Journal of Autism and Developmental Disorders, Vol. 31, No. 5, 2001

Factors Affecting the Reading of Rimes in Words and Nonwords in Beginning Readers With Cognitive Disabilities and Typically Developing Readers: Explorations in Similarity and Difference in Word Recognition Cue Use

J. Anne Calhoon[1,2]

The exploratory research reported in this study was designed to initiate research in reading that includes children who have cognitive disabilities other than learning disabilities. Forty children, whose word recognition level was at the second-grade level, were assessed for knowledge of letter names, letter sounds, and rime recognition for high and low frequency target words and nonwords. Of these children, 20 were typically developing children and 20 were children with cognitive disabilities broadly defined. Both groups of children were found to be more similar than dissimilar in their rime-recognition accuracy, miscues, and grapheme-phoneme knowledge. In general, results proved to be more heuristic than concrete.

KEY WORDS: orthographic knowledge; reading acquisition.

INTRODUCTION

The research reported in this study was designed to be heuristic (exploratory) in nature. Results of such research frequently find more questions than answers. Generalization of findings is assumed to be limited because the questions must be borrowed from research not directly related to participants in a particular study. Iteratively, the lack of research with specific participants necessitates the borrowing of questions. Early decoding processes in typically developing children have been thoroughly examined, but an equally important examination of these processes in children with cognitive disabilities has yet to be pursued. This study examines processes related to decoding for word recognition and represents a first attempt at this type of research.

For individuals with cognitive disabilities, literacy is an important tool for functioning in inclusive educational and vocational environments. Heath (1983) has described literacy uses crucial for interacting in the everyday world as the following: (a) instrumental uses that provide information about daily life-problems, (b) social-interactional, (c) news-related, (d) memory-supportive, where literacy serves as a substitute for an oral message, (e) permanent records, serving legal and medical needs, and (f) confirmatory, where literacy provides support for attitudes and beliefs that individuals hold. Yet, literacy remains a priority for the inclusion of all individuals in our society.

It is a commonly accepted idea and a theoretically efficacious belief that the more children read the better their reading skills become (Stanovich, 1986). Reading has reciprocal relationships with other cognitive

[1] The work of the author of this study was funded by NIH grant # designated to promote research in the area of Mental Retardation. POST-DOCTORAL TRAINING IN MENTAL RETARDATION RESEARCHT32 HD07489.

[2] All correspondence to J. Anne Calhoon, 431 Joseph R. Pearson Hall, School of Education, University of Kansas, 1122 W. Campus Rd, Lawrence, KS 66045-3101; email: acalhoon@ukans.edu

0162-3257/01/1000-0491$19.50/0

skills. Experience in reading builds a fund of knowledge and a working vocabulary that supports the development of expressive and receptive language (Echols *et al.,* 1996; Senechal *et al.,* 1996). Reading also supports the further development of phonemic awareness, which has been proposed as both a causal and supportive mechanism for growth in early word recognition skill (Tunmer & Nesdale, 1985). Phonemic awareness is the ability to detect speech sounds embedded within words. Children who experience chronic problems in hearing (e.g., due to frequent occurrences of otitis media or the presence of other speech and language disorders) appear to be at-risk for poor development of phonemic awareness (Chapman, 1995; Thielke & Shriberg, 1990).

Research on reading skills of children with cognitive disabilities has primarily focused on instructional methodology (Blanton & Semmel, 1987). In contrast to research with typically developing readers, there has been little research on the influence of word-part cues in early word recognition of children with cognitive disabilities (Blanton & Semmel, 1987). Studies of cognitive processes in such children, who are beginning readers, and studies which are grounded in a developmental perspective are virtually nonexistent. This study seeks to begin these lines of inquiry within two groups of children with specific developmental disabilities.

Current Research on Word Recognition in Children with Autism or with Down Syndrome

Children with Autism

Children with autism develop word recognition skills that appear similar to those skills in typically developing children (Frith, & Snowling, 1983; Welsh, Pennington, & Rogers, 1987). That is, they develop some phonemic awareness, letter-name knowledge, and grapheme-phoneme correspondence knowledge and use those cues in word recognition. Word recognition skills of children with autism may appear far more advanced than their comprehension skills (Pennington, Johnson, & Welsh, 1987). About 6% of children with autism display evidence of hyperlexia, the ability to decode unknown words at a level not predicted by general intelligence and accompanied by limited comprehension skill (Aaron, 1989). Although comprehension at the word level does not appear to differ from typically developing children (Eskes, Bryson, & McCormick, 1990), children with autism appear to differ from typically developing children in their ability to understand connected text (Snowling, & Frith, 1986).

Children with Down syndrome appear to develop letter-name knowledge and letter-sound knowledge but may fail to develop phonemic awareness (Cossu, Rossini, & Marshall, 1993). They frequently have phonological processing deficits in oral language (Chapman, 1995). Such deficits in oral language have been associated with delays in developing phonemic awareness and word recognition skill among children with other developmental delays such as dyslexia and specific language impairment (Olson, Forsberg, & Wise, 1995).

Research on the development of word recognition in children with Down syndrome is virtually nonexistent. Within the literature there exists a single case study detailing a peer-tutoring intervention with a 7-year-old girl with Down syndrome (Cooke *et al.,* 1982) and one study measuring the effect of visual feedback on word recognition (Jackson, 1974).

Children with Down syndrome appear to develop comprehension skills similar to mental age matches but demonstrate comprehension of syntactic forms that are advanced compared with those matches (Chapman, 1995). Limited research exists that describes their ability to use context to facilitate word recognition, nor have studies of reading acquisition that are grounded in a developmental perspective been conducted.

Developmental Perspectives: Word Recognition in Typically Developing Children

A key concept of developmental perspectives of word recognition is that readers attend to different word-parts in qualitatively different phases (Ehri, 1995). Readers' unique experiences with individual grapheme-phoneme correspondences (GPCs), larger orthographic segments, and their experience with connected text all play specific and predictable roles in the development of a lexicon of sight words (Ehri, 1995; Leslie & Calhoon, 1995; Leslie & Thimke, 1986; Treiman, Goswami, & Bruck, 1990). As typically developing children acquire word recognition skills, they appear to follow a path that accommodates the use of qualitatively different cues or representations. These representations "reflect the predominant type of connection that links the written forms of sight words to their pronunciations and meanings in memory" (Ehri, 1995 p. 117). Changes in grapho-phonic representations appear to develop as a result of readers' increasing experience with and knowledge of the alphabetic principle. More recent research suggests that the frequency with which readers encounter identical rimes (the vowel and everything after it in single syllable words, e.g., *-at* in c*at*, h*at*, and s*at*) also contributes to readers' word recognition (Leslie & Calhoon, 1995; Treiman, 1983, 1985; Treiman & Chafetz, 1987; Treiman *et al.*, 1990; Zinna, Liberman, & Shankweiler, 1986). Rimes are salient units in both auditory and visual identification studies with typically developing children and adults (Treiman, 1983, 1985; Treiman & Chafetz, 1987). Rime frequency appears to provide additional cues during the acquisition of word recognition skills (Leslie & Calhoon, 1995).

Differences in the frequency of occurrence of rimes varies in a continuous manner, but many researchers find it more useful to identify and group rimes that occur at similar rates into rime neighborhoods, thus creating a categorical variable (e.g., friendly versus unfriendly neighborhoods; Laxon, Coltheart, & Keating, 1988). The frequency effects of such rime neighborhood sizes (RNS) have been demonstrated using both word recognition accuracy (Leslie & Calhoon, 1995; Zinna *et al.*, 1986), rime accuracy (Calhoon, 1995; Calhoon & Leslie, in press; Leslie & Calhoon, 1995) and response time (Andrews, 1992).

Leslie and Calhoon (1995) proposed a developmental path that makes use of rime frequency as a categorical variable with three levels: large, moderate, and small. They sought to disentangle those effects from the influence of word frequency by creating a Triplet Rime List which kept RNS and word frequency independent of one and other (Appendix A). Fig. 1 illustrates how sensitivity to rime neighborhoods is predicted in high frequency words as word recognition level increases in typically developing children. Similar effects are expected for low frequency words and nonwords, with the developmental pattern observed when children reach higher word recognition levels.

The developmental path suggests that, in the earliest phase of word recognition (approximately first-grade reading level), children are not sensitive to RNS (point A, Fig. 1). Presumably, these readers have not had enough reading experience to have developed sensitivity to RNS, thus, word recognition accuracy is dependent on word frequency alone (Leslie & Calhoon, 1995; Zinna, *et al.*, 1986). Next, children read more

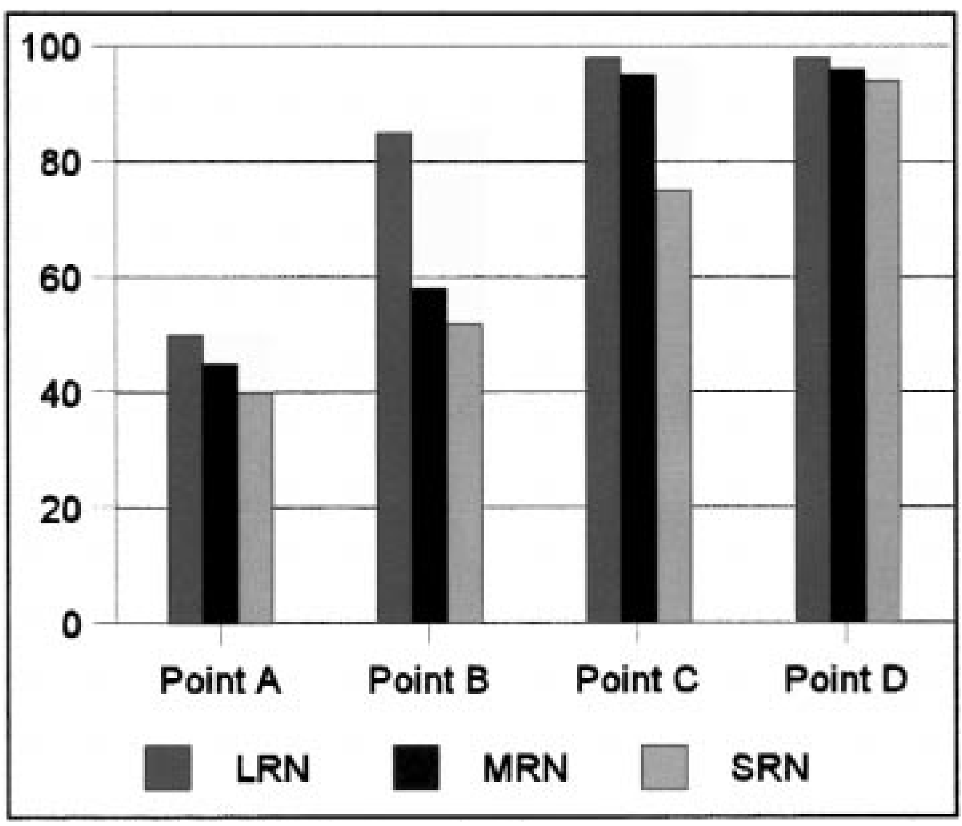

Fig. 1. Proposed developmental progression of rime recognition in large, moderate, and small rime neighborhoods as a function of achieved word recognition level in high frequency words.

accurately rimes from large rime neighborhoods than rimes from moderate or small rime neighborhoods (point B, Fig. 1). Building RNS sensitivity in high frequency words should continue as a function of increased word recognition level such that children will read words from large and moderate rime neighborhoods more easily than from small rime neighborhoods (point C, Fig. 1). Finally, when students become proficient readers of single-syllable high frequency words, ceiling effects occur on accuracy (point D, Fig. 1). Although ceiling effects are expected in high frequency words, RNS effects are predicted to continue in low frequency words and nonwords or when response times become the dependent variable. Initial longitudinal research has supported these findings (Calhoon, 1995; Calhoon & Leslie, in press; Leslie & Calhoon, 1995).

This developmental model of reading implies qualitative and quantitative changes in readers' use of cues for the purpose of word recognition. Other assumptions of this model are: (a) processes related to the development of word recognition may function autonomously or may become a modularized cognitive process (Karmiloff-Smith, 1992; Stanovich, 1992)—such processes may operate independent of general cognitive function; and (b) the development of word recognition is more related to phonological recoding ability than to general cognitive ability (Olson *et al.*, 1995). These assumptions imply that, while enviable, knowledge of specific levels of intellectual functioning may not significantly impact studies which examine questions related to developing processes in word recognition.

Because so little is known about the development of word recognition in children with Down syndrome or autism relative to such development in typically developing children, this study examines the influence of different word parts, grapheme-phoneme knowledge, rime knowledge, and knowledge of high frequency words in children with cognitive disabilities, and compares their performance with typically developing peers whose word recognition is at the second-grade level.

Three questions guided the research reported in this study. First, do children with cognitive disabilities identify words and nonwords in ways that are similar to typically developing readers? Second, do children with cognitive disabilities use context to support word recognition? Children with autism appear to have difficulty understanding relationships between people, their actions, and events. When they read stories containing these elements, they would presumably be less able to comprehend the text, making it more likely that they may not use context to facilitate word recognition (Snowling & Frith, 1986; Stanovich, 1986). Our knowledge of the supportive influence of context for children suggests that typically developing children are more accurate in identifying words in stories than they are in identifying those same words in lists because connected text provides additional cues to the meaning of each word (Stanovich, 1992).

The third question explores the types of miscues made by each group of children. An examination of miscues can better describe the word-part cues that children use. If children's rates of identification of low frequency words when they had correctly identified the high frequency words is greater than when they did not identify the high frequency word, can we assert that this represents a form of generalization of word-part knowledge?

METHOD

The influence of GPC knowledge, word frequency, and RNS on children's rime and word recognition accuracy in typically developing children and children with cognitive disabilities was examined using a reading level-match design. All children read high frequency and low frequency words that shared target rimes in stories (Appendix B) and lists and pronounced nonwords that shared target rimes in lists.

Participants

Children with cognitive disabilities were recruited from two sources, a metropolitan city school district and the Human Subjects Core of a research facility. Fifty children with cognitive disabilities were recruited, 20 of whom met the word-recognition level criterion for this study. Of these children, only 2 were not found on the list of available participants from the Human Subjects Core. All of these children were identified as having Down syndrome or autism on the bases of testing within a major research unit of a university-affiliated hospital and treatment centers. Children with Down syndrome selected for this study had IQs in the 50 to 60 range. Teachers of the children with autism who were located in school districts explained that their "school psychologists had told them that it was not possible to assess cognitive functioning in such children because of the children's inability to communicate socially" (Mary Engelbretson, personal communication, April 6, 1997). Eight of the 10 children with autism were found on the Human Subjects Core list and had IQs in the 60 to 100 range. Although the IQs of the children in this study varied, the assumptions of this developmental study, and the current research supporting a minimal involvement for IQ in children's word recognition skill, support the single criterion for selection.

The choice of these two groups of children with cognitive disabilities was intentional for several reasons. First, children with autism appear to have superior phonological processing skill, as suggested by their ability to recall verbatim specific information from a variety of sources. In comparison, children with Down syndrome frequently have difficulties in phonological processing, which may be due the presence of chronic otitis media in many children (Chapman, 1995). Presumably, these differences would play differential roles in the acquisition of word recognition skill. This choice of differences was made to explore issues related to planned future study. Second, whereas one criterion for diagnosis of autism is "difficulty developing or forming social relationships," children with Down syndrome appear to seek and enjoy developing and forming social relationships. This choice was also made to explore issues related to planned future study. Third, although intellectual development and differences in the array of difficulties within each group varies greatly, the present study was designed to assess cue use during word recognition tasks which appear to have a minimal relationship to intellectual development (Olsen *et al.*, 1995) and may be characterized as a form of encapsulated knowledge separated from the outside influence of general knowledge (Karmiloff-Smith, 1992; Stanovich, 1992).

Word recognition skill, letter-name knowledge, consonant and vowel sound knowledge in isolation, and rime recognition within word frequency and RNS were assessed in children with cognitive disabilities ($n = 20$) and word recognition-level match in typically developing children ($n = 20$). Children were reading, on average, at second-grade level, with means for word reading levels being very similar ($p = .962$). In practical terms, this means that, of the total of 20 words on the second-grade list which could be recognized correctly, all children recognized at least 15 correctly. In order to attempt the second-grade list, all children would have had to have read the previous 60 words from three lower level lists equally well. The mean age for participants was dissimilar (F 1, 37 = 9.77, p = .003), with a mean age of 9.35 for children with cognitive disabilities and a mean age of 7.37 for typically developing children.

Materials, Procedures and Scoring

Rimes and Nonwords

Prior to beginning their initial study, Leslie and Calhoon (1995) operationalized RNS as three neighborhoods for 27 target rimes. Neighborhoods were established through the convergence of words from *Webster's Elementary Dictionary* (1986), organized by phonemes (Calhoon, 1991) and the *WordPerfect Spell-Checker* (1990). A master list of rimes chosen from those used by Treiman and colleagues (1990), and used in Leslie and Calhoon (1995), was also used for this study. These rimes were used to create a triplet list (Appendix A). The triplet list includes one high frequency word, one low frequency word, and one nonword for each targeted rime (e.g., truck, muck, kuck). Word frequency for each real word uses the Standard Frequency Index (SFI) value, a measure of the frequency per million words with which a word appears in children's reading material (Carroll, Davies, & Richman, 1971). The rime triplets divide themselves into three non-overlapping neighborhood sizes (see Table I).

Graded Word Lists

The criterion for word recognition levels was established as accurate decoding of 75% of the words on the second-grade word list of the Qualitative Reading Inventory-II (QRI-II) (Leslie & Caldwell, 1995). High and low frequency words and nonwords were read from separate lists. Only QRI-II words were used to estimate word recognition accuracy. Only words and nonwords containing the 27 target rimes were used for tests of RNS frequency effects. All target words and nonwords were scored to reflect children's accuracy in identifying the onset and rime for each examplar. Scoring the words in this way allowed for separate analysis of rime knowledge and generalization. No word representing a rime triplet contributed to any child's word recognition level score and likewise, no word from the QRI-II was a dependent measure of rime recognition.

Grapheme-Phoneme Correspondences

Readers' knowledge of GPCs was assessed using all of the consonant and vowel combinations found in the triplet lists (e.g., "shr," "ou," and "d" from *shroud*). Lower-case letters were printed on individual cards and displayed as either single letters or blends. If children were unable to produce a sound, the tester asked them to give a word with that letter or those letters in it, and to tell what sound that letter or those letters made in that word. Internal consistency reliability of the single

Table I. Standard Frequency Index (SFI) Means and Rime Neighborhood Size (RNS) Means and Ranges Within each of Three Rime Neighborhoods

SFI and RNS Means (Neighborhood ranges)	Large rime neighborhood	Moderate rime neighborhood	Small rime neighborhood
High Frequency Words	60.21	59.15	54.66
Rimes	20 (18–24)	11.73 (7–15)	3.88 (2–5)
Low Frequency Words	38.96	36.75	36.88
Rimes	20 (18–24)	11.73 (7–15)	3.88 (2–5)
Non word Rimes	20 (18–24)	11.73 (7–15)	3.88 (2–5)

consonant task was .98, of the double consonant task was $a = .86$, and of the vowel task was $a = .66$. Children's knowledge of the consonant sounds appears to be better established than their knowledge of vowel sounds. Few children gave any common pronunciation of the vowels but appeared to rely on letter names as responses.

Short Stories

Three short stories were constructed using all high and low frequency words from a rime neighborhood (Appendix B). The stories were evaluated for readability. The large rime neighborhood story was evaluated at a second-grade readability level as derived by the Wheeler/Smith formula (Wheeler & Smith, 1954). Both the moderate rime neighborhood and small rime neighborhood stories were evaluated at a primer reading level using the same formula. Internal consistency reliability of rimes read in stories was $a = .92$.

Target Word List

Participants read target words in two lists: high frequency words and low frequency words. Internal consistency reliability of rimes read in lists was $a = .97$.

Participants were told that the nonwords were pretend words that could be read aloud like real words. Nonwords were also scored to reflect the accuracy of identification of both the onset and the rime. Internal consistency reliability for nonwords was $a = .86$.

Adaptations in Materials and Procedures

Because some children with cognitive disabilities experienced visual confusion when viewing longer sections of text or multiple words, word list reading and target word and nonword recognition were assessed by the use of flash cards. Stories were printed on sentence strips which were displayed one at a time. Pauses in reading necessitated by sentence strip use were deemed acceptable because the purpose of the study was to assess target word identification rather than comprehension, which might have been compromised under such conditions. Because the purpose of this study was to explore the cue use of children with cognitive disabilities compared with that of typically developing children, assessment procedures followed a power model of testing, where optimal results are the purpose of assessment. These adaptations created the appropriate testing conditions to ensure optimal performance on the part of all students.

Session Procedures

Each participant was assessed individually in a quiet area of the school or in the researcher's office. Length of session was dictated by the ability of the child to focus productively on the tasks and to maintain a positive involvement with tasks. Some children required as many as four brief sessions to complete the tasks, whereas others were able to maintain concentration and focus for as long as 50 minutes.

Because it could be argued that the order in which tasks were presented might influence the findings by priming reader responses, the order of tasks was randomized. The order of arrangement was varied in one of the four following orders: (1) letter names; large rime neighborhood story; letter sounds; moderate rime neighborhood story; QRI-II word lists; small rime neighborhood story; (2) small rime neighborhood story, letter names, moderate rime neighborhood story, letter sounds, large rime neighborhood story, QRI-II word lists; (3) QRI-II word lists, moderate rime neighborhood story, letter names, large rime neighborhood story, letter sounds, small rime neighborhood story; and (4) moderate rime neighborhood story, letter names, small rime neighborhood story, QRI-II word lists, large rime neighborhood story, letter sounds. Ten children were randomly assigned to one of the four assessment orders.

Schools were the primary settings for working with children with autism. In such settings, the primary teachers expected that each child's instructional aide would accompany the child during the testing to ensure that primed behavioral cues were used to prompt responses to the researcher's protocol. The author assessed all children in the research reported in this article. Thus this part of the testing environment was similar for all participants. Although concern for the wide divergence in assessment contexts should be voiced, the purpose of this study was to explore how children with cognitive disabilities and typically developing children perform word recognition tasks in nearly optimal situations.

Table II. Contrast Differences in Grapheme-Phoneme Knowledge of Children With Cognitive Disabilities (CD) and Typically Developing (TD) Children

Tasks in isolation	Obtained *p* values
Letter Name Knowledge	.088
Vowel Sound Knowledge	.072
Consonant Sound Knowledge	.004
Tasks in context	**Obtained *p* values**
Initial Consonant Sound Knowledge	.112
Medial Vowel Sound Knowledge	.102
Final Consonant Sound Knowledge	.173

RESULTS

Analysis of GPC Data

Grapheme-Phoneme Knowledge in Isolation and in Context

An analysis of variance (ANOVA) was used to determine any group differences in the three tasks measuring GPC knowledge. With alpha set at .0167 to control for family-wise error, children with cognitive disabilities were similar to their typically developing peers in their GPC knowledge (see Table II), with the exception of GPC knowledge assessed in isolation (F 1, 38 = 9.35, p = .004). Typically developing children were more accurate in their identification of consonant sounds when letters were presented one at a time.

Analyses of Group Differences

Multivariate analysis of variance (MANOVA) was used for this preliminary test. In these rime recognition studies, the data were initially analyzed in the context of a two (word frequency: high and low) by three *RNS*: large, moderate, and small rime neighborhoods) by two (*condition*: list and story) by two (*group*) factorial design to test for main effects and interaction effects. The dependent measure was rime recognition accuracy (Table III shows the means and standard deviations of the *proportion* of correctly read rimes for each group; Table IV displays the results of the initial analysis). There were main effects of group (F 1, 38 = 6.11, p = .018, word frequency; F 1, 38 = 223.01, $p < .001$; RNS, F 2, 76 = 5.27, p = .001; and condition, F 1, 38 = 20.13, $p < .001$). Children with cognitive disabilities were more accurate in word and nonword recognition than their typically developing peers (Table III).

Interaction effects of group by RNS, (F 1, 38 = 3.46, p = .036) and RNS by condition (F 2, 76 = 114.94, $p < .001$) were noted. There was also a three-way interaction effect of word frequency by RNS by condition (F 2, 76 = 12.51, $p < .001$). No other interactions were found.

Rimes Read in Stories

Planned nonorthogonal contrasts within each group were conducted for each word frequency level to examine the pattern of RNS effects in stories. All children read rimes from the large rime neighborhoods more accurately than rimes from the moderate rime neighborhood, which were read more accurately than rimes from the small rime neighborhood.

Did Context Facilitate Rime Recognition in Both Groups of Children?

ANOVA was used to compare condition between groups and within word frequency. Context facilitated rime recognition for both children with cognitive disabilities (F 1, 19 = 26.11, $p < .001$) and typically developing children (F 1, 19 = 18.90, $p < .001$). The facilitative effects of context existed in both groups for high frequency words (F 1, 19 = 12.43, p −.002, and F 1, 19 = 7.68, p = .012, respectively) and for low frequency words (F 1, 19 = 14.52, p = .001, and F 1, 19 = 21.71, $p < .001$, respectively).

Miscue Analysis of Low Frequency Words and Nonwords Read in Lists

Miscues were analyzed by calculating the proportion of attempts that each child made in reading low

Table III. Means and Standard Deviations Based on Proportions of Correctly Read Rimes for Children With Cognitive Disabilities and Typically Developing Children When Reading in All Conditions

	Children with cognitive disabilities	Typically developing children
Stories		
High Frequency Words		
LRN	.981 (.029)	.872 (.150)
MRN	.884 (.080)	.832 (.086)
SRN	.819 (.143)	.763 (.155)
Low Frequency Words		
LRN	.825 (.169)	.672 (.243)
MRN	.677 (.145)	.636 (.144)
SRN	.572 (.193)	.516 (.146)
Lists		
High Frequency Words		
LRN	.919 (.097)	.800 (.183)
MRN	.832 (.124)	.798 (.099)
SRN	.741 (.196)	.675 (.162)
Low Frequency Words		
LRN	.756 (.181)	.638 (.257)
MRN	.652 (.166)	.470 (.246)
SRN	.434 (.103)	.320 (.167)
Nonwords		
LRN	.719 (.189)	.797 (.179)
MRN	.666 (.166)	.677 (.141)
SRN	.347 (.123)	.362 (.074)

Table IV. MANOVA for Word Frequency (WF), Rime Neighborhood Size (RNS), Condition (Cond), and Group Assignment (GP)

Source	*df*	*ms*	*F*	*p*
		Between subjects		
Group	1	1.01	6.11	.018
		Within subjects		
Word Frequency	1	.86	40.68	<.001
RNS	2	4.42	195.92	<.001
Cond	1	.72	43.41	<.001
GP by WF	1	.02	1.07	.307
GP by RNS	2	.01	.23	.796
GP by Cond	1	.00	.10	.753
WF by RNS	2	.07	7.69	.001
WF by Cond	1	.00	.14	.709
RNS by Cond	2	.16	10.44	<.001
GP by WF by RNS	2	.04	4.49	.014
GP by WF by Cond	1	.02	3.4	.073
GP by RNS by Cond	2	.06	3.61	.032
WF by RNS by Cond	2	.03	5.48	.006
GP by WF by RNS by Cond	2	.00	.35	.707

frequency words and nonwords in lists (Tables V and VI). Miscues were categorized for each group by total number of attempts and attempts that resulted in a real word substitution (lexicalization). Lexicalizations were further categorized as those words that preserved the rime of the target word or nonword (rime), those words that preserved a single GPCs of the target word or nonword, or those words that preserved the initial and final GPCs of the target word or nonword (scaffolded).

Comparisons Between Groups: Low Frequency Words

Effect sizes were calculated for all comparisons by subtracting the two means and dividing by the higher of the two standard deviations. Using effect sizes gives a more practical estimate of meaningfulness in the comparisons, which may clarify any subsequent instructional implications. Typically developing children miscued on low frequency less often than did children with cognitive disabilities (effect size = .59). Typically developing children substituted real words for low frequency less often than did children with cognitive disabilities (effect size = .52). The hierarchy of lexicalized miscues was the same for both groups. Both groups substituted scaffolded miscues more often than GPC matched miscues, which were substituted more often than rime-matched miscues. However, there were differences between groups in the frequency with which types of miscues were used. Of those lexicalized miscues, children with cognitive disabilities preserved the rime portion of each low frequency word far more often than did typically developing children (effect size = 1.73), who preserved the initial and final consonant sounds far more frequently than did children with cognitive disabilities (effect size = 1.08). Table VII presents sample lexicalized miscues and indicates the number of children who made each miscue.

When pronouncing nonwords, both groups were more similar in the frequency of miscues (effect size = .29). The frequency of miscues in nonwords for both groups was, in order, scaffolding, rime-matched, then lexicalized. Children with cognitive disabilities substituted lexicalized miscues more often than did their typically developing peers (effect size = 1.13). The largest difference between groups in substitution type was between scaffolded substitutions (effect size = .72), with differences between GPC and rime-matched substitutions being more similar (effect sizes = .33 and .37, respectively). Table VIII presents sample lexicalized miscues and indicates the number of children who made each miscue.

Table V. Means and Standard Deviations for Miscue Variables in Low Frequency Words*

	Children with cognitive disabilities			Typically developing children		
	M	(*SD*)	*Range*	*M*	(*SD*)	*Range*
LFTRY	.97	(.09)	1.00–.58	.81	(.27)	1.00–.22
LFLEX	.82	(.11)	1.00–.60	.70	(.23)	1.00–.00
LFRIME	.23	(.11)	.50–.00	.04	(.05)	.15–.00
LFNON	.38	(.17)	.74–.00	.31	(.23)	.67–.00
LFSCAF	.39	(.11)	.58–.19	.65	(.24)	1.00–.33

* Children's attempts to read a word (LFTRY), proportion of attempted pronunciations that represented lexicalizations in low frequency words (LFLEX), proportion of lexicalizations in low frequency words that were rime matched to the target word (LFRIME), proportion of lexicalizations in low frequency words that were not matched to a target word part (LFNON), and proportion of lexicalizations in low frequency words that were matched to target words on beginning and ending consonant sounds, but not on medial vowel sounds (LFSCAF).

Table VI. Means and Standard Deviations for Miscue Variables in Nonwords*

	Children with cognitive disabilities			Typically developing children		
	M	(*SD*)	*Range*	*M*	(*SD*)	*Range*
NTRY	.95	(.14)	1.00–.47	.99	(.03)	1.00–.93
NLEX	.83	(.15)	1.00–.51	.66	(.15)	.92–.33
NRIME	.27	(.17)	.60–.08	.17	(.27)	1.00–.00
NNON	.21	(.18)	.55–.00	.15	(.11)	.36–.00
NSCAF	.51	(.19)	.88–.15	.66	(.21)	1.00–.00

* Children's attempts to read a nonword (NTRY), proportion of attempted pronunciations that represented lexicalizations in nonwords (NLEX), proportion of lexicalizations in nonwords that were rime matched to the target nonword (NRIME), proportion of lexicalizations in nonwords that were not matched to a target nonword part (NNON), and proportion of lexicalizations in nonwords that were matched to target nonwords on beginning and ending consonant sounds, but not on medial vowel sounds (NSCAF).

DISCUSSION

The global picture from the results appears to support the idea that the processing of text in children with cognitive disabilities and typically developing children is more similar than different. The influence of orthographic cues, word frequency, and rime frequency on word and rime recognition was apparent in both groups. Teachers of children with cognitive disabilities may find interesting the clear preference for mak-

Table VII. Samples of Lexicalized Miscues for Both Groups in Low Frequency Target Words With Frequency of Occurrences

Target	Children with cognitive disability		Typically developing children			
mesh	mush (4)	mess (2)	mush (3)	mess (6)		
deem	dream (6)	team (4)	dream (2)			
shoal	soul (4)	shoe (4)	shawl (5)	shell (3)		
speck	speak (9)		speak (7)			
moan	moon (9)		moon (1)			
bliss	bless (6)		bless (3)			
droop	drop (14)		drop (10)			
mod	mud (3)	mood (5)	mode (3)	mud (3)	mood (1)	mode (2)
glum	gum (9)		gum (3)			
chess	cheese (5)		cheese (6)			
grog	grow (4)		grow (4)			
bleed	bled (5)		bled (2)			
pep	peep (11)		peep (11)			
muck	much (6)	make (3)	much (3)	make (3)		

ing use of onset-rime structure and the generalization of rime units as observed from the analyses of predictor variables for target word recognition and from the miscue analyses.

In regard to the first question, children with cognitive disabilities are similarly influenced by GPC knowledge, word frequency, and RNS effects-patterns. Both groups were sensitive to RNS such that they identified rimes from large rime neighborhoods or from large and moderate rime neighborhoods more accurately than from moderate and small rime neighborhoods or small rime neighborhoods, respectively. The interaction effects observed in this study appear to result from a

Table VIII. Samples of Lexicalized Miscues for Both Groups in Target Nonwords with Frequency of Occurrences

Target	Children with cognitive disability		Typically developing children	
dain	den (2)		den (3)	
kip	keep (4)	skip (1)	hip (1)	keep (3)
dag	dog (8)		dog (4)	
dail	bail (1)	trail (1)	doll (4)	bail (2)
doon	down (3)	don (4)	down (3)	done (2)
kud	could (3)		could (4)	
deef	beef (1)	deaf (5)	deaf (1)	
kog	frog (1)	dog (3)	dog (1)	
tep	step (1)	tip (2)	tip (2)	
doop	drop (6)		drop (3)	
teep	peep (1)	deep (3)	tape (1)	talk (1)
toach	touch (5)	teach (4)	touch (4)	teach (1)
desh	dish (8)		dish (7)	
toud	toad (2)	loud (4)	toad (3)	
doal	doll (8)		doll (2)	

preference for use of rime-units in word analysis on the part of children with cognitive disabilities. This preference is further clarified by the miscue analyses.

The second question examined whether differences in the facilitative effects of context, previously observed in typically developing children, would be found in children with cognitive disabilities. Both groups demonstrated significantly higher accuracy rates for rime and word recognition when reading connected text. An exploratory analysis of differences was conducted to verify whether the context effect was the result of a strong effect in the children with Down syndrome or whether both groups benefitted equally; there were no differences between groups in this regard ($p = .706$). Word recognition accuracy of children with cognitive disabilities was similar to their typically developing word recognition-level peers. Teachers of children with cognitive disabilities may find this appealing because it appears that children with cognitive disabilities may be able to benefit from reading instruction, which is analogy-based. Analogy-based instruction includes the use of strategies such as Word Walls or Word Families, and the instructional cue of using known words to decode unknown words. The implications are greater for children with autism, who were more inclined to use rime units than were children with Down syndrome.

One of the deficits in children with autism is their failure to detect relationships or to use that knowledge in their interpersonal lives. It can be argued that one kind of relationship-like condition is that of characters and events within connected text. The question can be posed as follows: If children with autism fail to develop schema or representations for interpersonal relationships in their daily lives, will they make use of such relationships observed in connected text such that they are more accurate in identifying target words? If children with autism are unable to use connected text to develop schema or representations for intra sentence relationships, then their rime recognition accuracy should not appear similar to typically developing children in this condition. This was not the case.

The stories dealt with people and animals as characters in everyday situations that involved dialogue. Children with autism had sufficient event-schema or representations to support recognition of such relationships for word recognition purposes. Further examination of the extent of the effect needs to be pursued; however, these findings suggest that children with autism may benefit by presenting information about social relationships in the context of reading materials. However, they may only be able to use such knowledge while reading silently and independently. The social interaction required by some reading strategies may be sufficient to preclude full use of context (e.g., forms of guided reading or questioning strategies). This area requires further investigation. Nevertheless, independent reading may be one way in which children with autism can learn about the social world which they appear not to experience. This may lead to development of text-based lessons that develop a knowledge base for social interaction, followed by explicit social-skill instruction supported by the text-based knowledge.

The third question was an exploration of the ways in which children with cognitive disabilities and typically developing children are alike or different in regard to word recognition. Children with cognitive disabilities appeared to use similar cues for word recognition compared with typically developing children. However, children with cognitive disabilities appear to rely more on rime-based strategies for decoding nonwords than did their typical peers, who relied on the initial and final consonant as a strategy for identifying nonwords. This observation is suggested by the interaction effects of RNS and group, the forced-order multiple regression analyses of predictors of word recognition, and the miscue analyses. The traditional view holds that children who use rimes as a cue to aid identification of unknown words are processing text using more sophisticated knowledge than children who are using partial cues described as scaffolded errors (Ehri, 1995). If, as suggested by the traditional view, children with cognitive disabilities are using a more sophisticated cue system for decoding than are their typically developing peers, what would explain this apparent contradiction of the expected? First, recall that the children with cognitive disabilities were approximately 2 years older, on average, than their peers. In other reading level-match design research, both the processing maturity that age presumes and the opportunity for experience with text that may be assumed can be suggested as reasons for these findings. Second, no attempt was made to obtain information about the kind of instructional methods used in the classrooms of the children with cognitive disabilities, although it was known that the typically developing children were instructed within a balanced program that emphasized literature-based instruction. It may be that the instructional methods used with the children with cognitive disabilities in this study developed more analytical skill than did the balanced program, which may suggest instructionally developed sensitivity to the use of different word parts as cues. Further research is needed.

The miscue analyses also present some interesting results which are more clear in their interpretation. Children with cognitive disabilities made more miscues on their first attempts to read low frequency words and nonwords (recall that although it appears from an examination of Appendix A that children were more accurate in word recognition, Appendix A represents their means for correct rime identification). They also produced significantly more lexicalized (real word substitutions) miscues than did their typically developing peers. More informative is the observation that their lexicalized miscues relied on correctly identified rime segments to a greater degree than did their typically developing peers, who supplied lexicalized miscues based on the beginning and ending consonant, scaffolded lexicalization. Again, the results suggest a greater sensitivity to rime units in children with cognitive disabilities than in typically developing children.

Implications

Although preliminary, the most promising implication of this study is that children with cognitive disabilities are similar to their typically developing peers in their use of cues when reading rimes in lists and stories. Like their typically developing word recognition-level peers, they are sensitive to word-part cues and their sensitivity appears to be quantitatively and qualitatively similar to that seen in typically developing readers.

A second implication, based primarily on the results from the miscue analyses, is that children with cognitive disabilities may benefit from instructional methods that focus on word-part units and word analysis. Specific strategies involving the use of onset and rime units may be of particular benefit. Research regarding the use of specific instructional strategies should be conducted.

Strengths Weaknesses, and Future Research

The major strength of this preliminary study is its use of a reading level-match design to examine comparisons in processing of words and nonwords between children with cognitive disabilities and typically developing children. Currently, there has been little research that has examined the processing of text in groups of children with cognitive disabilities. At the global level, similar studies are needed to address the results of strategy instruction as well as cognitive functioning.

The major weakness in this preliminary study is the manner in which participants with cognitive disabilities were selected. Participants were drawn from a pool of applicants without regard to age, cognitive functioning, or classroom instructional methods. Future research needs to include the consideration of more highly specified parameters for participants in order to infer results with a higher degree of certainty.

This preliminary study demonstrates that children with cognitive disabilities use grapho-phonic cues in similar ways, are similarly sensitive to rime neighborhood effects, and similarly generalize grapho-phonic knowledge when the word recognition level of each group is at second grade, on average. This study identifies sets of questions and broadens the scope of future work, both in research and application, in reading. Children with cognitive disabilities need to be followed longitudinally in order to examine the developmental nature of their use of grapho-phonic cues compared with their typically developing peers.

If it is the case that children with cognitive disabilities are more similar to their word recognition matched typically developing peers, then much more needs to be known about the developmental route taken by children with cognitive disabilities prior to reading at this level of word recognition. Currently, we have not described the development of phonemic awareness in children with autism or Down syndrome, nor has anyone documented the linguistic and metalinguistic skills that accompany such development. Anecdotally, the participants with autism in this study represent a very broad continuum of the disorder. Although all responded verbally to print, three participants were not responsive to any other form of social verbal interaction. The directions for one of the participants had to be given in writing because she would not respond to any orally presented requests. Despite these limitations, she obtained reading scores in the upper range on all tasks.

Finally, much more needs to be understood about the interaction of word recognition and reading methodology within the two groups of children with cognitive disabilities. The need is highlighted by the fact that both groups of children were able to use known words and their word part cues to figure out unknown words, thus demonstrating unsuspected strengths in this narrow area of learning.

APPENDIX A RIME TRIPLET LIST

	High frequency words			Low frequency words			Nonwords		
	Word	SFI	RNS	Word	SFI	RNS	Word	SFI	RNS
Large Rime	rain	62.4	22	stain	39.4	22	dain	0	22
	ship	62.3	24	zip	44.2	24	kip	0	24
Neighborhood	bag	58.0	23	wag	35.0	23	dag	0	23
	dug	54.4	18	jug	48.0	18	kug	0	18
	job	61.8	18	lob	34.9	18	dob	0	18
	need	66.3	19	bleed	41.6	19	keed	0	19
	club	56.1	18	stub	41.5	18	kub	0	18
	tail	60.4	18	wail	43.8	18	dail	0	18
Total:		481.7	160		328.4	160		0	160

(*continued*)

APPENDIX A (continued)

	High frequency words			Low frequency words			Nonwords		
	Word	SFI	RNS	Word	SFI	RNS	Word	SFI	RNS
Moderate Rime	truck	58.7	15	muck	34.7	15	kuck	0	15
	soon	65.9	10	loon	38.4	10	doon	0	10
Neighborhood	mud	57.3	10	thud	45.8	10	kud	0	10
	drum	53.1	11	glum	30.7	11	tum	0	11
	frog	55.9	14	grog	23.9	14	kog	0	14
	step	61.1	07	pep	38.2	07	tep	0	07
	rod	54.2	15	mod	31.0	15	dod	0	15
	loop	52.1	12	droop	41.9	12	doop	0	12
	keep	66.7	15	beep	30.6	15	teep	0	15
	check	61.8	09	speck	44.9	09	teck	0	09
	less	63.8	11	chess	44.1	11	dess	0	11
Totals		650.6	129		404.2	129		0	129
Small Rime	Joan	52.6	05	moan	48.2	05	koan	0	05
	miss	53.9	05	bliss	25.1	05	tiss	0	05
Neighborhood	coach	55.1	04	roach	36.4	04	toach	0	04
	fresh	61.5	04	mesh	30.5	04	desh	0	04
	seem	59.9	03	deem	43.2	03	keem	0	03
	loud	57.8	04	shroud	33.7	04	toud	0	04
	coal	58.4	04	shoal	32.0	04	doal	0	04
	beef	48.9	02	reef	45.9	02	deef	0	02
Totals		448.1	31		295.0	31		0	31

RNS, rime neighborhood size; SFI, standard frequency index.

APPENDIX B TARGET WORDS IN STORIES

Large Rime Neighborhood Story

Captain Jack

Captain Jack was about to sail into a storm. The name of his *ship* was The *Zip*. The Zip was the fastest ship on the lake. On board were two boxes and a *bag*. There was a *jug* in one box and cans of redwood *stain* in the other box. In the bag was the food Captain Jack brought for the trip. The *rain* was coming down hard. A broken can of stain began to *bleed*. "I *need* a new *job*!" cried Captain Jack with a *wail*.

His pet dog, *Stub, dug* open a box and crawled into it. He was afraid of storms and he wanted to hide. When the storm ended, Stub was happy. Captain Jack could tell when Stub was happy because his *tail* would *wag*. Stub liked to eat *club* sandwiches from the ship's kitchen. He also liked to play with tennis balls. The captain would *lob* a ball to Stub. He would leap into the air to catch it. When the days were sunny, they had fun, but today was not a sunny day. Captain Jack and Stub both hoped that tomorrow the weather would be better. (193 words)

Moderate Rime Neighborhood Story

Croak

My *truck* broke down and stopped with a *thud*. My pet *frog* and I were *glum*. A *rod* in the middle of the road was struck in the *mud*. I gave the horn a *beep*. *Soon* an animal walked up to my door. It was a *loon* with a *drum*. He said "You don't look happy. Let's go have some fun! Can you *keep* in *step* to a *loop* dance? We can *check* out the *mod* dance club and have a cup of *grog*."

"Sure!" said my pet frog, Croak. With a leap, Croak was off with a great deal of *pep*. They danced and sang until they began to *droop*.

When he was *less* peppy, Croak came back to the truck. Croak said, "I *seem* to have a *speck* of *muck* on my nose." A repairman came soon. Our truck got fixed. Croak and I went home to play *chess*. (151 words).

Small Rime Neighborhood Story

The Run

It was a warm Spring day. *Joan* dressed in a hurry. She closed her *mesh* jacket with a zip. She was full of pep and ready to go. Joan did not want to *miss* her *coach*.

"A run in the *fresh* air can *seem* like *bliss.* I *deem* this day to be a wonderful day!" she said out *loud.* She ran to the *reef* to meet John, her coach. John and Joan ran for five miles. John tried to kick a *coal* black bug from his shoe. When John kicked again, he hit a rock in the *shoal.* He hurt his foot and let out a *moan.* The bug, a *roach,* had struck to the mud on his shoe. John gave Joan the dead bug. Joan wrapped the bug in a little *shroud* and buried it. John looked less glum. They went home and ate *beef* sandwiches. After a week, John could run again. (156 words)

REFERENCES

Aaron, P. G. (1989). *Dyslexia and hyperlexia: Diagnosis and management of developmental reading disabilities.* Dordrecht, ND: Kluwer Academic Publishers.

Andrews S. (1992). Frequency and neighborhood effects of lexical access. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 18*(2), 234–254.

Blanton, L. P., & Semmel, M. I. (1987). Research on the reading of mildly mentally retarded learners: A synthesis of the empirical literature. In S. Rosenberg (Ed.), *Advances in applied psycholinguistics: Reading, writing, and language learning* (Vol. 2). New York: Cambridge University Press.

Calhoon, J. A. (1991). *Elementary words categorized by sound units.* Unpublished manuscript.

Calhoon, J. A. (1995). Factors affecting reading of rimes in words and nonwords by proficient readers. Unpublished doctoral dissertation, Marquette University, Milwauke, WI.

Calhoon, J. A., & Leslie, L. (in press). The effects of rime neighborhood size and word frequency on beginning readers' rime recognition in words and nonwords: A longitudinal study.

Caroll, J. B., Davies, P., & Richmond, B. (1971). *The American heritage word frequency book.* Boston: Houghton-Mifflin.

Chapman, R. S. (1995). Language development in children and adolescents with Down syndrome. In P. Fletcher & B. MacWhinney (Eds.), *Handbook of Child Language,* pp. 641–663 Oxford: Blackwell.

Cooke, N. L., Heron, T. E., Heward, W. L., & Test, D. W. (1982). Integrating a Down syndrome child in a classwide peer tutoring system: A case report. *Mental Retardation, 20*(1), 22–25.

Cossu, G., Rossini, F., & Marshall, J. C. (1993). When reading is acquired but phonemic awareness is not: A study of literacy in Down syndrome. *Cognition, 46*(2), 129–138.

Echols, L. D., West, R. F., Stanovich, K. E., & Zehr, K. S. (1996). Using children's literacy activities to predict growth in verbal cognitive skills: A longitudinal investigation. *Journal of Educational Psychology, 88*(2), 296–304.

Ehri, L. C. (1995). Phases of development in learning to read words by sight. *Journal of Reading Research, 18*(2), 116–125.

Eskes, G. A., Bryson, S. E., & McCormick, T. A. (1990). Comprehension of concrete and abstract words in autistic children. *Journal of Autism and Developmental Disorders, 20*(1), 61–73.

Frith, U., & Snowling, M. (1983). Reading for meaning and reading for sound in autistic and dyslexic children. *Developmental Psychology, 1,* 329–342.

Heath, S. B. (1983). *Ways with words.* Cambridge, England: Cambridge University Press.

Jackson, M. (1974). Visual feedback in word acquisition behaviour in moderately retarded subjects. *Slow Learning Child: Australian Journal on the Education of Backward Children, 21*(3), 155–163.

Karmiloff-Smith, A. (1992). *Beyond modularity: A developmental perspective on cognitive science.* Cambridge, MA: MIT Press.

Laxon, V. J., Coltheart, V., & Keating, C. (1988). Children find friendly words friendly too: Words with many orthographic neighbors are easier to read and spell. *British Journal of Educational Psychology, 58,* 103–119.

Leslie, L., & Caldwell, J. (1995). *The Qualitative Reading Inventory-II.* New York: Harper Collins.

Leslie, L., & Calhoon, J. A. (1995). Factors affecting children's reading of rimes: Reading ability, word frequency and rime frequency. *Journal of Educational Psychology, 87,* 576–586.

Leslie, L., & Thimke, B. (1986). The use of orthographic knowledge in beginning reading. *Journal of Reading Behavior, 28*(3), 229–241.

Olson, R. K., Forsberg, H., & Wise, B. (1995). Genes, environment, and the development of orthographic skills. In V. W. Berninger (Ed.), *The varieties of orthographic knowledge (Vol. I): Theoretical and developmental issues* (pp. 27–71) Dordrecht, ND: Kluwer Academic Publishers.

Pennington, B. F., Johnson, C., & Welsh, M. C. (1987). Unexpected reading precocity in a normal preschooler: Implications for hyperlexia. *Brain and Language, 30,* 165–180.

Senechal, M., LeFevre, J., Hudson, E., & Lawson, E. P. (1996). Knowledge of storybooks as a predictor of young children's vocabulary. *Journal of Educational Psychology, 88*(3), 520–536.

Snowling, M., & Frith, U. (1986). Comprehension in "hyperlexic" readers. *Journal of Experimental Child Psychology, 43,* 392–415.

Stanovich, K. E. (1986). Mathew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360–406.

Stanovich, K. E. (1992). Reading, spelling, and the orthographic cipher. In P. Gough, L. Ehri, & R. Treiman (Eds.), *Reading Acquisition* (pp. 307–342). Hillsdale, NJ: Erlbaum.

Thielke, H. M., & Shriberg, L. D. (1990). Effects of recurrent otitis media on language, speech, and educational achievement in Menominee Indian Children. *Journal of American Indian Education, 29*(2), 25–35.

Treiman, R. (1983). Phonemic-analysis training helps children benefit from spelling-sound rules. *Memory and Cognition, 11*(4), 382–359.

Treiman, R. (1985). Onsets and rimes as units of spoken syllables: Evidence from children. *Journal of Experimental Child Psychology, 39,* 161–181.

Treiman, R., & Chafetz, J. (1987). Are there onset- and rime-like units in printed words? In M. Coltheart (Ed.), *Attention and performance XII: The psychology of reading* (pp. 281–298). Hillsdale, NJ: Erlbaum.

Treiman, R., Goswami, U., & Bruck, M. (1990). Not all nonwords are alike: Implications for reading development and theory. *Memory and Cognition, 18*(6), 559–567.

Tunmer, W. E., & Nesdale, A. R. (1985). Phonemic segmentation skill and beginning reading. *Journal of Educational Psychology, 77,* 417–427.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*(2), 192–212.

Webster's Elementary Dictionary, (1986). Springfield, MA: Merriam-Webster.

Welsh, M. C., Pennington, B. F., & Rogers, S. (1987). Word recognition and comprehension skills in hyperlexic children. *Brain and Language, 32,* 76–96.

Wheeler, L. R., & Smith, E. H. (1954). A practical readability formula for the classroom teacher in the elementary grades. *Elementary English, 31,* 397–399.

WordPerfect Corporation (1990). *Word-Perfect: SpellChecker (Version 5.1)* Orem, UT: Author.

Zinna, D. R., Liberman, I. Y., & Shankweiler, D. (1986). Children's sensitivity to factors influencing vowel reading. *Reading Research Quarterly, 21,* 465–479.