language skills are influencing their OR. To that end, we selected word sets for OR that contained items controlled for specific lexical factors known to influence oral language. We asked: (a) Will children with WFD display a discrepancy between their OR and SSR performance *on the same words* that is different from that of TL students who have not yet learned the reading strategies tested? (b) Will specific lexical factors of words known to influence oral *word-finding* success (word frequency, lexical neighborhood, rated auditory familiarity, and phonotactic probability) also influence learners' OR success? (c) Will oral word-finding error patterns emerge in the OR task? and (d) Will reading miscues be biased by the lexical factors under study? We believe that if we observe a discrepancy between learners' OR and SRR skills on the same words and if lexical factors previously shown to be related to learners' naming performance influence OR success, miscues, and reading error patterns, it would suggest that learners' OR performance may well be related to their oral language (word-finding) skills.

Learners With Word-Finding Difficulties

Word finding refers to the mental activity of selecting or retrieving known words from the lexicon in order to express what you want to say or write. A word-finding difficulty is a disruption in this mental activity, resulting in problems generating words to express one's thoughts. Children with language and learning disabilities tend to have word-finding difficulties (Faust, Dimitrovsky, & Davidi, 1997; German, 1984; Lahey & Edwards, 1999; Larrivee & Catts, 1999; Wiig & Semel, 1984; Wolf & Bowers, 2000). Further, these students' reading and writing skills are often compromised as a result of their difficulties in retrieving verbal labels for printed words (Johnson & Myklebust, 1967; Rubin & Liberman, 1983). Students with lexical-retrieval difficulties respond poorly to phonemic awareness instruction because of difficulties in quickly retrieving phonological codes from long-term memory (Blachman, 1994; Howard, Fuchs, & Mathes, 2001) and clinical reports have stated that students with WFD are often unable to orally read or write words, even though they can recognize a word's correct spelling among choices. These reports motivated our interest in studying the relationship between word-finding abilities and OR skills to better understand the connection between language and literacy.

Lexical Access Model

A functional, architectural model of lexical access by Levelt (1989, 1991; Levelt, Roelofs, & Meyer, 1999) and adapted by German (2000a) can be used to illustrate how, theoretically, oral language and OR might overlap. This model provides a blueprint for lexical access that can be further adapted to apply to OR (German, 2000b, 2000c). Displayed in Figure 1, this model implies that oral language and OR share the same routes in the final production of the word. If this hypothesis is true, difficulties in lexical access could potentially manifest themselves in OR as noted clinically. This lexical access model is further described below. The usefulness of this lexical model for oral language production has been demonstrated in several studies considering the nature of learners' word-finding errors in groups of children with and without word-finding difficulties as well as those with dyslexia (Faust et al., 1997; German & Newman, 2004; Newman & German, 2002).

Lexical Access for Oral Language (Speech)

According to the adapted model, the task of retrieving and producing a word involves 6 stages (see Figure 1). The first three stages can be thought of as a bottom-up (or perceptual) process (Stages 1–3), in which the input from the word leads to the activation of a particular concept for a response; the last three stages can be thought of as a top-down process (Stages 4–6), in which the individual acts to produce the word matching the activated concept. Thus, the 6-stage process begins with a triggering stimulus (or intention to produce a word) and ends with execution of the motor plan for articulation. Specifically, at Stage 1, the triggering stimulus (for example, an open-ended sentence or question) maps onto the input phonological lexicon, which, subsequently, in Stage 2, maps onto the input semantic lexicon, ultimately linking to the conceptual structure (Stage 3) or underlying concepts associated with the triggering stimulus (Bierwisch & Schreuder, 1991). It is at

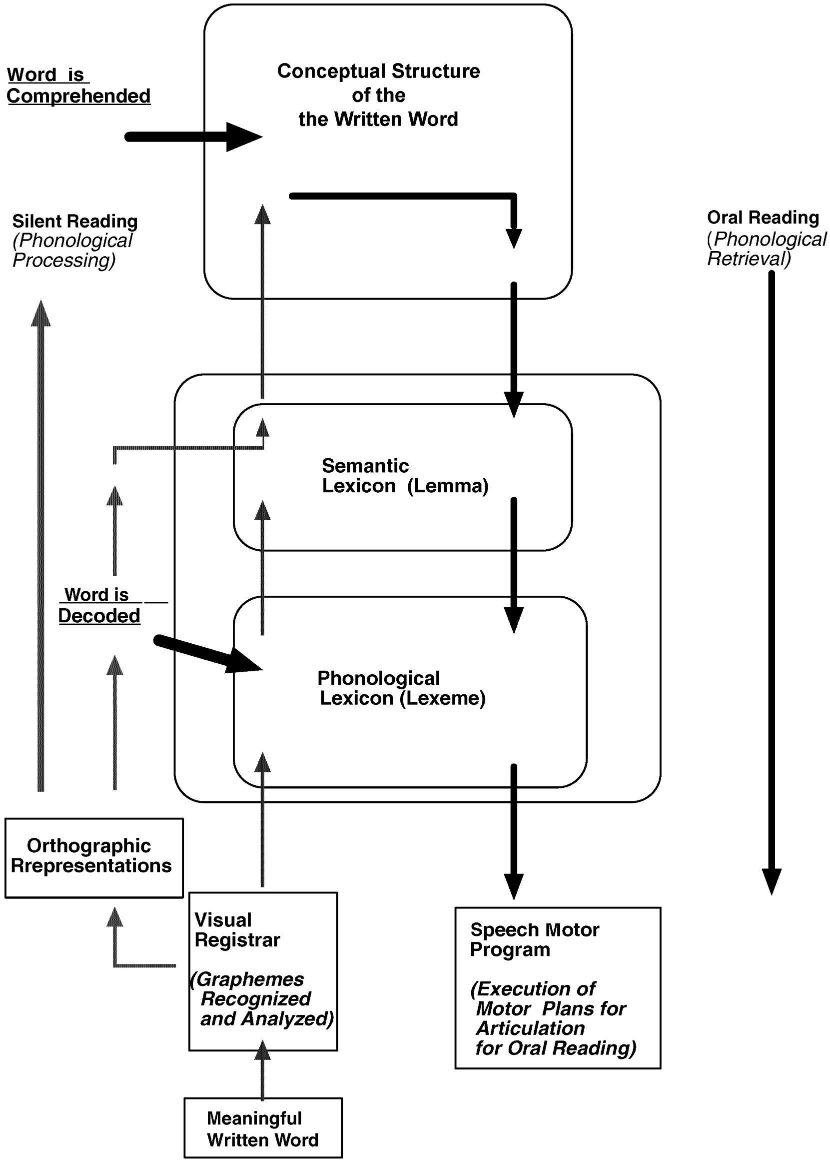

FIGURE 1 Silent and oral reading routes.

this third stage, elicitation of the conceptual structure, that we assume the stimulus sentence or question has been comprehended and a response has been selected. This leads to activation of the appropriate answer. To respond to the stimulus, lexical access for word production proceeds in a top-down fashion, in which the conceptual structure for the selected response accesses the target word's lemma (its semantic and syntactic features) from among neighboring entries (Garrett, 1991) in the output semantic lexicon (Stage 4). The selected lemma accesses the target word's phonological features (its syllabic frame and sound units; Levelt, 1991) in the output phonological lexicon (Stage 5) to create the word's complete phonological schema. Lastly, at Stage 6, a motor plan is created for the target word and forwarded to lower-level articulation processes to execute the motor plans for speech.

Lexical Access for Oral Reading

In oral reading, the triggering stimulus, unlike for speech, is the written word. Yet the final output, like speech, involves executing the motor plan for articulation. The stages in between parallel those for oral word-finding. That is, after a word is decoded and comprehended, the reader has to access the decoded word's lemma and form to read the word aloud. So in the first three stages, the written word is decoded and comprehended. Depending on whether a direct visual route (word form; Shaywitz, 2003) is utilized or phonological conversion occurs (word analysis; Shaywitz, 2003; see also Coltheart, Curtis, Atkins, & Haller, 1993), graphemes of the written word either link directly to the input semantic lexicon (orthographic reading) or link to corresponding phonemes in the input phonological lexicon (phonological decoding) at which time the word is decoded (Stage 1). The decoded word, in a bottom-up fashion, maps onto the input semantic lexicon (Stage 2), eliciting the word's meaning or conceptual structure (Stage 3). At Stage 3 we assume the decoded word has been comprehended, after which lexical access for oral reading proceeds, following the same trajectory described above for speech. That is, in Stage 4, the conceptual structure accesses the target word's lemma in the output semantic lexicon (its semantic and syntactic features) and the selected lemma accesses the target word's corresponding phonological features (its syllabic frame and sound units; Stage 5), creating the word's phonological schema (Levelt, 1991). Lastly, at Stage 6, a motor plan is created for the decoded word and forwarded to lower-level articulation processes to execute the motor plans for oral reading.

Inherent in this model is the assumption that lexical access for oral reading output follows the same trajectory as speech output. To put it another way, after a word's conceptual structure has been activated, the last 3 stages of oral output are identical for oral reading and speaking aloud. If this assumption is true, the word read orally could be vulnerable to the same disruptions in lexical access as the spoken word. To test this prediction, we examined whether factors known to influence oral language would also influence oral reading accuracy, oral reading error patterns, and oral reading miscues.

Lexical Factors Known to Influence Oral Language

Research on adult perception and production of spoken language has suggested that lexical factors such as target word frequency, neighborhood density, perceived word familiarity, and phonotactic probability impact lexical access. Although most of this research has focused on how these factors influence lexical access during perceptual tasks (Luce & Pisoni, 1998), a few studies have examined the influence of these factors on children's production (e.g., German & Newman, 2004; Newman & German, 2002) and how such effects may change during development and maturation (Charles-Luce & Luce, 1995; Dollaghan, 1994; Faust et al., 1997; Newman & German, 2005; Storkel, 2002; Walley & Metsala, 1992). There have also been a number studies examining these factors in the realm of adult reading performance, although these studies have tended to focus on orthographic, rather than phonologic, similarity among words (e.g., Coltheart, Davelaar, Jonasson, & Besner, 1977). These reading-based studies have generally involved either adult lexical decision or naming aloud (Andrews, 1997; Grainger, O'Regan, Jacobs, & Segui, 1989) but have not contrasted oral vs. silent reading recognition or examined clinical populations.

In an earlier developmental study (Newman & German, 2002), we reported differing lexical factor effects for typical and atypical language-learning children. In general, words that were high in frequency and phonological neighborhood frequency and low in neighborhood density were easier for children to name, and the number of neighbors that were more frequent than the target word also had an effect on its ease of retrieval. To expand this child database, the present investigation looks beyond the impact of lexical factors on learners' naming abilities to examine the influence of these factors on learners' oral reading skills. Guided by these prior language studies, we considered four lexical factors as they relate to reading: target word frequency, lexical neighborhood, word familiarity, and phonotactic probability. These factors are discussed in turn.

Word Frequency

Known words differ in terms of how often they are encountered. Research in speech perception indicates that high frequency words (common words) tend to be recognized more quickly (Luce & Pisoni, 1998; Newbigging, 1961; Solomon & Postman, 1952) and identified more accurately (Dirks, Takayanagi, Moshfegh, Noffsinger, & Fausti, 2001) than are low-frequency (rarer) words. Similarly, high-frequency words are produced more quickly (Jescheniak & Levelt, 1994; Lachman, Shaffer, & Hennrikus, 1974; Oldfield & Wingfield, 1965), are less likely to be involved in speech production errors (Dell, 1988; Vitevitch, 1997, 2002), and result in fewer tip-of-the-tongue states in both young and elderly speakers (see Vitevitch & Sommers, 2003, for work on young and elderly typical speakers; Gordon, 2002, for work with individuals with aphasia). Frequency has also been shown to predict naming for read words (Andrews, 1989; Forster & Chambers, 1973), perhaps as a result of the connection strength between orthographic and phonological representations (McCann & Besner, 1987). Finally, children (both those with word-finding difficulties and those who are typically developing) have greater success naming words that are more common in the language (German, 1984; German & Newman, 2004; Newman & German, 2002).

Lexical Neighborhood

According to the Neighborhood Activation Model (Luce & Pisoni, 1998), the phonological lexicon is organized on the basis of sound patterns, such that items that are phonologically similar to one another are stored together. These lexical organizations, referred to as neighborhoods, can be described as either dense or sparse. For example, the phonological neighborhood of the word *let* is considered dense because there are many other English words that are similar to it (e.g., *bet, less, lent,* and *light,* among others). In contrast, the word *yarn* is located in a sparse neighborhood, as it is similar to only three words (e.g., *barn, darn,* and *yard*). Neighborhood properties have been reported to influence production in complex ways (Luce & Pisoni, 1989; Vitevitch, 2002). The *accuracy* of word retrieval appears to be improved by the presence of neighbors; adults make more phonological (Vitevitch, 1997) and tip-of-the-tongue (Harley & Bown, 1998) errors on words from sparse neighborhoods, and similar advantages of neighborhood density have been found for aphasic speakers (Gordon, 2002). (In contrast, Newman and German, 2005, showed a different pattern of more accurate naming for words with few neighbors for both typical learning adolescents and adults.)

Children also appear to find it easier to produce and remember words that are phonologically similar to other known words (Gathercole, Frankish, Pickering, & Peaker, 1999; Gathercole, Willis, Emslie, & Baddeley, 1991). Likewise, German and Newman (2004) found that children with word-finding difficulties tended to make more errors on words with few neighbors and instead substituted words with more neighbors, suggesting that neighbors could facilitate lexical access in this population. Given these findings for oral production, it seems relevant to consider the impact of lexical neighborhood on the oral reading task for this same population of children.

Neighborhood effects in reading can be examined in terms of either orthographic or phonologic similarity, although orthographic similarity is more typical. However, phonological neighborhoods and orthographic neighborhoods tend to overlap substantially as they are often correlated. For example, *hint, lint,* and *mint* are both orthographic neighbors and phonologic neighbors. While it is possible to disentangle these two constructs given a sufficient pool of words from which to draw, it is not possible to do so when the available word set is limited. Because we wanted to ensure that words in the present study would be readable by young learners, our word set was limited to first-grade reading lists; among this limited set of items, it was not possible to separate orthographic from phonological neighborhoods. Future research will need to explore these distinctions more carefully; however, as a preliminary study of oral language and oral reading we examined only whether phonological neighborhood factors might have an effect on oral reading performance.

Familiarity

Individuals tend to rate some words as being more familiar to them than others, and this, too, can influence lexical access. Indeed, while both adolescents and young adults show effects of familiarity, these effects are even greater in older adults, suggesting that familiarity may play a larger role for those individuals who have more difficulty with lexical access (Newman & German, 2005). Since children with word-finding difficulties exemplify the group of individuals with weaker access skills, they may similarly show strong effects of familiarity on their word-finding success. In order to capture some aspect of the extent to which children might be likely to know the target word, we looked at target word familiarity. Further, because we were studying the impact of oral language on reading, the familiarity measures in the present study were based on auditory perception of words, rather than on reading of words (Nusbaum, Pisoni, & Davis, 1984).

Phonotactic Probability

This lexical factor refers to the frequency with which a sound or sequence of sounds occurs in the language. Storkel and Rogers (2000) and Storkel (2001) examined the effect of phonotactic probability on children's word learning and reported better learning for words with more common phonological patterns and interactions between phonological probability and the development of semantic representation. When a word had a relatively unusual sound sequence, learners' errors were unrelated to the particular word while errors on words with common sound patterns were related semantically to the target word. This implies that the children had successfully accessed the appropriate semantic representation. Storkel proposed that phonotactic information influences both the development of semantic representations and the connections between these representations and lexical forms. Phonotactic information also appears to influence access once the representations are fully formed. For example, adults are faster at repeating words that are high in phonotactic probability (Vitevitch et al., 1997), and words with high phonotactic probability are easier for both adolescents and adults to name (Newman & German, 2005). Given these findings for phonotactic probability and word finding it seemed meaningful to also examine this variable in relation to oral reading.

Aspects of Learners' Lexical Access During Oral Reading

In order to study the relationship of oral language and oral reading, this investigation considered three aspects of lexical access during oral reading: the nature of the erred words, the oral reading error patterns observed, and the nature of the oral reading errors produced (e.g., reading word miscues). These are discussed in turn.

Oral Reading Errors (Or, Which Words Are Erred On)

German and Newman (2004) studied the impact of a word's lexical features on its ease of retrieval, reporting that neighborhood density predicted word-finding success. Using this study as a guide, we also examined the influence of lexical neighborhood, as well as target word frequency, familiarity, and phonotactic probability, to see if these lexical factors would similarly influence oral reading ease. We predict that if oral language or word finding is related to reading, children's OR should be influenced by neighborhood factors in a manner similar to oral language. More specifically, we expect children with WFD to be more successful reading those words that are higher in frequency, familiarity, and phonotactic probability.

Error Patterns Implied (Or Where in Lexical Access the Error Occurs)

This investigation also studied the impact of lexical factors on three oral reading error patterns that have their counterpart in the oral naming performance of children with word-finding difficulties (German, 2000a; German & Newman, 2004). These three oral language error patterns represent points of disruption in the explanatory lexical model (German, 2000a) above. In oral language these WF error patterns are (a) lemma-related disruptions, like saying *starfish* for *octopus* or *start* for *starts* (referred to as semantic and syntactical errors, respectively, in this investigation); (b) word form–related errors typically demonstrated while talking by either a lack of a response or saying *I don't know* (referred to as blocked errors); and (c) word form segment-related disruptions, like saying *tamber* for *tambourine* (referred to as phonologic errors). Our interest was to see if these error patterns would also emerge in the oral *reading* performance of learners with WFD. In oral reading, examples of these reading errors would be (a) to orally read *octopus* for *ostrich* or *jumps* for *jumped* (semantic and syntactical errors); (b) a lack of a response or saying *I don't know* (referred to as blocked errors), and (c) word form segment-related disruptions, like reading *brichfrost* for *breakfast* and *canry* for *canary* (phonologic errors). This investigation examined whether the lexical factors under study would predict which of these oral reading error patterns occurred in the manner previously observed in oral language.

Oral Reading Word Miscues

German and Newman (2004) studied the relationship between target words and their substitutions in oral naming tasks with respect to words' lexical features. They reported that students produced substitutions that were higher in frequency and that resided in neighborhoods of greater density and higher frequency then the target word. Using this earlier investigation as a guide we examined the impact of word frequency, lexical neighborhood, familiarity, and phonotactic probability on learners' oral reading miscues. Of interest was whether oral reading errors or miscues would also be biased by a word's lexical factors in the same way as oral language word-finding errors. Thus, both miscues and their targets were compared relative to these lexical factors to determine which were maintained when a child's lexical access was disrupted during oral reading. Knowledge of the influence of these factors on reading miscues selected would also provide insight as to where in the lexical process an oral reading disruption might be occurring.

Study Design

In summary, the present study examined the influence of lexical access (or word-finding) on oral reading in two ways. First, learners' performance on reading tasks that do and do not require oral language were compared on the same words; second, lexical factors of erred reading words and their miscues were compared with respect to four lexical factors: frequency of occurrence, lexical neighborhood, familiarity, and phonotactic probability. Of interest was the impact of these features on lexical access during oral reading relative to predicting: (a) oral reading ease in single-word reading; (b) oral-reading error patterns displayed during reading disruptions in context reading; and (c) the nature of the oral-reading errors (miscues) produced. (See Table 1 for specific hypotheses.)

Method

Participants

Fifteen typical learning (TL) first-grade students (M = 6 yrs, 9 mos.; SD = 4 mos.) and 25 second- and third-grade learners (7 yrs, 6 mos. to 9 yrs, 6 mos.) with WFD participated in this study. Participants were from middle to upper-middle socioeconomic class homes (determined by parents' educational level). Two ethnic groups were represented: Caucasian (92%) and African American (8%).

Diagnostic Criteria

TL children had normal auditory and visual acuity, had never been referred for Special Education Services, and were judged to be average readers by their classroom teacher, scoring within 1 SD of the grade mean on tests of letter naming and phoneme segmentation.

Participants with WFD were diagnosed as having WFD by their school SLP using formal measures, either the *Test of Word Finding,* second edition (TWF-2; German, 2000a) or the *Test of Word Finding in Discourse* (TWFD; German, 1991). Twenty-four of the participants earned Word Finding Quotients in the weak to below-average range on the TWF-2 (MWFQ = 81.13; SD = 6.60), indicating word-finding difficulties in single-word naming contexts. One learner received a standard score of 66 (M = 110; D = 15) on the TWFD, indicating word-finding difficulties in discourse context. The receptive language of these participants was judged to be in the average range by (a) their SLP, (b) age-appropriate language comprehension scores on file for the Peabody Picture Vocabulary Test—Three (PPVT-III; Dunn & Dunn, 1997; N = 25,

TABLE 1 Specific Hypotheses, and the Relevant Empirical Tests and Assessment Sections for Evaluating These Hypotheses

Hypothesis	Test	Assessment Sections
Children with WFD will show a larger discrepancy between OR and SSR performance on the same words than TL children	2 × 2 ANOVA comparing two groups of children on the two performance levels, looking for an interaction	Performed on all 6 reading sections
Lexical factors that influence oral word-finding will also influence oral reading success	a) Compare reading accuracy for words high and low in neighborhood density (paired t-tests); b) compare reading accuracy for words high and low in phonotactic probability (paired t-tests); c) stepwise regression of accuracy data, examining frequency, familiarity, density, and phonotactic probability of target words	Tests a and b performed on Section 1, sight words, and Section 2, monosyllabic words, and Test c performed on Section 6, reading in context
Children's reading error patterns will be predicted by lexical factors	Errors subdivided into three patterns; these error patterns compared to one another on the basis of frequency, neighborhood density, phonotactic probability and familiarity (one-way repeated-measures ANOVAs)	Reading in context, Section 6
The miscues children make will be biased by lexical factors	Compared the frequency, neighborhood density, phonotactic probability and familiarity of children's erred target words and the miscues to those target words (MANOVA)	Reading in context, Section 6

M = 102.5, SD = 10.05); and (c) no goals or benchmarks for language comprehension difficulties on their Individualized Education Plan (IEP). Although the learners with word-finding difficulties had not had formal reading evaluations, they all had reading goals for improving oral fluency and decoding skills and were enrolled in various reading support programs in their schools as a result of their weak reading performance in the classroom. Further, all learners with word-finding difficulties were enrolled in a speech and language therapy program and were receiving word-finding intervention with related IEP goals.

Procedure, Presentation, and Counterbalancing

Using a PowerPoint presentation on a PC computer, learners were individually administered an experimental reading assessment, the Test of Oral and Silent Reading Recognition (TOSR) (German & Newman, 2005; in progress). Learners were first asked to read presented target words and stories aloud, tasks that require oral language. All seven sections of the assessment were tape-recorded. To control for word order effects, two different random word orders were created for all sections, and learners were randomly assigned to one of these two orders. To control for section presentation order effects, a Latin square design was used, such that each of the first 7 participants received a different order of tasks. The next 7 participants received the same order as members of the first 7, and so forth. In this way, we varied both the order within the tasks and the order in which tasks followed one another.

Following the oral reading assessment, learners were then administered, in the same assigned order, the silent reading recognition (SRR) assessment for each section, tasks that did not require oral language. In this SRR task they were asked to identify words embedded in a four-word multiple-choice frame. To control for order effects within the multiple-choice frame (to ensure that the target word was not consistently the first [or second, or third, or last] choice), the target word and decoys were randomized across items. To reduce the time required for testing, the SRR test was only performed on words that the child failed to read aloud; if the child read the word orally correctly, we assumed they would be able to recognize it silently as well.

Students' responses were recorded, and accuracy was tallied for each item. Errors on Condition 1, Oral Reading, could consist of a child reading the target word incorrectly, mispronouncing the word, saying "I don't know," failing to respond within 10 seconds, or describing the intended referent (a circumlocution). Errors on

Condition 2, SRR, occurred when the learner failed to select the correct choice in response to hearing the examiner say the word (either by selecting an incorrect word, or by saying they did not know the answer).

Calculation of Lexical Factors

To determine the frequency of occurrence of target words in this investigation we used U-values as reported in the Carroll, Davies, and Richman (1971) corpus.[1] These U-values (occurrences per million words) were then transformed into log-frequency values.

To determine neighborhood density, each word was looked up phonetically in a computerized version of Webster's dictionary. Those words in the lexicon that differed from the target word by a single phoneme (either a single phoneme addition, deletion, or substitution) were considered to be neighbors; the number of these neighbors was thus the target word's neighborhood density. Only words which themselves had familiarities of at least 6.0 on a 7-point familiarity scale (see below; Nusbaum et al., 1984) were considered to be neighbors for this analysis. (We avoided using unfamiliar words on the assumption that these would not necessarily have full lexical representations for our participants. See Newman & German, 2002; German & Newman, 2004, for similar methods.) However, since the familiarity scaling was based on adult language users, this method could include some items as "neighbors" that young children are unlikely to know. To avoid this, we further checked each of these neighbors in the Carroll et al. (1971) frequency listing; any item that did not have a U-value of at least 1.0 was also excluded from consideration as a neighbor. Thus, we can be assured that the items considered to be neighbors for this analysis are words likely to be known by young children.

Familiarity ratings were taken from Nusbaum et al. (1984) and were based on a 7-point scale, with 7 indicating greatest familiarity. Although these ratings are adult-based, the Nusbaum et al. corpus contains many more words than are found in child-based familiarity corpora, allowing for familiarity assessments for a greater variety of words.

The final lexical factor considered was phonotactic probability. This consists of the probability of the phonemes and biphones in the target word when assessed across the language as a whole (see Vitevitch & Luce, 2004, for information on these calculations); these values are then summed for the word as a whole. Both phoneme and biphone probabilities were analyzed when selecting target words. Thus, target words with high phonotactic probability contained both phonemes that were frequent in the language and combinations of phonemes that were frequent in the language. (As an example of how this could matter, both /m/ and /t/ are frequent phonemes in English, but the combination /mt/ is quite rare.)

Conditions, Sections and Items

The TOSR consists of two conditions, OR and SRR, across six reading sections;[2] two single-word assessments, one reading-in-context section, and three phonological processing tasks (reading analysis, blending, and rhyming assessments). These are described below.

ORAL READING CONDITION

The OR condition focused on learners' oral reading skills. Learners were asked to read individually-presented target words and stories aloud. Using PowerPoint presentation software, target words were presented visually on a Gateway laptop computer; word stimuli remained on the screen until the learner read the word or indicated that he or she could not read the word. In order to be reasonably sure that participants had previous school experience reading the target words, reading words were drawn primarily from first-grade reading lists, with a few words drawn from second-grade reading lists.

SILENT READING RECOGNITION CONDITION

This condition focuses on learners' SRR skills for words erred in the oral reading assessment. Administered after completion of the Oral Reading Condition, it consisted of multiple-choice frames (see below). Learners were asked to select the erred target word from among decoys (example: target word, *put*; decoys, *pun*, *pot*, and *pull*). For most sections of the test (see below), the target word was presented among three multiple-choice decoys; for the reading-in-context section, the child was asked to pick the word from the midst of the paragraph. In order to reduce guessing and be assured that the learners were using their decoding skills to identify target words, multiple-choice decoys were phonemically matched to target words in either initial, medial or final positions (target word, *matter*; decoys, *batter*, *madder*, and *master*; target word, *white*; decoys, *wheat*, *while*, and *which*), and, for the most part, had the same stress pattern (target word, *window*; decoys, *willow, widow, and winter*) and the same number of syllables as the target word (target word, *take*; decoys, *bake*, *tack*, and *took*). OR and SRR assessments for the six different sections are highlighted below.

READING SIGHT WORDS (SECTION 1)

Learners were asked to read aloud 43 Dolch sight words chosen based on their lexical factors. Dolch sight words were selected from a list of 64 preprimer, primer, and first-grade sight words. Thus, they are intended to be words that our second- and third-grade readers should be able to read automatically, rather than words that would require sounding out. To determine the lexical factors of these words, all sight words were looked up in both an online database and in a frequency table (Carroll et al., 1971) to determine their neighborhood density, frequency of occurrence (or U-value), and phonotactic probability. Two subsets of words were then selected; one subset varied in phonotactic probability while keeping constant neighborhood density, the words' U-values, and both the number of letters and number of phonemes in the words; the other subset varied in neighborhood density while keeping constant phonotactic probability, U-value, and the number of letters and phonemes in the words This resulted in the following sets of words: a 24-word phonotactic-probability set, containing 12 words that were high in phonotactic probability (average total phoneme probability of 0.17 and biphone probability of 0.010) and 12 that were low in phonotactic probability (average total phoneme probability of 0.11 and biphone probability of 0.005), with both sets matched for neighborhood density, length, and U-value; and a 26-word neighborhood-density set, containing 13 words that resided in dense neighborhoods (average of 23.6 neighbors) and 13 that resided in sparse neighborhoods (6.9 neighbors), all of which were similarly matched for other factors. There was some overlap in words across these sets, resulting in a total of 43 sight words in Section 1. (Overlap occurred because, for example, a word high in phonotactic probability could also be high in neighborhood density.) Examples of target words include *look*, *play*, *good*, *where*, *our*, and *came*.

Corresponding SRR assessment for this section asked learners to select, within 10 seconds, the erred target word from among three decoys all presented on one line in a four-word multiple-choice frame. ("Point to *ate*" [ace ape act ate]).

READING MULTISYLLABIC WORDS (SECTION 2)

Learners were asked to read aloud 59 multisyllabic words chosen based on their lexical factors. These words were drawn from first-grade reading vocabulary lists. To determine lexical factors of selected words, all multisyllabic words were looked up in both an online database and in a frequency table to determine their neighborhood density, frequency of occurrence (or U-value), and phonotactic probability. Subsets of words were then selected that varied in both phonotactic probability and neighborhood density, while keeping constant the other factor, the word's U-value, and both the numbers of letters and phonemes in the words. This resulted in the following sets of words: a 32-word phonotactic-probability set, containing 16 words that were high in phonotactic probability (average phoneme probability of 0.30 and biphone probability of 0.021) and 16 words that were low in phonotactic probability (average phoneme probability of 0.11 and biphone probability of 0.005), with both sets matched for neighborhood density, length and U-value; and a 28-word neighborhood-density set, containing 14 words that resided in dense neighborhoods (average of 5.3 neighbors) and 14 words that resided in sparse neighborhoods (no neighbors), which similarly were matched for other factors. There was some overlap across these sets, resulting in a total of 59 test words. Examples of these words are *family*, *soccer*, *window*, *squirrel*, *heavy*, and *decide*.

Corresponding SRR assessment for this section asked the learner to select the erred target word from among three decoys presented in a four-word multiple-choice frame. ("Point to *beneath*" [behind beneath because beside]).

PHONOLOGICAL PROCESSING—SYNTHESIS (SECTION 3)

Here learners were asked to orally blend 20 multisyllabic words divided into syllables presented visually on the monitor. Words were drawn primarily from first-grade reading lists.

Examples include *di-a-gram*, *cor-ner*, and *trou-ble*. Corresponding SRR assessment for this section asked learners to select the target word from among three decoys (all divided in syllables) presented in a multiple choice frame. ("Point to *pencil*" [coun-cil sten-cil pen-cil pen-dant]. (To reduce the attention requirements for the younger TL children, these children were not tested on any of the three phonological processing tasks.)

PHONOLOGICAL PROCESSING—ANALYSIS (SECTION 4)

Here learners were asked to read aloud the first consonant and vowel of 20 monosyllabic and bisyllabic reading words. Words were drawn primarily from first-grade reading lists (examples include *whether*, *circle*, *coin*, and *basket*). Embedded in a multiple-choice frame, the corresponding SRR assessment for this section asked learners to identify the word that began with the specific consonant and vowel combination missed. (Point to the word that begins with the "koy" sounds [groin, join, coin, point]).[3]

PHONOLOGICAL PROCESSING—RHYMING (SECTION 5)

Here learners were asked to orally name words that rhymed with 20 monosyllabic words. Words were drawn primarily from first grade reading lists. These included *meat*, *manner*, and *rule*. Corresponding SRR assessment for this section asked learners to identify a word, embedded in a multiple choice frame among phonemically similar decoys, that rhymed with the target word said by the examiner ("Point to the word that rhymes with *eye*" [pie brow nose ear]).

READING IN CONTEXT (SECTION 6)

Here learners were asked to read 4 short stories aloud consisting of first- and second-grade words controlled for inherent lexical factors. First, a base story that served as the syntactic framework for the test stories was selected from a first-grade reader. We then substituted words in the base story with selected first-grade reading-level target words to create four short stories, totaling 168 words in length, with 54 target words. These target words varied in word frequency (from 4 to 814 instances per million), neighborhood density (from 0 to 25 neighbors), length (1–4 syllables), and phonotactic probability (0.0032 to 0.4689 by phonemes, 0.0003 to 0.046 by biphones). The corresponding SRR assessment for this section asked learners to re-read the stories silently pointing to their erred words as said by the examiner. The other words in the selected story served as decoys for the target word ("Point to the word *huge* in the story.").

Thus, to summarize, children read words in two conditions that did and did not require oral language, for each of 6 reading sections/tasks (sight words, multisyllabic words, phonological processing: synthesis, phonological processing: analysis, phonological processing: rhyming, and reading in context/stories). Comparing performance in the two conditions provides a means of contrasting children's reading in conditions that do and do not require oral production. For three of the six sections (sight words, multisyllabic words, and reading in context/stories), the words selected were chosen to vary on lexical factors, allowing an examination of how these lexical factors influence oral reading performance.

Results and Discussion

To investigate the influence of lexical access or word finding on oral reading we contrasted learners' OR and SRR skills on the same words and studied their reading miscues and erred target reading words with respect to four lexical factors: frequency of occurrence, lexical neighborhood, familiarity, and phonotactic probability. We considered oral reading ease, reading error patterns observed, and the nature of the OR miscues produced. These analyses are reported below for each research question.

1. Will children with WFD display a discrepancy between their OR and SRR performance on the same words different from that of TL students who have not yet learned the reading strategies tested?

With regards to the first question, we contrasted oral reading and silent reading recognition performance on the same words in single word tasks and reading in context. For learners with WFD, accuracy for oral reading was quite low, ranging from 57 to 62% on the multisyllabic words and phonological processing tasks. Oral reading accuracy for sight words and the stories (which included many sight words) was higher,

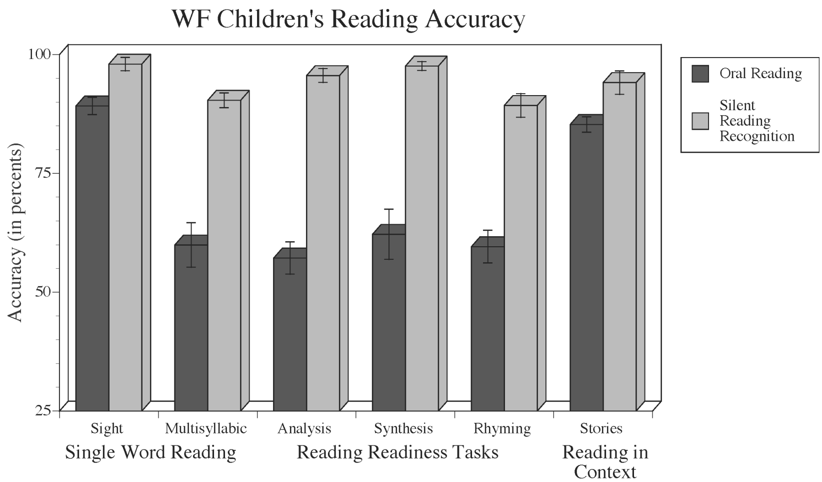

FIGURE 2 Reading accuracy of children with word-finding difficulties.

ranging from 85 to 88%. These accuracy scores are shown in Figure 2.

To compare the difference in performance between our two groups of learners, we performed a 2 × 2 ANOVA, with two factors: group (TL or WFD) and testing method/condition (oral vs. silent reading recognition). These are performed separately for each section. For the sight words, there was an overall effect of group, as learners with WFD performed significantly better than the TL first grade children ($F(1,37) = 49.86$, $p < .0001$). However, there was also a significant interaction with testing method ($F(1,37) = 19.14$, $p < .0001$), such that the two groups had much more disparate scores on the silent than on the oral assessment (on oral reading, accuracy was 77% for TL children, and 89% for WFD; on SRR of the words missed orally, these scores were 58 and 98%, respectively). That is, although the two groups differed only slightly on oral reading, they showed a greater difference on their ability to read silently those items they failed to read orally.

The multisyllabic words showed a similar pattern. There was again a significant effect of group ($F(1,38) = 31.73$, $p < .0001$) and a significant interaction between group and assessment method ($F(1,38) = 10.13$, $p < .005$). Here, too, children with WFD showed a significantly greater discrepancy than did those learners with typical language skills between their OR and SRR performance (scores of 60 and 39% for OR, with 90 and 51% for SRR on the words missed orally. There was also a significant main effect of testing method, $F(1,38) = 71.51$, $p < .0001$, but this is not actually an appropriate comparison, as the SRR tasks were only performed on a subset of the words read orally.)

Finally, performance on the stories showed the exact same pattern; the effect of group ($F(1,38) = 36.99$, $p < .0001$) and the group by assessment method interaction ($F(1,38) = 59.09$, $p < .0001$) were both significant. For oral reading performance scores, the percent accuracy scores for TL learners was 76% and for learners with WFD, 85%; but for SRR, scores were 50 and 94%, respectively.

Thus, for all three sections, the two groups of learners performed much more similarly to each other on the oral reading than they did on the SRR. Learners with WFD consistently outperformed the first-grade readers on the silent tasks to a much greater extent than they did on the OR tasks.

If our learners' difficulties in oral reading were the result of oral language difficulties, we would expect them to demonstrate poor performance in oral reading in the presence of good performance on reading tasks that do not require oral language (that is, good SRR performance for those words that they failed to read orally). Or, put another way, on the SRR task, learners' accuracy on the items they failed to read orally should be significantly greater than chance performance. In contrast, if their difficulties were the result of decoding, we would expect these difficulties to be demonstrated in both tasks that do (oral reading) and do not require oral language (SRR tasks). To examine this, accuracy on the SRR tasks of our learners with word-finding difficulties was compared to chance performance, with chance based on two criteria. First, we set chance at one out of 4, or 25%, for the single word reading and the phonological processing tasks (sections 1–5) because these tasks entailed choosing the correct word from among four choices. However, because sophisticated guessing strategies could result in our children performing above this level by chance alone, we also decided to use our 15 beginning (first-grade) readers to determine our chance level for our students with WFD. If the oral reading difficulties of our children with WFD are based on oral language skills, and not decoding difficulties, they should do better on the SRR tasks than the children who had not yet developed those decoding strategies. Therefore, because our first-grade readers' silent reading performance ranged from 50 (on the story) to 58% (on the sight words), we set 58% (the highest silent-reading performance for our first-grade readers) as our level of chance performance for our older children with WFD.

The learners with WFD' silent reading recognition accuracy on those same items that they missed orally ranged from 89–98% as shown in Figure 2. Given these WFD learners' low accuracy for these words when read orally, this is a striking difference. They performed far above both levels of chance performance. For example, relative to the 25% criteria, scores were significantly above chance performance in each case (for sight words, $t(23) = 51.3$; for multisyllabic words, $t(24) = 42.2$; for phonological processing tasks, $t(24) = 48.4$, $t(23) = 79.3$, and $t(24) = 25.9$, all $p < .0001$).[4] Relative to the 58% criteria, learners' scores were also significantly above chance performance in each case (for sight words, $t(23) = 28.0$; for multisyllabic words, $t(24) = 20.9$; for phonological processing tasks, $t(24) = 25.8$, $t(23) = 43.2$, and $t(24) = 12.63$; and for the story, $t(24) = 14.8$, all $p < .0001$). Thus, this observed discrepancy between OR and SRR performance across these reading sections suggests that our learners with WFD may have had more knowledge of reading decoding strategies than was indicated in their oral reading performance.

2. Will specific lexical factors of reading words known to influence oral word finding success (word frequency, lexical neighborhood, familiarity, and phonotactic probability) also influence learners' oral reading success in single words?

To address this second research question, whether oral reading would show similar effects of lexical factors as does oral naming, we performed analyses on three sections: Reading sight words, reading multisyllabic words, and reading in context. Each is discussed below.

READING SIGHT WORDS (SECTION 1)

First, we tested children with WFD on Dolch sight words (and multisyllabic words; see below) that differed in terms of the words' neighborhood density and phonotactic probability. Since the Dolch sight words are encountered far more frequently in general than are the longer words, we would expect access to these words to be fairly automatic for typical learners; although they might still cause word-finding difficulties in our participants, we would expect them to pose less difficulties than the multisyllabic words. More critically, the Dolch sight words, being potentially automatic, may not require phonological decoding in the same manner as the longer words, although both require oral output. We therefore performed the analyses separately for the two word types.

For the Dolch sight words, learners with WFD did not differ in their accuracy for the words varying in neighborhood (93% accuracy for sparse neighborhoods vs. 89% for dense neighborhoods, $t(24) = 1.58$, $p > .10$) but did differ in their reading of words with differing phonotactic properties. Interestingly, they were more accurate on words with less common phonological properties (90.9% accuracy for rare phonological properties vs. 83.7% accuracy for common phonological properties, $t(24) = 2.59$, $p < .02$). In general, this pattern suggests that for these sight words, children performed better when the words contained rare phonological properties, making them less similar to other words in the language.

Moreover, this pattern is actually quite different from that of typical learners. On the sight words, the first-grade prereaders showed a significant effect of lexical neighborhood ($t(14) = 2.40$, $p < .05$), which the WFD group did not. In contrast, the TL children showed no effect of phonotactic probability ($t(14) = 1.12$, $p > .10$), while the group with WFD did show an effect. This discrepancy in pattern across the groups suggests that the neighborhood effects in these Dolch sight words for children with word-finding difficulties are not what would be expected if they had simply not yet learned to phonologically decode the target words.

READING MULTISYLLABIC WORDS (SECTION 2)

For the multisyllabic words, there was a different pattern. Children with WFD performed more accurately on words from dense neighborhoods (66.4% vs. 58.8% accuracy, $t(24) = 2.43$,

$p < .05$) and on words with common phonological patterns (63.5% vs. 52.3% accuracy, $t(24) = 4.96$, $p < .0001$). Thus, words from sparse neighborhoods and with rare phonological patterns were more difficult for these children to read aloud. The TL learners showed the same pattern for lexical neighborhood, but again showed no effect of phonotactic probability ($t(14) = 1.64$, $p > .10$). Thus, for both sets of words, children with WFD show effects of phonotactic probability, while TL children who have not yet learned phonological strategies for decoding do not. This implies that effects of phonotactics may be dependent upon having first phonologically decoded the word. If so, this performance discrepancy strongly supports the hypothesis that the oral reading difficulties faced by children with WFD are not the result of a lack of phonological decoding.

Looking across these two sets of findings, we see that for sight words, children with WFD performed better on words in sparse neighborhoods, but with longer words they performed better on words in dense neighborhoods. Perhaps neighborhood density affects oral reading differently depending on the type of words being read, sight words vs. longer words; that is, multisyllabic words with too few neighbors are more difficult to read orally, whereas sight words with too many neighbors are more difficult to read. It may be that for longer words, the existence of neighbors provides a form of "support," helping the reader access the correct phonological form. This would be consistent with reports that learners with WFD have more difficulty in oral language accessing longer, multisyllabic words (Newman & German, 2002). In contrast, sight words, which are typically shorter and more automatic in access, may be more easily derailed by many neighbors competing for selection. This, too, would be consistent with oral language observations as some learners with WFD have been reported to have difficulty inhibiting a target word's competitors, as evidenced by their fast, inaccurate responses on naming tasks (German, 1984, 2000a). It may be that their greater difficulty with orally reading sight words with many neighbors is a function of their inability to inhibit competing forms while they read, similar to the fast inaccurate responses (slips of the tongue) they produce during oral language. If so, it would be logical that they would perform best when reading sight words that do not have as many competitors.

READING IN CONTEXT (SECTION 6)

We also examined learners' reading in context relative to these lexical factors. The stories contained 54 key words, all of which are on first-grade reading lists. We examined oral performance on those key words, relating that performance to the words' lexical statistics (word frequency/log of the U-value, familiarity, number of lexical neighbors, phoneme probability, and biphone probability) in a stepwise multiple regression. For this analysis, we only looked at those words that children succeeded at reading in one of the two tasks (either silently or aloud); this ensures that the words were ones that children did actually know, regardless of their actual performance on the OR task. (Thus, a word that a child failed to read aloud, but also did not recognize silently, was not considered an error, but was instead removed from analysis.)

Learners' OR accuracy (correct decoding) on the target words was predicted ($F = 18.85$, $p < .0001$) by two lexical factors: the frequency of the words in the language (their U-value) and the number of phonological neighbors the words had. Children with WFD were more accurate on words that were more frequent in the language ($r = .52$, $p < .0001$) and on words that resided in dense neighborhoods ($r = .49$, $p < .0001$). These two factors have previously been shown to be related to learners' naming performance (German & Newman, 2004; Newman & German, 2002), and here we see them predicting learners' reading performance as well, another indication that OR performance for words successfully recognized silently may be related to the learners' word-finding ability (German, 2000b, 2000c). This same pattern occurred with the typical first graders, looking only at the words they recognized but failed to name. Among words that were recognized silently, first graders likewise showed a pattern whereby their accuracy in orally naming the word was predicted ($F = 15.33$, $p < .0001$) by the word's frequency ($r = .51$, $p < .0005$) and neighborhood ($r = .51$, $p < .0001$). Thus, when a word is known, the likelihood of saying it aloud correctly seems to be predicted by the same factors for both groups. However, the overall likelihood of knowing the word (recognizing it silently) was far higher for children in the WF group than it is for typical first-graders.

3. For children with word-finding difficulties, will lexical factors predict OR error patterns in context, similar to how

these factors predict errors observed in children's oral language?

We examined whether particular lexical factors might predict the type of OR errors patterns observed during the OR in context task. First, erred reading words were assigned a value for each of the lexical factors under study (word frequency/U-value, familiarity, phonotactic probability, and neighborhood density). Second, reading miscues were classified according to one of three error patterns: Error Pattern 1, a real-word lemma-related substitution that was either semantic (*insect* for *butterfly*, commonly known as a slip of the tongue) or syntactical (*jumps* for *jumped*) in nature; Error Pattern 2, a form-related blocked error (commonly known as a tip-of-the-tongue) where a learner either said they didn't know the answer or failed to come up with the word; or Error Pattern 3, a form-related phonologic error for errors that were related to the target in form only (*finckles* for *freckles*, commonly known as a twist of the tongue. We first compared the lemma-related semantic and syntactic and the form-related phonologic reading error patterns to each other using one-way repeated measures ANOVAs (with Bonferroni correction for repeated tests).[5] We treated the semantic and syntactic errors as different types for this analysis. The majority of the learners with WFD produced at least one of each of these three error patterns (three did not produce any syntactical errors): lemma-related semantic error pattern (range: 1–22 errors, mean = 11, SD = 5.9); lemma-related syntactical error pattern (range: 0–9, mean = 2.3, SD = 2.1); and form-related phonologic error pattern (range: 1–19; mean = 6.5, SD = 5.5). Average values for each of the lexical factors under consideration (word frequency/U-value, familiarity, phonotactic probability, and neighborhood density) were calculated for each child's erred words. U-values, phonotactic probability, and neighborhoods were available for all words, but familiarity ratings were not; these were available for all but three of the syntactical reading errors and 17 of the phonologic reading errors.

The error patterns differed from one another in all four factors (word frequency/U-values: $F(2,42) = 20.74$, $p < .0001$;

neighborhood density, $F(2,42) = 15.29$, $p < .0001$; familiarity, $F(2,40) = 6.09$, $p < .005$; phonotactic probability, $F(2,42) = 33.25$, $p < .0001$). Follow-up t-tests showed that the phonologic error pattern differed from both semantic and syntactical error patterns in terms of word frequency, as more phonologic errors tended to occur on lower frequency words (log U-values for phonologic errors: 2.37, semantic errors: 3.13, syntactical errors: 3.23; phonologic vs. syntactical errors $t(21) = 6.41$, $p < .0001$; phonologic vs. semantic errors, $t(24) = 6.52$, $p < .0001$; semantic vs. syntactical errors, $t(21) = -0.64$, $p > .05$). The phonologic error pattern differed also from the other error patterns in neighborhood density, with words residing in sparse neighborhoods being more likely to lead to phonologic errors (number of neighbors for phonologic errors: 2.41; semantic errors: 6.41; syntactical errors: 6.97; phonologic vs. syntactical errors, $t(21) = 4.29$, $p < .0005$; phonologic vs. semantic errors, $t(24) = 6.99$, $p < .0001$; semantic vs. syntactical errors, $t(21) = -0.59$, $p > .05$).

In contrast, the syntactical error pattern was distinguished from the other patterns in regard to word familiarity, with syntactical errors more likely to occur on highly familiar words (familiarity for syntactical: 7.0; phonologic: 6.95; semantic: 6.88; syntactical vs. phonologic: $t(20) = 2.19$, $p < .05$; syntactical vs. semantic: $t(21) = 4.83$, $p < .0001$; phonologic vs. semantic: $t(23) = 1.88$, $p = .07$).

Finally, all three error patterns differed from one another in terms of phonotactic probability. Phonotactics can be analyzed either in terms of phoneme probability or in terms of biphone probability; by either measure, the phonologic error pattern occurred on words with common phonologic patterns, and the lemma-related syntactical pattern occurred on items with less common phonologic patterns (syntactical = 0.14 for phonemes, 0.01 for biphones; lemma-related semantic error pattern = 0.18 for phonemes, 0.014 for biphones; phonologic error pattern = 0.27 for phonemes, 0.02 for biphones; phonologic vs. semantic, $t(24) = 6.01$, $p < .0001$ and $t(24) = 3.81$, $p < .001$ for phonemes and biphones, respectively; phonologic vs. syntactical, $t(21) = 7.59$ and $t(21) = 5.89$, both $p < .0001$; semantic vs. syntactical, $t(21) = 2.63$ and $t(21) = 2.14$, both $p < .05$).

In order to also study the word form blocked errors, Error Pattern 3, we examined these reading error patterns through the use of stepwise multiple regression (see German & Newman, 2004). The regression analysis, unlike the subject analysis, allowed us to also look at word form blocked errors since this method treats each error as a separate occurrence, ignoring whether errors came from the same child or different children. First, all erred words in the story context were assigned a value for each of the lexical factors under investigation. Second, the number of times that word was erred on was calculated; this was performed separately for each of the error patterns. This analysis indicated that the word form-related blocked error pattern was predicted by word frequency and phonotactic probability ($F = 9.83$, $p < .0005$), with more blocked errors occurring on words with a lower frequency ($r = 0.40$) and words with low phonotactic probability ($r = 0.42$). This analysis also suggested that the phonologic error pattern was determined by the frequency and phonotactic probability of the words ($F = 32.7$, $p < .0001$), as more phonologic errors were produced on words of low frequency ($r = 0.50$) with high phonotactic probability ($r = 0.57$).

4. For children with word-finding difficulties, do the lexical factors of the target reading words impact on the nature of their oral reading word miscues?

Whereas research question 3 was about the types of errors that children make, here we examine the relationship between the miscue and the target word that generated it. We compared target reading words and their corresponding reading miscues; for this analysis only participants' real-word miscues were considered.[6] Average values for each of the lexical factors under consideration (word frequency/U-value, familiarity, neighborhood density, and phonotactic probability by both phonemes and biphones) were calculated for each child's set of miscues and the corresponding target reading words in the reading-in-context task. The average values for each lexical factor served as the unit of analysis, and we performed a repeated-measures MANOVA as an omnibus test comparing the intended reading words with the reading miscues, using the word (indended vs. miscue) as the IV and all of the lexical factors as DVs. This was then followed by the univariate tests of each of these DVs separately.

The overall MANOVA showed a significant effect of word (intended vs. miscue), $F(5,20) = 6.28$, $p < .001$. This suggests that the target words differed significantly from the miscues in at least one measure. Univariate analyses were then conducted on the averaged log U-values, the average number of neighbors for each word, averaged phoneme probabilities, averaged biphone probabilities, and averaged familiarity ratings.

For frequency, the univariate analysis showed that children's miscues were higher in frequency than the targets ($F(1,24) = 29.64$, $p < .0001$; log U-values of 3.18 for target words, 3.55 for miscues). This implies that children have a tendency to misread less common words as more common alternatives, just as they have a tendency to misname less common words as more common alternatives (German & Newman, 2004).

For neighborhood density, the analysis showed that children's miscues were words with more neighbors than the target words (targets averaged 7.0 neighbors, produced words averaged 8.6 neighbors; $F(1,24) = 5.02$, $p < .05$). This suggests that children tended to have difficulty with words with few neighbors, and to err towards words in denser regions of neighborhood space. This pattern, too, matches that which German and Newman reported for oral naming, and is thus another indication that learners' word-finding skills may impact on oral reading success.

For phonotactic probability, both phoneme probability and biphone probability values were averaged for each target word and its miscue. There was no difference between the targets and their miscues on either value (by phonemes, $F(1,24) = 2.78$, $p = .11$; by biphones, $F < 1$). Apparently, phonotactic probability does not play a role in children's miscues.

Lastly, familiarity ratings were generated for each erred target word and its corresponding miscue (this value was available for all but 8 of the 274 miscues, and 18 of the original targets). In general, children's miscues were words with higher rated familiarities ($F(1,24) = 5.25$, $p < .05$). This finding differs from that in the prior literature with naming; German and Newman (2004) reported no difference in rated familiarity values between target words and substitutions, although there had been a trend in that direction. It is not clear why the effects were stronger in the present study, but the direction of the effect was the same, supporting the idea that oral reading performance and oral naming performance show similar patterns.

General Discussion

To examine the impact of lexical access or word finding on learners' oral reading skills, this investigation posed four questions. These questions are considered in turn.

1. Will children with WFD display a discrepancy between their OR and SRR performance on the same words different from that of TL students who have not yet learned the reading strategies tested?

This examination contrasted learners' performance on reading tasks that do and do not require oral language to determine if a performance discrepancy exists for learners who have known difficulties with lexical access that is different from that observed among TL students. A significant discrepancy between task and group did emerge. The SRR of learners with WFD was far superior to their OR performance on the same words, whereas task differences were smaller for TL students. This finding suggests that unlike our typical learners who have not yet learned the decoding strategies, the OR performance of learners with WFD may not represent their decoding abilities. Rather, it may indicate some aspect of their oral word production, such as their lexical-access skills.

The explanatory lexical model (German, 2000a) discussed earlier may also help us understand the observed discrepancy between reading tasks that do and do not require oral language and/or lexical access. According to this model, after a word is decoded and comprehended, the processes involved in oral word finding and OR overlap; the reader accesses the word's lemma and form to read the word aloud. Thus individuals who have difficulty naming words aloud will frequently also have difficulty reading words aloud. However, because recognition and/or decoding of a word takes place prior to lexical access of the word for oral production, tasks that require only SRR (no oral reading) do not overlap in the final stages of lexical access. If this assumption is true, the learner is able to decode the word in the SRR tasks as this process occurs before having to orally read the target word. Oral language processes, which (according to the model) occur during stages of lexical access, are not involved in the SRR task, sparing a learner with WFD failure on the task.

Consequently, one could hypothesize that observed OR errors may be in some cases word-finding based and not decoding-based as typically assumed. These findings converge with earlier investigations reporting correlations between naming tests and reading achievement tests (Swan & Goswami, 1997) and support the concomitant relationship between word finding and reading. Moreover, we have expanded on this word-finding and reading hypothesis to suggest that the phonological-access difficulties observed in earlier studies may be related only to learners' oral reading performance (where lexical access and reading overlap), since our learners had minimal difficulty matching graphemes to phonemes in the silent-reading recognition tasks. If so, learners with word-finding difficulties, by virtue of their language challenge, may be vulnerable to expressive language disruptions during oral reading tasks that could appear to be decoding difficulties.

2. Will specific lexical factors of reading words known to influence oral word-finding success (word frequency, lexical neighborhood, and phonotactic probability) also influence learners' oral reading success in single words?

Lexical factors did predict oral reading success of sight words and multisyllabic words. For example, for Dolch sight words, reading accuracy varied for words with differing phonotactic properties; learners with WFD were more accurate when reading words with less common phonological properties. This was not the case for our first-grade TL children who actually had difficulty with the process of phonological decoding. It may be that written words with less common phonological patterns are less vulnerable to errors during oral reading because there are fewer stored words with similar phonological properties competing for selection. This results in greater ease in lexical access of these sight words with less common phonological properties and, thus, higher oral reading accuracy on these words. This interpretation is consistent with observations reported in the reading literature, which indicate that successful word recognition requires the ability to efficiently retrieve sight words from memory (Torgeson, 1999). However, in this investigation, the retrieval disruption was not orthographic in nature since the WFD learners were able to read the erred sight words silently (98% accuracy), and the effect was absent in the first-grade children who had not learned the decoding strategies. Rather, this phonotactic bias appears to be related to the oral production of the written word and, thus, the lexical access component of the oral reading tasks; learners with WFD were more successful when reading aloud words which had fewer phonological competitors to compete for selection. This might explain why some pairs of sight words like *come* and *came* and *what* and *where* are more vulnerable to oral reading errors. For example, children made many oral reading errors on the high phonotactic-probability words *came*, *ran*, *well*, and *what*, whereas no oral reading errors were made on the low phonotactic-probability sight words *good*, *and*, *have*, and *old*.

Oral reading of the multisyllabic-word list was also influenced by the lexical factors under study. However, a different pattern emerged; both lexical neighborhood and phonotactic properties biased oral-reading accuracy. Specifically, OR accuracy was higher on words residing in dense neighborhoods and containing common phonological patterns. In contrast, the effect of form (neighborhood and phonological schema) was not found in the typical first-grade readers. These findings for students with WFD are consistent with those reported for studies of oral language in which fewer word-finding errors occurred on words from dense neighborhoods (German & Newman, 2004; Newman & German, 2002). It may be that learners were similarly experiencing word-form blocked word-finding errors during OR in the present study. Characteristics typical of oral word-finding errors were present during the OR task; semantic miscues (caterpillar for crocodile) as well as "I don't know" responses and long delays before reading the word correctly were noted by the examiner. Because these reading errors occurred in the presence of being able to identify these same target words on the SRR task, and did not occur in those individuals whom had not learned the reading strategies, we can hypothesize that these reading errors were word-finding based OR errors and not decoding errors.

The presence of similar neighborhood effects in oral naming and OR suggest that lexical access or word finding may be related to OR accuracy. That is, as in oral naming, when a written word has more neighbors, the access paths to that region of the lexicon may be stronger, making its access easier and, consequently, its OR more successful. Further, learners were more successful when reading those multisyllabic words (words they have to decode in contrast to sight words) with more common phonological patterns, words whose sequence of sounds occurs more frequently in the language. Like reports from earlier word-finding studies where children made more word-finding errors on rare words, these results suggest that learners will also have more difficulty decoding words aloud whose phonological patterns are rare. This is particularly noteworthy since our learners were able to identify these words in the SRR tasks. Lastly, lexical factors of words also predicted learners' OR accuracy in context. Again, similar to oral naming, learners were more accurate when orally reading high-frequency words that resided in dense neighborhoods.

In summary, this investigation reports that learners' OR accuracy, on words subsequently identified correctly, is influenced by the nature of the target word and the organization of the phonological lexicon. This suggests that lexical access can impact on learners' ability to orally read sight words and multisyllabic words, in both single-word and context formats. If so, children with word-finding difficulties may be vulnerable to making word-finding based OR errors on sight and multisyllabic words, but for different underlying reasons.

3. For children with word-finding difficulties, will lexical factors predict OR error patterns in context similar to those observed in their oral language?

This investigation also studied the impact of lexical factors on three oral word-finding error patterns identified in learners' OR: lemma-related disruptions (semantic and syntactical errors); word form–related errors (blocked errors); and word form segment-related disruptions (phonologic errors). Findings indicated that during oral reading, learners with WFD were more likely to make phonologic reading errors on those low-frequency words with highly common phonological patterns. In contrast, WFD learners were more likely to make syntactical reading errors on words that were highly familiar. Regression analyses confirm these findings, as few phonologic reading errors were observed on high frequency words and words with lower phonotactic probability. Similarly, more word form blocked reading errors occurred on words with a lower frequency; however, in contrast to the findings for phonologic errors, more word form blocked errors occurred on words with lower phonotactic probability. That is, children with WFD had difficulty reading out loud words with rare phonologic patterns and tended to block on these words, whereas phonologic reading errors only occurred on words that had higher phonotactic probability (such that partial phonotactic information was available). These findings converge with frequency and phonotactic effects reported for oral word finding; prior research has shown higher incidence of phonologic errors on low frequency words and more blocked errors on words from sparse neighborhoods (German & Newman, 2004). This suggests that lexical factors of vocabulary that impact on oral language (word finding) success may also impact on the oral reading success of learners with WFD. This further substantiates the influence that lexical access or word finding may have on oral reading.

More specifically, the presence of lexical factor effects on error patterns studied in this investigation can be interpreted as an indication of an underlying disruption in WFD learners' lexical access system during oral reading. Again, the adapted lexical model (German, 2000b, 2000c), referenced earlier, can be further adapted to explain how the three error patterns observed in oral language can occur in oral reading (see Figure 3). Inherent in this lexical model is the assumption that in oral word finding semantic and phonological aspects of words are accessed from two independent structures. If so, in oral reading, the semantic aspects of the to-be-read word

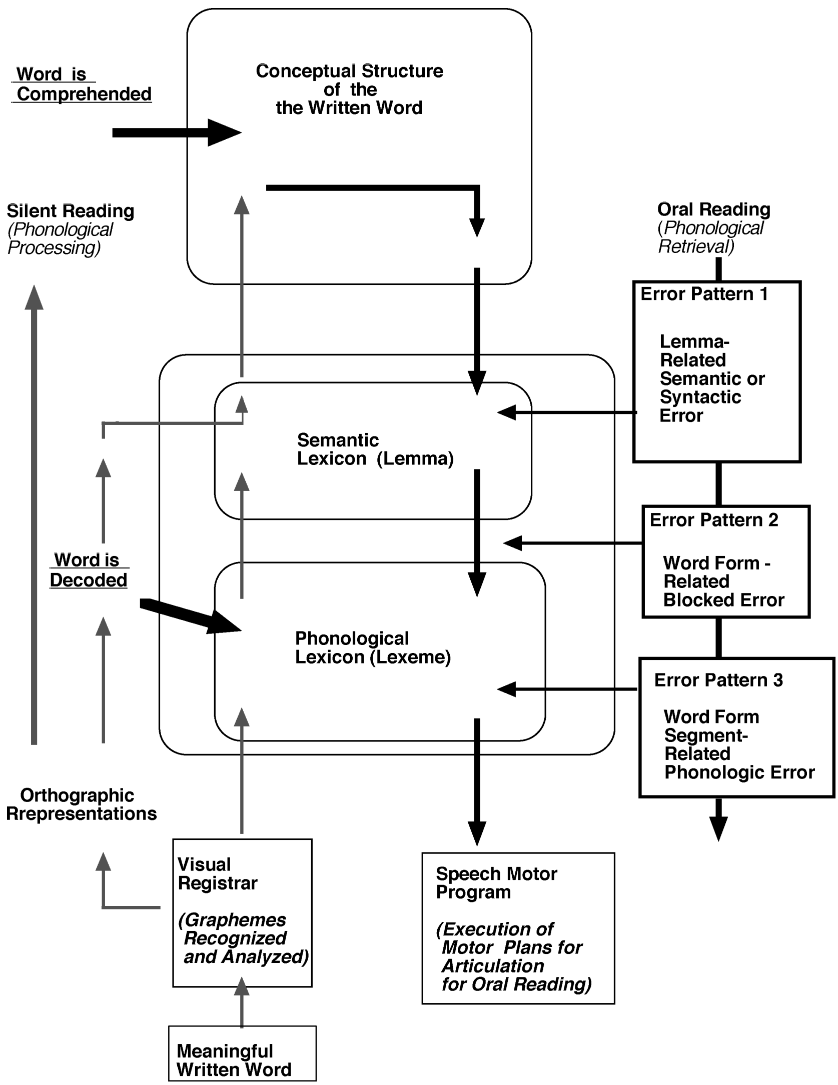

FIGURE 3 Word-finding error patterns present in oral reading performance.

would be accessed in Stage 4 with the phonological aspects for the written word accessed in Stage 5 (see Figure 3 and earlier discussion; Garrett, 1991; Gordon, 1997; Levelt, 1989, 1991, 1999).

This implies that the following three potential disturbances can occur in lexical access for speech and correspondingly may occur in oral reading: semantic aspects of a target word may be inaccessible to a child while speaking and reading orally, making the phonological features unavailable also (resulting in lemma-related semantic errors; error pattern 1 in Figure 3), or the semantic features of the oral or written word may be accessible while subsequent retrieval of the word's phonological features are blocked (word form–related blocked errors; error pattern 2 in Figure 3), or third, only partial elicitation of the oral or written word's phonological features may be available for speech or oral reading (word form segment-related errors; error pattern 3 in Figure 3). This hypothesis has support in the literature. Faust et al. (2003), studying the word form blocked error as in our investigation, reported that their learners with dyslexia were able to access the target word's lemma but failed to access the target word's phonological form. They concluded that a difficulty in accessing a word's phonological code might underlie both word-finding difficulties and reading difficulties among children with dyslexia.

An anecdote supports this supposition as well, as one learner, when attempting to orally read the word cocoon, manifested Error Pattern 2, the word form blocked error pattern. He produced a classic circumlocution describing the perceptual and locative attributes of the evasive reading word, "You know, it is that brown thing hanging in the tree" as he attempted to access the word cocoon for oral reading. This student had decoded and comprehended the target word but nonetheless had difficulty retrieving the word's phonological form to read the word aloud. These clinical observations, along with our experimental findings documenting the oral reading presence of the three word-finding error patterns, suggest that oral word-finding disruption points may also underlie some of the oral reading errors observed.

4. For children with word-finding difficulties, do the lexical factors of the reading words impact on the nature of the children's oral reading word miscues?

   The current results indicate that various lexical factors of words may also influence the miscues our learners produced during OR. Miscues produced in this investigation were higher in frequency, resided in denser neighborhoods, and were more familiar than the target written word. Noteworthy is that the same lexical factors of words reported earlier to facilitate lexical access during OR may also make a reading word substitution more accessible then the written word. That is, lexical access was more accurate for words that were high in frequency and had dense neighborhoods; when children erred, they tended to err toward words with these same properties. However, in the present case these factors worked to the students' disadvantage as they accessed the miscue rather than the written word for oral reading. These findings are similar to observations reported from earlier oral language studies where learners with WFD were more likely to substitute words that were higher in frequency, learned earlier than the intended word, and resided in denser neighborhoods than did the target words (German & Newman, 2004). In addition, these findings also indicate that during the OR task, students had reached a lexical space for the written word beyond decoding and beyond the comprehension level, as otherwise target word frequency and neighborhood density would not have influenced miscue selection.

Educational Implications

A good reader, according to the National Research Council of the National Academy of Sciences, should be able to decode words, understand read material (comprehension), and read fluently (Snow, Burns, & Griffin, 1998). This has led to a focus in today's schools on oral reading, oral reading fluency, and listening comprehension skills. The findings in this investigation do not challenge the need for these skills in successful reading, but suggest that we may want to be cautious when assessing the skill strength of learners with WFD via oral reading. First, we observed a discrepancy between our learners' oral and SRR skills, suggesting that OR assessments may underestimate the reading skills of learners with WFD. Similar discrepancies have also been reported between standardized OR assessments and corresponding adapted SRR assessments for learners with word-finding difficulties (German & Gellar, 2001). Further, our students' OR errors reflected oral word-finding error patterns and their miscues were affected by the same lexical factors that influenced children's oral word-finding skills. These findings suggest too that the OR task may be influenced by the learners' oral language skills after they have decoded the word. Practically, this may mean that students with WFD who are able to identify words in SRR tasks may produce miscues during OR because of their difficulties in accessing the semantic or phonological features of the word to be read aloud. If so, educators would want to be cautious determining the reading instruction level of students with oral-language difficulties. Basing such decisions on OR performance could result in reading instruction expectations set below students' SRR skills (German, 2005) and thus reading group placement below their actual decoding abilities. Instead, silent reading assessments may be a better means of evaluating the reading skills of learners with WFD. Further, besides a reduction in OR, use of mnemonic strategies to anchor retrieval of grapheme-to-phoneme relationships during phonics instruction would be helpful. Reading comprehension assessments employing recognition response formats (multiple choice, find the answer or select the answer) will also facilitate these learners' reading success as these latter tasks have a lower retrieval-load than the traditional "write" or "tell me" what happened in the read story.

Notes

1. Although a more typical protocol is to use Kucera and Francis's (1967) norms to determine frequency of occurrence, we thought adult-based norms might not be the best measure of the frequency with which a child encounters any given word. The Carroll et al. corpus is based specifically on reading material intended for children.
2. Originally a seventh reading analysis section was administered, syllable dividing. Learners earned low accuracy scores on both oral reading (58%) and corresponding SRR (66.6%) tasks. We therefore concluded that this skill was above the instructional level of our participants and removed it from the battery.

3. Note that while we wrote "koy" in the text, these were said aloud, so there was no apparent mismatch between the spelling of the sequence in isolation and in the target.
4. Two children had perfect scores in oral reading for their sections and thus were not tested on any items silently for that section; they were not included in the analysis.
5. Form-related blocked errors were studied only in the regression analysis, since while there were a substantial number of these errors, they were made by only a small number (3) of participants.
6. Although nonword miscues emerged, they were excluded from this substitution analysis because meaningful comparisons could not be conducted: familiarity and frequency values could not be calculated for items that did not result in real words. Further, miscues that were words in the adult lexicon but may not have been meaningful to the child (did not have a U-value of at least .1) were considered "nonwords" for the children and thus not considered in this analysis (*candor* for *canary*). Miscues of a purely syntactical nature, where the free morpheme was the same, were also excluded from these analyses as neighborhood values for the reading word (*jumped*) and miscue (*jumps*), determined on the base morpheme, were identical.

Acknowledgements

The authors thank Kristine Reiser, research assistant at National-Louis University; Jan Schwanke, SLP-CCC, and the teachers and students at Oak Grove School, Green Oaks, IL; and the speech and language pathologists, teachers, and students at Baker Demonstration School, Wilmette, IL; at Cherokee School, Lake Forest, IL; at Elizabeth Blackwell Elementary School, Schaumburg, IL; Grove School, Northbrook, IL; at Hillcrest School, Hoffman Estates, IL; at Indian Trail and Ravinia Schools, Highland Park, IL; and at Lyon School, Glenview, IL, for their participation in this investigation.

References

Andrews, S. (1989). Frequency and neighborhood effects on lexical access: Activation or search? *Journal of Experimental Psychology: Learning, Memory and Cognition, 15*(5), 802–814.

Andrews, S. (1997). The effect of orthographic similarity on lexical retrieval: Resolving neighborhood conflicts. *Psychonomic Bulletin & Review, 4*(4), 439–461.

Badian, N. A. (1998). A validation of the role of preschool phonological and orthographic skills in the prediction of reading. *Journal of Learning Disabilities, 31*, 472–481.

Betourne, L. S., & Friel-Patti, S. (2003). Phonological processing and oral language abilities in fourth-grade poor readers. *Journal of Communication Disorders, 36*, 507–527.

Bierwisch, M., & Schreuder, R. (1991). From concepts to lexical items. In W. J. M. Levelt (Ed.), *Lexical access in speech production* (pp. 23–60). Cambridge, MA: Blackwell.

Blachman, B. A. (1994). What we have learned from longitudinal studies of phonological processing and reading, and some answered questions: A response to Torgesen, Wagner, and Rashotte. *Journal of Learning Disabilities, 27,* 287–291.

Carroll, J. B., Davies, P., & Richman, B. (1971). *The American Heritage frequency book.* Boston: Houghton Mifflin.

Catts, H. W. (1989). Phonological processing deficits and reading disabilities. In A. G. Kamhi & H. W. Catts (Eds.), *Reading disabilities: A developmental language perspective* (pp. 101–132). Boston: Allyn & Bacon.

Catts, H. W., Fey, M., & Tomblin, B. (1997). *Language basis of reading disabilities.* Paper presented at the Society for the Scientific Study of Reading, Chicago, IL.

Catts, H. W., & Hogan, T. P. (2003). Language basis of reading disabilities and implications for early identification and remediation. *Reading Psychology, 24,* 223–246.

Catts, H. W., & Kamhi, A. (1999). Causes of reading disabilities. In H. G. Catts & A. G. Kamhi (Eds.), *Language and reading disabilities* (pp. 95–127). Boston: Allyn & Bacon.

Charles-Luce, J., & Luce, P. A. (1995). An examination of similarity neighborhoods in young children's receptive vocabularies. *Journal of Child Language, 22,* 727–735.

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual-route and parallel distributed processing approaches. *Psychological Review, 100,* 589–608.

Coltheart, M., Davelaar, E., Jonasson, J. T., & Besner, D. (1977). Access to the internal lexicon. In S. Dornic (Ed.), *Attention and performance VI* (pp. 535–555). Hillsdale, NJ: Lawrence Erlbaum.

Dell, G. S. (1988). The retrieval of phonological forms in production: Tests of predictions from a connectionist model. *Journal of Memory and Language, 27,* 124–142.

Denckla, M. B. (1976). Naming of object-drawings by dyslexic and other learning disabled children. *Brain and Language, 3,* 1–15.

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

Denckla, M. B., & Rudel, R. G. (1976). Rapid automatized naming (RAN): Dyslexia differentiated from other learning disabilities. *Neuropsychologia, 14,* 471–479.

Dirks, D. D., Takayanagi, S., Moshfegh, A., Noffsinger, P. D., & Fausti, S. A. (2001). Examination of the neighborhood activation theory in normal and hearing-impaired listeners. *Ear and Hearing, 22,* 1–13.

Dollaghan, C. A. (1994). Children's phonological neighborhoods: Half empty or half full? *Journal of Child Language, 21,* 257–271.

Dunn, L., & Dunn, L. (1997). *Peabody Picture Vocabulary Test* (3rd ed.). Circle Pines, MN: American Guidance Service.

Faust, M., Dimitrovsky, L., & Davidi, S. (1997). Naming difficulties in language disabled children: Preliminary findings with the application of the tip-of-the tongue paradigm. *Journal of Speech and Hearing Research, 40,* 1026–1036.

Faust, M., Dimitrovsky, L., & Shacht, T. (2003). Naming difficulties in children with dyslexia. *Journal of Learning Disabilities, 36,* 203–215.

Forster, K. I., & Chambers, S. M. (1973). Lexical access and naming time. *Journal of Verbal Learning and Verbal Behavior, 12,* 627–635.

Garrett, M. (1991). Disorders of lexical selection. In W. J. M. Levelt (Ed.), *Lexical access in speech production* (pp. 143–180). Cambridge, MA: Blackwell.

Gathercole, S. E., Frankish, C. R., Pickering, S. J., & Peaker, S. (1999). Phonotactic influences on short-term memory. *Journal of Experimental Psychology: Learning, Memory & Cognition, 25,* 84–95.

Gathercole, S. E., Willis, C., Emslie, H., & Baddeley, A. D. (1991). The influence of number of syllables and wordlikeness on children's repetition of nonwords. *Applied Psycholinguistics, 12,* 349–367.

German, D. J. (1984). Diagnosis of word-finding disorders in children with learning disabilities. *Journal of Learning Disabilities, 17,* 353–358.

German, D. J. (1991). *Test of Word Finding in Discourse* (TWFD). Austin, TX: Pro Ed.

German, D. J. (2000a). *Test of Word Finding,* Second Edition (TWF-2). Austin, TX: Pro Ed.

German, D. J. (2000b, October) *Formulate a second hypothesis: Word finding based oral reading errors.* Presentation at the Illinois Dyslexia Association, Oak Park, IL.

German, D. J. (2000c, November) *Word finding (WF) sensitive oral reading (OR) analysis.* Poster presented at the American Speech, Language, and Hearing Association (ASHA). Washington, DC.

German, D. J. (2005) *Word Finding Intervention Program,* Second Edition (WFIP-2). Austin, TX: Pro Ed.

German, D. J., & Gellar, M. (2001, November). *The effect of word-finding difficulties on oral reading assessment, preliminary investigation.* Poster presented at the International Dyslexia Association (IDA), Albuquerque, NM.

German, D. J., & Newman, R. S. (2004). The impact of lexical factors on children's word finding errors. *Journal of Speech, Language, and Hearing Research, 47,* 624–636.

German, D. J., & Newman, R. S. (2005, July). *Word finding based oral reading errors.* Paper presented at the International Congress of the Study of Child Language (IASCL), Berlin, Germany.

Gordon, B. (1997). Models of naming. In H. Goodglass & A. Wingfield (Eds.), *Anomia: Neuroanatomical and cognitive correlates* (pp. 31–64). San Diego, CA: Academic Press.

Gordon, J. K. (2002). Phonological neighborhood effects in aphasic speech errors: Spontaneous and structured contexts. *Brain and Language, 82,* 113–145.

Grainger, J., O'Regan, J. K., Jacobs, A. M., & Segui, J. (1989). On the role of competing word units in visual word recognition: The neighborhood frequency effect. *Perception & Psychophysics, 45*(3), 189–195.

Harley, T. A., & Bown, H. E. (1998). What causes a tip-of-the-tongue state? Evidence for lexical neighbourhood effects in speech production. *British Journal of Psychology, 89,* 151–174.

Howard, J. K., Fuchs, D., & Mathes, P. (2001). Do students with and without severe lexical retrieval deficits respond differently to instruction. *Journal of Learning Disabilities, 34*(3), 264–275.

Jescheniak, J. D., & Levelt, W. J. M. (1994). Word frequency effects in speech production: Retrieval of syntactic information and of phonological form. *Journal of Experimental Psychology: Learning, Memory & Cognition, 20,* 824–843.

Johnson, D., & Myklebust, H. (1967). *Learning disabilities: Educational principles and practices.* New York: Grune & Stratton.

Katz, R. B. (1986). Phonological deficiencies in children with reading disability: Evidence from an object-naming task. *Cognition, 22,* 225–257.

Kucera, H., & Francis, W. N. (1967). *A computational analysis of present-day American English.* Providence, RI: Brown University Press.

Lachman, R., Shaffer, J. P., & Hennrikus, D. (1974). Language and cognition: Effects of stimulus codability, name-word frequency, and age of acquisition on lexical reaction time. *Journal of Verbal Learning and Verbal Behavior, 13,* 613–625.

Lahey, M., & Edwards, J. (1999). Naming errors of children with specific language impairment. *Journal of Speech and Hearing Research, 42*(1), 195–205.

Larrivee, L. S., & Catts, H. W. (1999). Early reading achievement in children with expressive phonological disorders. *American Journal of Speech-Language Pathology, 8*(2), 118–128.

Levelt, W. J. M. (1989). *Speaking: From intention to articulation.* Cambridge, MA: MIT.

Levelt, W. J. M. (1991). *Lexical access in speech production.* Cambridge, MA: Blackwell.

Levelt, W. J. M. (1999). Models of word production. *Trends in Cognitive Sciences, 3,* 223–232.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22,* 1–75.

Luce, P. A., & Pisoni, D. B. (1998). Recognizing spoken words: The Neighborhood Activation Model. *Ear & Hearing, 19,* 1–36.

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.

McCann, R. S., & Besner, D. (1987). Reading pseudohomophones: Implications for models of pronunciation assembly and the locus of word-frequency effects in naming. *Journal of Experimental Psychology: Human Perception and Performance, 13*(1), 14–24.

Messer, D., Murphy, N., & Dockrell, J. E. (2004). The relationship between naming and literacy in children with word-finding difficulties. *Journal of Educational Psychology, 96,* 462–470.

Murphy, L. A., Pollatsek, A., & Well, A. D. (1988). Developmental dyslexia and word retrieval deficits. *Brain and language, 1,* 1–23.

Newbigging, P. L. (1961). The perceptual reintegration of frequent and infrequent words. *Canadian Journal of Psychology, 15,* 123–132.

Newman, R. S., & German, D. J. (2002). Effects of lexical factors on lexical access among typical language-learning children and children with word-finding difficulties. *Language & Speech, 43*, 285–317.

Newman, R. S., & German, D. J. (2005). Life span effects of lexical factors on oral naming. *Language & Speech, 48*(2), 123–156.

Nusbaum, H. C., Pisoni, D. B., & Davis, C. K. (1984). Sizing up the Hoosier Mental Lexicon: Measuring the familiarity of 20,000 words. In *Research on Speech Perception Progress Report* (pp. 357–376). Bloomington, IN: Indiana University.

Oldfield, R. C., & Wingfield, A. (1965). Response latencies to naming objects. *Quarterly Journal of Experimental Psychology, 17*, 273–281.

Roth, F. P., Speece, D. L., & Cooper, D. H. (2002). A longitudinal analysis of the connection between oral language and early reading. *The Journal of Education Research, 95*, 259–272.

Rubin, H., & Liberman, I. (1983). Exploring the oral and written language errors made by language disabled children. *Annals of Dyslexia, 33*, 110–120.

Shaywitz, S. (2003). *Overcoming dyslexia: A new and complete science-based program for reading problems at any level.* New York: Alfred A. Knopf.

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

Snowling, M., Wagtendonk, B., & Stafford, C. (1988). Object-naming deficits in developmental dyslexia. *Journal of Research in Reading, 11*, 67–85.

Snyder, L. S., & Downey, D. M. (1995). Serial rapid naming skills in children with reading disabilities. *Annals of Dyslexia, 45*, 31–49.

Solomon, R. L., & Postman, L. (1952). Frequency usage as a determinant of recognition thresholds for words. *Journal of Experimental Psychology, 43*, 195–201.

Storkel, H. L. (2001). Learning new words: Phonotactic probability in language development. *Journal of Speech and Hearing Research, 44*, 1321–1337.

Storkel, H. L. (2002). Restructuring of similarity neighborhoods in the developing mental lexicon. *Journal of Child Language, 29*, 251–274.

Storkel, H. L., & Rogers, M. A. (2000). The effect of probabilistic phonotactics on lexical acquisition. *Clinical Linguistics & Phonetics, 14*, 407–425.

Swan, D., & Goswami, U. (1997). Phonological awareness deficits in developmental dyslexia and the phonological representations hypothesis. *Journal of Experimental Child Psychology, 66*, 18–41.

Torgeson, J. K. (1999). Assessment and instruction for phonemic awareness and word recognition skills. In H. W. Catts & A. G. Kamhi (Eds.), *Language and reading disabilities* (pp. 128–153). Boston: Allyn & Bacon.

Vitevitch, M. S. (1997). The neighborhood characteristics of malapropisms. *Language & Speech, 40*, 211–228.

Vitevitch, M. S. (2002). The influence of phonological similarity neighborhoods on speech production. *Journal of Experimental Psychology: Learning, Memory & Cognition, 28*, 735–747.

Vitevitch, M. S., & Luce, P. A. (2004). A web-based interface to calculate phonotactic probability for words and nonwords in English. *Behavior Research Methods, Instruments, & Computers, 36*, 481–487.

Vitevitch, M. S., Luce, P. A., Charles-Luce, J., & Kemmerer, D. (1997). Phonotactics and syllable stress: Implications for the processing of spoken nonsense words. *Language and Speech, 40*(1), 47–62.

Vitevitch, M. S., & Sommers, M. S. (2003). The facilitative influence of phonological similarity and neighborhood frequency in speech production. *Memory & Cognition, 31*, 491–504.

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

Walley, A. C., & Metsala, J. L. (1992). Young children's age-of-acquisition estimates for spoken words. *Memory and Cognition, 20*, 171–182.

Wiig, E. H., & Semel, E. M. (1984).*Language assessment and intervention for the learning disabled.* Columbus, OH: Merrill.

Wiig, E. H., Zureich, P., & Chan, H. H. (2000). A clinical rationale for assessing rapid automatized naming in children with language disorders. *Journal of Learning Disabilities, 33*, 359–374.

Wolf, M. (1997). A provisional, integrative account of phonological naming-speed deficits in dyslexia: Implications for diagnosis and intervention. In B. Blachman (Ed.), *Foundations of reading acquisition and dyslexia* (pp. 67–92). Mahwah, NJ: Lawrence Erlbaum.

Wolf, M. (1999). What time may tell: Towards a new conceptualization of developmental dyslexia. *Annals of Dyslexia, 49*, 3–28.

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. G. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology, 91*(3), 1–24.

Wolf, M., & Bowers, P. G. (2000). Naming-speed processes and developmental reading disabilities: An introduction to the special issue on the double-deficit hypothesis. *Journal of Learning Disabilities, 33*(4), 322–324.

Wolf, M., & Obregón, M. (1992). Early naming deficits, developmental dyslexia, and a specific deficit hypothesis. *Brain and Language, 42*, 219–247.