Minyi Shih Dennis, Lehigh University
Brian R. Bryant, The University of Texas at Austin
Mary Beth Calhoon, University of Miami

Oral Reading Miscues and Their Relation to Silent Reading Comprehension in Children With and Without Learning Disabilities

Abstract

Oral reading fluency (ORF) has been widely used as a measure of students' overall reading competency. However, accuracy, or words correct per minute (wcpm), derived from ORF testing may not reveal all aspects of a student's reading abilities. The present study investigated the oral reading miscue patterns of students with and without learning disabilities (LD). In addition, the predictability of oral reading miscues on silent reading comprehension performance was examined. Using the Gray Oral Reading Tests-Fifth Edition miscue coding system to categorize students' oral reading miscues, study findings suggest that there are differences in the oral reading miscue patterns of students with and without LD. Moreover, two miscue categories, function similarity and meaning similarity, significantly predicted silent reading comprehension performance. The discussion focuses on how incorporating oral reading miscue analysis along with rate and accuracy can add a layer of information to help teachers in their decision-making for instructional alignment.

Oral reading fluency – the ability to read connected text quickly and accurately – has received considerable attention in recent years, largely because its critical role in reading instruction has been recognized by the National Reading Panel (National Institute of Child Health and Human Development, 2000). The importance of reading fluency lies in its pivotal role in coordinating the reader's cognitive processes that underscore automatic word recognition, rapid syntax structure identification, and lexical and text comprehension (Pikulski, 2006). The level of accuracy and speed in oral reading reflects the extent to which one can efficiently recognize and sound out printed words at the graphophonic, syntactic, and semantic levels (Kim, Wagner, & Foster, 2011). Thus, reading fluency is affected by multiple language skills, including the ability to quickly identify groups of words that form meaningful grammatical units (Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; National Institute of Child Health and Human Development, 2000).

Recognition of the critical role of oral reading fluency as a general outcome measurement has spurred its use for monitoring students' overall reading competency (Ridel, 2007). A number of curriculum-based measurement (CBM) tools such as AIMSweb (Pearson, 2009), Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002), and Informal Reading Inventories (IRI; Johnson, Kress, & Pikulski, 1987) all include oral reading fluency (ORF) components.

Different ORF measures may use different procedures to measure reading fluency. For example, in one method the child reads a passage aloud for one minute, and the examiner notes any oral reading errors. The percentage of words read correctly or the total number of words read accurately at the end of one minute (words correct per minute [wcpm]) is

Dennis, M. S., Bryant, B. R., & Calhoon, M. B. (2016). Oral reading miscues and their relation to silent reading comprehension in children with and without learning disabilities. *International Journal for Research in Learning Disabilities, 3*(1), 47-60.

calculated. An alternative approach involves a reader reading an entire passage while the examiner marks reading errors. The total amount of time taken to read the entire passage is marked, and the rate and accuracy are then calculated.

Regardless of the procedure used to measure ORF, the fluency index (either wcpm or rate and accuracy) serves as a measure of overall reading competency at the level at which the passage is written (e.g., 193 wcpm for a third-grade-level passage). When teachers use the fluency index to track students' reading performance, they may use the data as an impetus to alter their teaching strategy if their students' rate of growth does not meet the desired growth trajectory. Indeed, student performance has been shown to be maximized when teachers analyze student performance and develop individually tailored instructional programs accordingly (Stecker, Fuchs, & Fuchs, 2005). However, fluency index measurement alone is insufficient when it comes to informing individualized instruction, because the index may not reveal the student's strengths and needs in relation to the factors that affect ORF performance. As a result, researchers have suggested that teachers conduct diagnostic analyses in conjunction with using progress monitoring tools (Fuchs, Fuchs, & Hamlett, 2007).

Within the context of ORF testing, a diagnostic and qualitative analysis is typically conducted through miscue analysis. An analysis of miscue patterns during oral reading may capture different levels of students' graphophonic, syntactic, or semantic processing that reflect the reading strategies the students used to process print. As such, an oral reading miscue analysis may provide useful information for planning an individualized intervention program.

Oral Reading and Miscue Analysis

Most reading specialists and elementary teachers are familiar with and regularly use oral reading error analysis in the context of running records (Bean, Cassidy, Grumet, Shelton, & Wallis, 2002). By most accounts, Gray (1915, 1920) was among the first to focus on oral reading analysis when he wrote his *Standardized Oral Reading Passages* and used them and other reading materials to study reading rate (i.e., number of words read in a specified period of time). In his 1920 paper, Gray noted the oral reading mistakes students made while reading aloud but made no mention of any type of error analysis.

A decade later, Monroe (1932) took oral reading analysis a step further by identifying several types of common oral reading errors (e.g., faulty vowels and consonants, sound addition and omission, and letter reversals) that could shed light on idiosyncratic reading patterns. In describing Monroe's and other later efforts at oral reading error analysis, Leu (1982, p. 422) noted that such analysis made the following assumptions:

1. Proficient reading equals exact oral reading.
2. Oral reading errors interfere with reading comprehension.
3. The number of oral reading errors that a person makes is related to their reading comprehension.

Finally, K. Goodman approached reading from a linguistic perspective. He preferred the term *miscues* to *errors* because he believed that reading is a process in which readers respond to three types of linguistic cues: graphophonic, syntactic, and semantic (K. Goodman, 1964, 1965). When a reader produces oral reading that departs from what was provided in the text, the reader is believed to be missing one or more of the linguistic cues (K. Goodman, 1969, 1973). Therefore, analyzing the linguistic cue that was missed by the reader can help teachers gain insight into the student's reading process. K. Goodman and colleagues devoted several years to creating a classification system for identifying and categorizing oral reading miscues (K. Goodman, 1969, 1973; Y. Goodman, Watson, & Burke, 2005). Throughout the remainder of this article we use the term *miscue* suggested by K. Goodman rather than *error* for students' deviations from print during oral reading.

Oral reading miscue analysis has been criticized, both in print (see McKenna & Picard, 2006, and K. Goodman's 2006 retort; Moats, 2000) and online (DeRosa, 2010). Yet, miscue analysis remains a popular and widely used means of examining oral reading and informing instruction. Wiederholt and Bryant (1986) incorporated a modified version of Goodman's miscue analysis system into their *Gray Oral Reading Test-Revised* (GORT-R), and it continues to be included in the latest edition of the test, *Gray Oral Reading Test-Fifth Edition* (GORT-5; Wiederholt & Bryant, 2012).

Regardless of whether reading professionals use the term *errors* or *miscues,* most would agree with what Fowler, Shankweiler, and Liberman wrote over 30 years ago: "The errors children make in oral reading provide a window through which we may view special problems of learning to read" (1979, p. 243). The window may not always be crystal clear, but oral reading miscues provide clinicians and diagnosticians with a perspective of a student's skills underlying oral reading fluency.

Studies on Oral Reading Miscues

Several studies have explored whether there is an association between students' level of language development and their oral reading miscue patterns. For example, Laing (2002) compared the miscue patterns of third graders with language delays with those of students having typical language development. Using a 12-category miscue system, Laing suggested that third-grade students with typical language development made more miscues that were meaningfully consistent with the original text than their counterparts with lower-than-average language abilities. Further, Gillam and Carlile (1997) compared miscue differences made by students with specific language impairment to those of their typically developed counterparts. Four miscue categories were used: graphophonemic, syntactic, semantic-pragmatic, and self-correction. Their findings suggested that typically developing participants had significantly higher percentage miscues that were graphophonemic, syntactic, and semantic-pragmatic similar to the print; they also had a higher percentage of self-corrected miscues.

In a third study, Cambourne and Rousch (1982) compared oral reading miscues produced by readers ranked by their teachers as the top 5%, middle 5%, or bottom 5% of their age-grade reading group. Participants were asked to read a passage deemed suitable for students' reading level by their teachers, and their oral reading miscues were subsequently categorized using a 24-category taxonomy. The results of the study showed that the proficient readers concentrated on sense and grammatical flow rather than the graphic and phonemic aspects of print. In contrast, the less proficient readers paid more attention to the physical aspects of print.

In summary, even though various miscue coding systems were used in previous studies to categorize students' oral reading miscues, these studies reached the same conclusion; that is, students with typical language development made more miscues that preserved the meaning of the text than students with impaired language development. However, the results were inconclusive regarding whether students with lower-than-average language development made more graphophonemic miscues. For example, the Cambourne and Rousch (1982) study, although alluding to differences in miscues made by students with different levels of reading proficiency, suffers from a lack of a refined and systematic approach to yield a valid comparison among groups (i.e., no standardized approach to grouping students).

Purpose and Research Questions

Because qualitative analysis of students' oral reading miscues can contribute to an understanding of students' graphophonic, syntactic, and semantic processes during oral reading, miscue analysis may provide more precise information for addressing students' individual needs as a means of improving their reading performance (K. Goodman, 1964, 1965, 1969, 1973). Such a level of individualization is especially critical for students with learning disabilities (LD) because these students are more likely to experience difficulties in reading (Kame'enui, Good, & Harn, 2005) linked to graphophonic, syntactic, and semantic processes during reading (Perfetti, 2007; Simmons, Kame'enui, Coyne, Chad, & Hairrell, 2011; Wise, Sevcik, Morris, Lovett, & Wolf, 2007).

Therefore, the purpose of the present study was to extend previous research (e.g., Cambourne & Rousch, 1982; Gillam & Carlile, 1997; Laing, 2002) to a distinct group of students by examining the oral reading miscues of students with LD. The following research questions were investigated:

Research Question 1: Is there a difference in the miscue patterns displayed by students with or without LD using the *Gray Oral Reading Test-Fifth Edition* (GORT-5) deviation coding system?

Research Question 2: Which GORT-5 miscue category best predicts students' silent reading comprehension performance?

Method

Participants

Participants were selected from a subject pool of 280 students from grades 3 through 5 in two suburban schools in the western United States. Among the 280 students, 36 had identified LD using the state of California LD identification criteria, whereby students are assessed by multidisciplinary teams using a discrepancy-based model to determine whether they have a severe discrepancy between their intellectual ability and achievement in oral expression, listening comprehension, written expression, basic reading skill, reading comprehension, mathematical calculation, or mathematical reasoning for LD diagnosis (California Code of Regulations §3030).

These 36 students were matched with counterparts without LD using the following variables: age, gender, and ethnicity. English language learners were not included in the study. A summary of the demographic information for the 72 students (36 students from each group, LD and non-LD) in the study is presented in Table 1.

Table 1
Student Demographic Information by Groups

	N	Male	Age Mean *(SD)*	African American	Asian	Hispanic	White	TOSCRF Mean *(SD)*	GORT-5 Fluency Scale Mean *(SD)*	GORT-5 Comprehension Scale Mean *(SD)*
LD	36	25	10.75 (1.01)	1	2	13	20	87.29 (8.44)	7.67 (2.89)	5.95 (1.91)
Non-LD	36	25	10.62 (0.97)	1	2	13	20	104.50 (10.19)	11.61 (2.50)	10.93 (2.31)

Measures

The *Test of Silent Contextual Reading Fluency* (TOSCRF; Hammill, Wiederholt, & Allen, 2006) and *Gray Oral Reading Test-Fifth Edition* (GORT-5; Wiederholt & Bryant, 2012) were administered to the participants. The TOSCRF was used to measure students' silent reading comprehension performance; GORT-5 was used to code and categorize their oral reading miscues.

Test of Silent Contextual Reading Fluency (TOSCRF). The TOSCRF (Hammill et al., 2006) is a standardized, norm-referenced test that is designed to measure the silent reading ability of children between the ages of 7 and 18. The test adopts a word chain technique by using words in a series of brief printed passages without providing spacing or punctuation within the passages. As exemplified in the test manual, the students are asked to read and draw lines between each word of the passage such as the following:
AYELLOWBIRDWITHBLUEWINGSSATONMOTHERSPRETTYHAT.

According to Hammill et al. (2006), the TOSCRF measures a wide range of silent reading skills, including word knowledge, syntax and morphology knowledge, and silent reading comprehension. The TOSCRF has high alternate-forms reliability ($r = 0.82 - 0.93$) and very high interscorer reliability ($r = 0.99$). The examiner's manual reports that the TOSCRF has moderate to large correlation with other reading fluency and comprehension measures (> 0.55).

***Gray Oral Reading Test-Fifth Edition* (GORT-5).** The GORT-5 (Wiederholt & Bryant, 2012) is an individually administered, standardized, norm-referenced test that measures oral reading rate, accuracy, fluency, and comprehension. The test was standardized on 2,556 students from 34 states between the age of 6 years, 0 months and 23 years, 11 months. In addition to providing normative scores for its subtests and composites, the GORT-5 offers a system for qualitatively analyzing oral reading miscues across five categories, as discussed later. Evidence for the following five forms of reliability is reported for the GORT-5: coefficients alpha, alternate-forms reliability (immediate

administration), alternate-forms reliability (delayed administration), test-retest, and interscorer reliability. Average reliability coefficients across ages for each type of reliability are reported as 0.93, 0.93, 0.77, 0.82, and 0.99, respectively. Considerable evidence supporting the validity of the GORT-5 is provided in the examiner's manual.

Procedures

Test administration. Both the TOSCRF and the GORT-5 were administered by 10 examiners who were experienced substitute teachers. They were either working on their teacher certifications or had already obtained their credentials. Prior to testing, the first author trained the examiners on how to administer each test. After the training, the examiners practiced with each other as the first author checked for fidelity. A reliability check on adherence to direction and scoring conducted after the training yielded an interscorer agreement of at least 90% across examiners.

All participants were administered the TOSCRF and the GORT-5 by the examiners at the students' schools. Following the GORT-5 standardized administration procedure, examiners asked participants to read each passage aloud as carefully and quickly as possible, and told them that after each passage reading they would be asked questions about what they had read. Examiners timed the students' reading and marked each miscue with a slash. After each passage was read, the examiners recorded the number of miscues and the total time each participant spent reading a specific passage. Upon completion of each passage, students were asked five open-ended comprehension questions. Entry points, basals, and ceilings were applied according to the instructions provided on the GORT-5. All students' oral reading was audio recorded for further miscue analysis.

Miscue system. The miscue system developed by the authors of the GORT-5 was used to categorize the students' oral reading miscues. The GORT-5 uses five miscue categories: meaning similarity, function similarity, graphic/phonemic similarity, multiple sources, and self-correction. Three of the miscue categories, meaning similarity, function similarity, and graphic/phonemic similarity, are consistent with K. Goodman et al. (1969, 1973) and Y. Goodman et al.'s (2005) miscue categories: semantic, syntactic, and graphophonic.

1. **Meaning Similarity:** A miscue is coded as "meaning similarity" if it does not significantly change the meaning of the sentence (e.g., "'Immediately' the murmur from the hive was amplified." for " 'Instantaneously' the murmur from the hive was amplified.").
2. **Function Similarity:** A miscue is coded as "function similarity" if it does not change the grammatical form of the word and fits within the context of the sentence (e.g., substitutes a noun for a noun or a verb for a verb in a sentence; thus, the sentence makes syntactic sense: "A 'bat' is perched on a fence." for "A bird is perched on a fence.").
3. **Graphic/Phonemic Similarity:** Words labeled "graphic/phonemic similarity" miscues include miscues of which some portion (e.g., affixes, roots, vowel sounds, or consonant sounds) of the response is aligned with the target word (e.g., affixes similarity: "**re**move" for "**re**turn"; roots similarity: "**merri**ly" for "**merry**"; vowel sounds similarity: "w**ai**t" for "st**ay**"; consonant sounds similarity: "**c**ome" for "**c**at").
4. **Multiple Sources:** Words labeled "multiple sources" are miscues fitting more than one miscue category (i.e., any combination of meaning similarity, function similarity, and graphic/phonemic similarity). For example, if a student read, "A bird is 'sitting' on a fence" for "A bird is perched on a fence," the miscue, "sitting," is marked as "multiple sources" because it meets the criteria for both "meaning similarity" and "function similarity."
5. **Self-Correction:** A word is coded as "self-correction" if it is initially a miscue but the student self-corrects it within three seconds without any prompts or help from the assessor (e.g., "The mounted … mountain loomed ahead" for "The mountain loomed ahead").

Although there are other possible miscue categories (e.g., insertion and omission), we did not code miscues outside of the miscue categories provided by GORT-5.

Scoring. The scorers, the authors, and a graduate student listened to the audio files recorded during the test administration and transcribed (orthographically and phonetically) the miscues students produced as they read. For each student across all passages read (GORT-5 basal and ceiling rules dictated first and last passage read), miscues

were coded, and the number and kind of miscues were summed across all passages.

The total number of miscues differed from student to student based on the number of passages read, in compliance with the GORT-5 basal and ceiling rules. To account for this, analyses were conducted using proportional data; that is, the number of miscues in each category was divided by the total number of miscues made (e.g., number of meaning similarity miscues ÷ total number of miscues).

Interrater reliability. Thirty-five percent of the passages read were randomly selected for the interrater reliability check. The scorers coded the readers' miscues independently, and the miscue coding was checked point by point. The interrater reliability was derived using the following formula: Interrater reliability = total agreement ÷ (total agreement + total disagreement) 100%. An interrater reliability of 95.6% was obtained.

Analyses and Results

To answer the first research question, a multivariate analysis of variance (MANOVA) was conducted to examine differences between the two groups in terms of the types of miscues produced during oral reading. Although MANOVA allows testing for the difference in two or more vectors of means, using MANOVA to analyze proportional data is problematic because such data do not satisfy the normality assumptions of analysis of variance (Stevens, 1992). Therefore, prior to statistical analysis, miscue types computed as percentages were transformed using arcsin transformations of the square root of the percentages. These transformations were computed to stabilize and normalize the proportion distribution, "so that all proportions will have equal variances and follow a standard normal distribution" (Rossi, 2012, p. 86). The untransformed group means and standard deviations for the percentage of oral miscue types are shown in Table 2.

Table 2
Group Mean Percentages and Standard Deviations for the Total Miscues by Categories

	LD	Non-LD
Meaning Similarity	8.17% (3.66)	11.68 % (5.44)
Function Similarity	7.91% (3.71)	13.80% (5.52)
Graphic/Phonemic Similarity	59.20% (12.32)	43.54% (13.64)
Multiple Sources	12.39% (4.14)	18.04% (5.23)
Self-Correction	12.33% (4.63)	12.93% (6.60)

The results of the MANOVA revealed a significant multivariate main effect, Wilks' $\lambda = 0.65$, F (5, 66) = 4.99, $p < 0.001$, = 0.16. Power to detect the effect was 0.98. Given the significance of the overall test, the univariate main effects were examined. Significant univariate main effects were obtained for the meaning similarity miscues for students without LD compared to those of students with LD, $F(1, 70) = 13.08$, $p < 0.05$, = 0.14; function similarity miscues for students without LD compared to those of students with LD, $F(1, 70) = 8.58$, $p < 0.01$, = 0.10; multiple sources miscues for students without LD compared to those of students with LD, $F(1, 70) = 12.47$, $p < 0.01$, = 0.13; and graphic/phonemic similarity miscues for students with LD compared to those of students without LD, $F(1, 70) = 14.97$, $p < 0.05$, = 0.15. No significant difference was found for self-correction. Stevens (1992) suggested that the value is medium when it is 0.06 and large when it is 0.14. The results of the MANOVA in the current study suggested a large effect size for the multivariate main effect and medium effect sizes for univariate main effects.

To explore the predictability of the five miscue categories as defined in GORT-5, a correlation matrix was computed to show the correlation between students' TOSCRF standard scores and miscue categories. As illustrated in Table 3, meaning similarity, function similarity, and graphic/phonemic similarity were significantly correlated with TOSCRF scores. It is notable that graphic/phonemic simi-

Table 3
Correlations Between Miscues and TOSCRF Scores at Two Grade Clusters

	1	2	3	4	5	6
1. TOSCRF		.41*	.58***	-.49***	.23	-.13
2. Meaning Similarity			.24	-.60***	.52**	-.26
3. Function Similarity				-.76***	.61***	-.01
4. Graphic/Phonemic Similarity					-.65***	-.26
5. Multiple Sources						-.13
6. Self-Correction						

*$p < .05$; **$p < .01$; ***$p < .001$.

larity was negatively correlated with the TOSCRF score, signifying an inverse relationship between this category and silent reading comprehension.

A hierarchical multiple-regression analysis was run to further examine the predictive power of each of the GORT-5 miscue categories. Given that the sample consisted of students spanning three grade levels (i.e., grades 3-5), the initial model in the regression was student age. For the second model, the miscue categories were entered as predictor variables. Evaluation of assumptions indicated that normality, linearity, homoscedasticity, and independence of residuals assumptions were met.

The results from the hierarchical multiple regression are provided in Table 4. As illustrated, age was not a significant factor in predicting TOSCRF standard scores: Model 1 yielded a p value of 0.246 for the F chance in the model. Model 2, however, was significant at $p < 0.01$. A closer examination shows that meaning similarity and function similarity were significant predictors of silent reading comprehension. Multiple sources, graphic/phonemic similarity, and self-correction failed to make a significant predictive contribution.

Table 4
Hierarchical Regression Analysis for Variables Predicting TOSCRF Scores

Model and Variable(s)	*B*	SE *B*		
Model 1				.000
Age	.71	.813	.008	
Model 2				.421
Age	0.49	.619	.213	
Meaning Similarity	7.38**	4.89	.55	
Function Similarity	6.54**	2.93	.24	
Graphic/Phonemic Similarity	-5.09	3.16	-.62	
Multiple Sources	2.677	3.91	.086	
Self-Correct	-1.96	2.52	.082	

*$p < .05$; **$p < .01$; ***$p < .001$.

Discussion

Previous research indicates that reading fluency is a significant indicator of overall reading competence, especially when measured by the rate and accuracy of reading text (Kim et al., 2011; Schiling, Carlisle, Scott, & Zeng, 2007). However, rate and accuracy alone provide little diagnostic information useful for instruction planning.

In this study, we first used the five GORT-5 miscue categories to investigate whether students with LD produced different miscue patterns than students without LD. Second, we explored whether the results from these miscue categories were predictive of comprehension performance.

As shown in Table 2, graphic/phonemic similarity accounted for the highest percentage of oral reading miscues made by both groups of students during oral reading. However, further examination showed differences between the two groups in their use of and dependency on different types of miscues. The most frequent miscues made by the students with LD fell in the graphic/phonemic similarity, self-correction, and multiple sources categories, whereas the most frequent miscues made by students without LD were graphic/phonemic similarity, function similarity, and meaning similarity. Specifically, significant differences were seen in the reliance of the students without LD on meaning similarity, function similarity, and multiple sources miscues compared to students with LD.

Replacing words with grammatically correct words in sentences (function similarity miscues) implies that even when their oral reading deviated from the original print, students without LD were more likely to quickly identify groups of words that form meaningful grammatical units and preserve the language structure of the print. This finding is consistent with earlier work showing that language skills, including syntactic knowledge, affected students' reading fluency (Jenkins et al., 2003). In addition, this finding also supports Cambourne and Rousch's observation (1982) that proficient readers are more apt to pay attention to grammatical flow of print as they read. Therefore, our findings corroborate those of earlier studies indicating that fluent readers are more sensitive to language patterns and better able to manipulate the structure of language than their less fluent counterparts.

The more frequent occurrence of meaning similarity miscues in the group of students without LD demonstrates that these students were more likely to either intentionally substitute original print to facilitate their comprehension (e.g., "park" on a limb for "perched" on a limb) or unintentionally replace the original print without compromising the original meaning of the text (e.g., "a" group of parents for "one" group of parents). Either way, these students showed use of good comprehension strategies, an understanding of the text, and were able to substitute contextually accurate words without compromising comprehension. This supports Samuels' (2006) findings that readers are considered fluent if they decode and monitor their comprehension in an automatic fashion.

Implementing multiple sources miscues can reflect the extent to which a reader uses different reading strategies to access print (Wiederholt & Bryant, 2012). Our finding shows that students without LD, during oral reading, were more inclined to use grapheme-phoneme correspondences along with the other structures of language for sense making. This corroborates a report from the National Reading Panel (National Institute of Child Health and Human Development, 2000) suggesting that fluent readers typically possess a higher level of language skills than their peers who have reading difficulties. It also supports the finding of Gillam and Carlile (1997) that students with typical language development make more miscues in the semantic-pragmatic category than students with language impairments.

The highest percentage of miscue observed in students with LD was graphic/phonemic similarity, and there was a significant increase in the percentage of this type of miscues compared to students without LD. This finding is not unexpected given that students with LD tend to have impairments at the letter-sound correspondence level, in particular in word identification and phonological processing (Kame'enui et al., 2005; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Torgesen, 1999).

In all, our results indicate that the miscues produced by students without LD were more closely aligned to the semantic and syntactical structure of the words and sentences. This suggests that, compared to students with LD, students without LD appeared

better able to process the language units and monitor their comprehension in a more automatic fashion. By contrast, the relatively higher percentage of graphic/phonemic similarity miscues made by students with LD suggests that these students were more inclined to rely on letter-level processing (i.e., orthographic, phonological features of words) and less likely to detect the relational meanings among the words or the sentences as they read. Although there are plausible explanations for the lack of awareness of relational meanings in words or sentences demonstrated by students with LD during oral reading, including lack of language proficiency (Kim, 2015), visual sequential memory differences (e.g., Scheiman & Rouse, 2005), and deficits in working memory (Nation, Adams, Bowyer-Crane, & Snowling, 1999; McVay & Kane, 2012), our study cannot confirm the cause of such observations.

We also explored the predictability of miscue categories on participants' silent reading comprehension performance using hierarchical regression analyses. Using TOSCRF standard scores as the outcome measure and the five miscue categories as the predictors, meaning similarity and function similarity miscues emerged as significant predictors of the TOSCRF scores even when students' age was controlled for. This result is interesting, as it is counterintuitive to find that any miscue category would predict comprehension performance. One possible explanation is that producing miscues in the meaning similarity and function similarity categories reflects an ability to understand the meaning of the text and identify grammatical categories of words while reading. Because of this preservation of the semantic and syntax structure when meaning similarity and function similarity miscues are produced, it might be possible that meaning similarity and function similarity miscues, to a certain extent, reveal language skills that are considered critical for overall reading competency (National Institute of Child Health and Human Development, 2000; Nunes, Bryant, & Barros, 2012).

Practical Implications

A number of observations can be made that have implications for reading teachers. However, it is important first to note that, although miscue analysis has been related to whole language (Giles, 2006), this need not be the case, and miscue analysis can be of benefit to allteachers of reading. Harris and Sipay (1980) long ago noted the differences between those who advocate top-down, bottom-up, and interactive models of reading instruction. Even acknowledging these differences, there is a commonality across the models. That is, most reading experts, regardless of persuasion, would agree that reading is a language-based activity that has comprehension as its sole purpose. Most "bottom-uppers" would agree that the purpose of word-study instruction, for example, is to foster accurate decoding, which then provides the opportunity to read with understanding. And most "top-downers" would not argue against the importance of word-recognition abilities. It is with this understanding that miscue analysis can be a contributory factor to any reading instruction.

In planning reading instruction for students with LD, every piece of information available creates a more complete picture of students' strengths and weaknesses. In addition to the use of rate and accuracy, miscue analysis brings a layer of information that helps teachers' decision-making for instructional alignment by providing a clearer insight into students' knowledge in specific areas.

As demonstrated by the results of this study, able readers made more meaning similarity and function similarity miscues than those with LD. Additionally, function similarity and meaning similarity miscues were significant predictors of silent reading comprehension. These findings suggest that students' knowledge of grammar and knowledge of written language play a role in reading comprehension. Our findings show that able readers tended to have a good grasp of language function and were able to substitute words while staying within the correct grammatical category (i.e., noun for noun; verb for verb; adjective for adjective) and preserve the meaning of the text. Poor readers, on the other hand, demonstrated much fewer function similarity and meaning similarity miscues, suggesting that they were less likely to detect the syntactic and semantic structure of language.

Because the ability, or lack thereof, to detect the syntactic and semantic structure of language during oral reading may be linked to working memory capacity, with which attentional control is mediated (McVay, & Kane, 2012; Nation et al., 1999),

or language proficiency level (Kim, 2015), the instructional implication of these findings points to the importance of addressing any limited areas in working memory or language skills.

However, because working memory training does not necessarily lead to improvement in reading skills (Randall & Tyldesley, 2016), another possible instructional approach to improving students' awareness of the syntactic and semantic structure of language is to make certain that they understand that, as a language activity, decoded grapheme combinations must make sense. For students who appear to have syntactic difficulties in oral language, activities using the maze technique (Shin, Deno, & Espin, 2000) may be beneficial. Such activities involve selecting a passage that is at the student's instructional or independent reading level and omitting key words that have syntactic relevance. Three response choices are provided among which the student selects the one that best fits syntactically. Activities such as these can be used to demonstrate that reading is a language-based activity and that syntactic irregularities in print should be reconciled. Furthermore, students who make few meaning similarity miscues, yet have low rate and accuracy levels, most likely do not have an understanding of what they read and, therefore, would profit from comprehension instruction.

Miscues associated with graphic-phonemic similarity are also important. In that regard, the focus should be on identifying the word part that is being misread and checking for consistency. For example, consider the student who misreads *take* as "tack." Initial inspection might target the vowel-consonant-e syllable pattern (V-C-e) as a focus of instruction. Before doing so, however, it would be important to look at the entire passage to see if the student made similar miscues when presented with other vowel-consonant-e syllable patterns. Too often reading teachers spend undue energy teaching word patterns that are identified in miscue analyses, even when overall competence has been achieved (at least as demonstrated by correct word identification elsewhere in the passage). The point is this: Teachers should examine graphic-phonemic miscues in the light of consistency throughout the exercise and not isolated miscues.

Finally, as noted, able readers made more miscues that appear in multiple categories than did students with LD. This may signify that able readers understand that reading is a meaningful language-based activity that relies on decoding words by making grapheme-phoneme correspondences. Many students with LD could benefit from this knowledge by emphasizing both the sense-making aspect of reading and word-level skills acquisition.

Limitation and Future Research

The most significant limitation of this study is the failure to control the readability level of the passages read by the participants. Thus, the types of miscues produced may be the function of the difficulty of a given text. Because the passages ranged from basal to ceiling passages, the passages a student read can cross over from his/her independent level to frustration level. Logically, the miscue analysis can yield more meaningful instructional information when it is carried out using the student's instructional level passages; however, the findings from the present study can still inform the use of miscue analysis for instructional planning. Although it would be helpful if future research further explored group differences in miscue categories using passages at different readability levels, the results of the present study nevertheless showed that students with LD demonstrated different miscue patterns compared to their peers without LD. Using miscue analysis in addition to calculating rate and accuracy may more accurately reveal strengths and instructional needs of students with LD.

Another limitation of the study is that students were not matched for educational environment (e.g., teacher, reading instructional method). Although matching students with and without LD for educational environment is difficult because students with LD typically receive additional or pull-out specially designed reading instruction or special accommodations as required by the Individuals With Disabilities Education Act (2004), controlling for educational environment at least at the school level may lead to more valid comparisons of student performance in miscues. Future research, therefore, should address the educational environmental factor to reveal a clearer picture of student reading performance and miscue patterns.

References

Bean, R. M., Cassidy, J., Grumet, J. E., Shelton. D, S., & Wallis, S. R. (2002). What do reading specialists do? Results from a national survey. *The Reading Teacher, 5,* 756-744. doi:10.1080/19388071.2014

California Code of Regulations. (1988). Retrieved from http://www.dir.ca.gov/dlse/ccr.htm.

Cambourne, B., & Rousch, P. (1982). How do learning disabled children read? *Topics in Learning and Learning Disabilities, 3*, 59-68.

DeRosa, K. (2010). *Ken DeRosa lambasts the foolishness known as miscue analysis*. Retrieved from http://lizditz.typepad.com/i_speak_of_dreams/2010/01/miscue-analysis-foolishness.html

Fuchs, L. S., Fuchs, D., & Hamlett, C. L. (2007). Using curriculum-based measurement to inform reading instruction. *Reading and Writing, 20*(6), 553-567. doi:10.1007/s11145-007-9051-4

Fowler, C. A., Shankweiler, D., & Liberman, I. Y. (1979). Apprehending spelling patterns for vowels: A developmental study. *Language and Speech, 22*(3), 243-252. doi:10.1177/002383097902200305

Giles, C. (2006). An invitation for a special issue: The future of whole language. *International Journal of Progressive Education, 2*(2), 43-61.

Gillam, R. B., & Carlile, R. M. (1997). Oral reading and story retelling of students with specific language impairment. *Language, Speech & Hearing Services in Schools, 28*(1), 30-42. doi:10.1044/0161-1461.2801.30

Good, R. H., & Kaminski, R. A. (2002). *Dynamic indicators of basic early literacy skills*: *Administration and scoring guide.* Eugene, OR: University of Oregon. Retrieved from http://dibels.uoregon.edu

Goodman, K. S. (1964). The linguistics of reading. *Elementary School Journal, 64*(7), 355-361. doi:10.1111/j.1467-1770.1955.tb01413.x

Goodman, K. S. (1965). A linguistic study of cues and miscues in reading. *Elementary English, 42,* 639-643.

Goodman, K. (1969). Analysis of oral reading miscues: Applied psycholinguistics. In F. Gollasch (Ed.), *Language and literacy: The selected writings of Kenneth Goodman. Vol. I* (pp. 123-134). Boston, MA: Routledge & Kegan Paul.

Goodman, K. (1973). Miscues: Windows on the reading process. In K. Goodman (Ed.), *Miscue analysis: Applications to reading instruction. Vol. II* (pp. 3-14). Urbana, IL: NCTE.

Goodman, K. (2006). *Revisiting miscue analysis: A response by Ken Goodman.* Retrieved from http://www.u.arizona.edu/~kgoodman/revisiting.pdf.

Goodman, Y., Watson, D., & C. Burke. (2005). *Reading miscue inventory*. Katonah, NY: Richard C. Owen Publishers, Inc.

Gray, W. S. (1915). *Standardized oral reading paragraphs*. Bloomington, IL: Public School Publishing.

Gray, W. S. (1920). The value of informal tests of reading achievement. *Journal of Educational Research, 1*(2), 103-111.

Hammill, D. D., Wiederholt, J. L., & Allen, E. A. (2006). *Test of silent contextual reading fluency*. Austin, TX: PRO-ED.

Harris, A. J., & Sipay, E. R. (1980*). How to increase reading ability: A guide to developmental and remedial methods* (7th ed.). New York, NY: Longman.

Individuals With Disabilities Education Act, 20 U.S.C. § 1400 (2004).

Jenkins, J. R., Fuchs, L. S., van den Broek, P., Espin, C., & Deno, S. L. (2003). Sources of individual differences in reading comprehension and reading fluency. *Journal of Educational Psychology, 95*(4), 719-729. doi:10.1037/0022-0663.95.4.719

Johnson, M. S., Kress, R. A., & Pikulski, J. J. (1987). *Informal reading inventories*. Newark, DE: International Reading Association.

Kame'enui, E. J., Good, R., III, & Harn, B. A. (2005). Beginning reading failure and the quantification of risk: Reading behavior as the supreme index. In W. L. Heward, T. E. Heron, N. A. Neef, S. M. Peterson, D. M. Sainato, G. Cartledge, et al. (Eds.), *Focus on behavior analysis in education: Achievements, challenges, and opportunities* (pp. 88-89). Upper Saddle River, NJ: Merrill/Prentice Hall.

Kim, Y. S. (2015). Developmental, component-based model of reading fluency: An investigation of predictors of word-reading fluency, text-reading fluency, and reading comprehension. *Reading Research Quarterly*, *50*(4), 459-481. doi:10.1002/rrq.107

Kim, Y. S., Wagner, R. K., & Foster, L. (2011). Relations among oral reading fluency, silent reading fluency, and reading comprehension: A latent variable study of first-grade readers. *Scientific Studies of Reading, 15*(4), 338-362. doi:10.1080/10888438.2010.493964

Laing, S. P. (2002). Miscue analysis in school-age children. *American Journal of Speech-Language Pathology, 11*, 407-416. doi:10.1044/1058-0360

Leu, D. J. (1982). Oral reading error analysis: A critical review of research and application. *Reading Research Quarterly, 17*(3), 420-437. doi:10.2307/747528

McKenna, M. C., & Picard, M. C. (2006). Revisiting the role of miscue analysis in effective teaching. *Reading Teacher, 60*(4), 378-380. doi:10.1598/RT.60.4.8

McVay, J. C., & Kane, M. J. (2012). Why does working memory capacity predict variation in reading comprehension? On the influence of mind wandering and executive attention. *Journal of Experimental Psychology: General, 141*, 302-320. doi:10.1037/a0025250

Moats, L. C. (2000). *Whole language lives on: The illusion of "balanced" reading instruction*. Washington, DC: Thomas B. Fordham Foundation.

Monroe, M. (1932). *Children who cannot read*. Chicago, IL: University of Chicago Press.

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups* (NIH Publication No. 00-4754). Washington, DC: U.S. Government Printing Office.

Nation, K., Adams, J. W., Bowyer-Crane, C. A., & Snowling, M. J. (1999). Working memory deficits in poor comprehenders reflect underlying language impairments. *Journal of Experimental Child Psychology*, *73*(2), 139.

Nunes, T., Bryant, P., & Barros, R. (2012). The development of word recognition and its significance for comprehension and fluency. *Journal of Educational Psychology, 104*(4), 959-973. doi:10.1037/a0027412

Pearson. (2009). *AIMSweb*. Retrieved from http://www.aimsweb.com/

Perfetti, C. A. (2007). Reading ability: Lexical quality to comprehension. *Scientific Studies of Reading*, *11*(4), 357-383. doi:10.1080/ 10888430701530730

Pikulski, J. J. (2006). Fluency: A developmental and language perspective. In S. J Samuels & A. E. Farstrup (Eds.), *What research has to say about fluency instruction* (pp. 70-93). Newark, DE: International Reading Association.

Randall, L., & Tyldesley, K. (2016). Evaluating the impact of working memory training programmes on children – A systematic review. *Educational & Child Psychology*, *33*(1), 34-50.

Ridel, B. W. (2007). The relation between DIBELS, reading comprehension, and vocabulary in urban first-grade students. *Reading Research Quarterly, 42*, 546-567. doi:10.1598/RRQ.42.4.5

Rossi, J. S. (2012). Statistical power analysis. In I. B. Wiener, J. A. Schinka, & C. F. Velicer (Eds.), *Handbook of psychology, Vol. 2: Research methods in psychology* (pp. 71-108). Hoboken, NJ: John Wiley & Sons.

Samuels, S. J. (2006). Toward a model of reading fluency. In S. J Samuels & A. E. Farstrup (Eds.), *What research has to say about fluency instruction* (pp. 24-46). Newark, DE: International Reading Association.

Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C., & Foorman, B. R. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology*, *96*(2), 265-282. doi:10.1037/0022-0663.96.2.265

Scheiman, M., & Rouse, M. W. (2005). *Optometric management of learning-related vision problems*. New York, NY: C. V. Mosby.

Schilling, S. G., Carlisle, J. F., Scott, S. E., & Zeng, J. (2007). Are fluency measures accurate predictors of reading achievement? *Elementary School Journal*, *107*(5), 429-448. doi:10.1086/518622

Shin, J., Deno, S., & Espin, C. (2000). Technical adequacy of the maze task for curriculum-based measurement of reading growth. *Journal of Special Education, 34*, 164-172.

Simmons, D. C., Kame'enui, E. J., Coyne, M. D., Chard, D. J., & Hairrell, A. (2011). Effective strategies for teaching beginning reading. In M. D. Coyne, E. J. Kame'enui, & D. W. Carnine (Eds.), *Effective teaching strategies that accommodate diverse learners* (4th ed., pp. 51-84). Upper Saddle River, NJ: Pearson.

Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). Using curriculum-based measurement to improve student achievement: Review of research. *Psychology in the Schools, 42*, 795-820. doi:10.1002/pits.20113.795

Stevens, J. P. (1992). *Applied multivariate statistics for the social sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Torgesen, J. K. (1999). Phonologically based reading disabilities: Toward a coherent theory of one kind of learning disability. In R. J. Sternberg & L. Spear-Swerling (Eds.), *Perspectives on learning disabilities* (pp. 231-262). New Haven, CT: Westview Press.

Wiederholt, T., & Bryant, B. (1986). *Gray oral reading test – Revised*. Austin, TX: PRO-ED.

Wiederholt, T., & Bryant, B. (2012). *Gray oral reading test – Fifth edition*. Austin, TX: PRO-ED.

Wise, J. C., Sevcik, R. A., Morris, R. D., Lovett, M. W., & Wolf, M. (2007). The relationship among receptive and expressive vocabulary, listening comprehension, pre-reading skills, word identification skills, and reading comprehension by children with reading disabilities. *Journal of Speech, Language & Hearing Research, 50*(4), 1093-1109. doi:10.1044/1092-4388