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Writing through retellings: an exploratory study of language-impaired and dyslexic populations

CYNTHIA S. PURANIK, LINDA J. LOMBARDINO,
LORI J. ALTMANN
Communication Sciences & Disorders, University of Florida, 43 Dauer Hall, P.O. Box 117420, Gainesville, FL, 32611-7420, United States

Abstract. This study was designed to examine differences and similarities in the writing of 15 language-impaired, 17 dyslexic and 15 typically developing control subjects matched on chronological age. Subjects ranging in age from 11 to 21 years were required to produce a written language sample using an expository text-retell procedure. The writing of these groups was compared on eight variables across discourse, T-unit, sentence, and word levels. Control subjects performed better than language-impaired and dyslexic subjects on all writing variables. Dyslexic subjects showed better performance than the language-impaired subjects on several variables including, (a) number of T-units, (b) number of ideas, (c) total number of words, and (4) number of different words while showing comparable performance on percentage of spelling and production of grammatically correct sentences. These findings support Bishop and Snowling's [*Psychol. Bull.* 130 (2004) 858] position that the differences between these two clinical populations exist in the non-phonological dimensions of language.

Key words: Dyslexia, Language impairment, Retellings, SLI, Writing, Written language disorders

Introduction

At the behavioral level, individuals with specific language impairment (SLI) or language impairment (LI) and dyslexia present with striking similarities and differences frequently leaving researchers and clinicians debating whether they are the same or different disorders (Bishop & Snowling, 2004; Kamhi & Catts, 1986; Rispens, 2004; Silliman, Butler, & Wallach, 2003; Tallal, Allard, Miller, & Curtiss, 1997). Bishop and Snowling (2004) argue that these two clinical populations are likely to differ in their nature, underlying causes, and developmental trajectories, despite sharing some behavioral characteristics. They contend that the differences between the two groups exist primarily in the non-phonological dimensions of language and, thus, cannot be characterized adequately by a single continuum of severity. Further, they emphasized the critical role of non-phonological aspects of language such as vocabulary and grammatical knowledge in the development of reading skills and underscore that strengths and weaknesses in oral language and in literacy skills can interact in different ways to produce different reading skill outcomes.

Despite the theoretical and clinical importance of understanding the degree to which language disordered populations share behavioral characteristics, very few studies have directly compared the oral language or written language skills of the two groups. With a few exceptions, the investigations that have compared children with SLI and children with dyslexia have focused mainly on reading and reading related behaviors. Joanisse, Manis, Keating, and Seidenberg (2000) and Rispens (2004), who administered reading and language tasks to children with dyslexia and children with language impairment, found that both groups presented with poor phonological skills and morphological impairments, although the impairments of the language-impaired group were more severe. In contrast Fraser and Conti-Ramsden (2005) reported that while both SLI and dyslexic groups performed poorly on tasks of phonological awareness, only children with SLI showed poorer performance on non-phonological tasks of vocabulary and morphological awareness compared to control subjects. The lack of convergence in the results on the grammatical/morphological awareness tasks between these studies could be due to task differences. Joanisse et al. (2000) examined the production of plural nouns and past tense verbs in a sentence completion task, with stimuli consisting of words and non-words and Rispens (2004) used a task where subjects were required to discriminate between grammatical sentences and sentences containing subject–verb agreement violations. Fraser and Conti-Ramsden (2005) required children to generate past tense forms for a series of verbs. Criteria for subject selection and standardized measures used to assess oral language for these studies differed greatly. In both the Joanisse et al. (2000) and Rispens (2004) study, verbal working memory resources needed to maintain the target sentence in memory while marking the verb to match the subject may have impacted the performance of the subjects. In addition, it is possible that the subjects in the Joanisse et al. (2000) study had greater difficulty with non-words, which affected their task performance. Longitudinal studies examining various aspects of spoken and written language in controlled and spontaneous contexts are needed to further our understanding of the language strengths and weaknesses of these two disorders over time.

The purpose of the current study was to compare writing skills in individuals with language impairment and dyslexia in preadolescents and young adults. Research on writing has been overshadowed by research on reading and reading related processes. As noted by Treiman and Kessler (2005) ‘‘Literacy research has concentrated on reading, but without the ability to write, a person could scarcely be called literate.'' (p. 120). Reading and writing are closely connected throughout school from kindergarten when children begin to learn sound–letter correspondences through high school when students are required to compose text (Scott, 1999). Writing requires the activation and coordination of several linguistic skills including, but not limited to, semantics, syntax, spelling, and writing conventions. It is a skill that develops after the foundations of reading have been laid and requires explicit instruction for its mastery. Despite the essential role of writing in the academic life of an individual, it is often overlooked when assessing children with reading and language difficulties. One reason that the analysis of writing has received little attention may be because the assessment of writing can be a time-consuming and tedious task. Moreover, some studies have shown a high correlation between reading and writing at the single word level, making assessment of writing seem redundant especially if it can be predicted from reading scores (Bishop & Clarkson, 2003). Given the central role of writing in today's literate society and the controversy regarding differences and similarities between language impairment and dyslexia, we chose to investigate the possibility of quantitative differences in the writing skills of these two clinical populations. To address this question, we compared the written language samples from preadolescents and young adults with diagnoses of language impairment or dyslexia and typically developing age-matched peers. We examined their writing at the discourse, t-unit, sentence, and word levels.

Writing samples were elicited using a retelling format. Retellings have been used by researchers to gather oral language (Gazella & Stockman, 2003; Gillam & Carlile, 1997; Ward-Longeran, Liles, & Anderson, 1999) and written language samples (Kiewra, Mayer, Christensen, Kim, & Risch, 1991; Meyer & Freedle, 1984). Retellings are an efficient way to assess and evaluate students' memories, reactions, writing, and listening and reading comprehension (Harp, 2000). No known studies to date have compared written retelling for expository discourse in language-impaired and dyslexic groups. An expository discourse structure was selected because it is the text genre that students in middle school, high school, and college are exposed to most frequently.

The language-impaired subjects were hypothesized to perform more poorly than the control and dyslexic groups on the majority of written language measures examined. This hypothesis is consistent with the findings of previous studies of writing skills in language-impaired individuals (Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Gillam & Johnston, 1992; Mackie & Dockrell, 2004; Scott & Windsor, 2000). Further we hypothesized that the dyslexic subjects would show comparable performance to the control subjects on discourse and sentence level variables while exhibiting significantly poorer spelling skills. This latter hypothesis reflects the tenet that dyslexia is characterized by deficits in phonological processing and strengths in listening comprehension and reasoning (Ramus et al., 2003; Stanovich & Siegel, 1994; Shaywitz, 2003).

Methods

Participants

The total sample consisted of 47 preadolescents and young adults ranging in age from 11 to 21 years. Subjects were assigned to one of three groups (1) language-impaired group, (2) dyslexic group, and a (3) control group. Demographic data on the participants are shown in Table 1. No significant differences in age were found between the groups, $F(2,44) = .41$, $p = .67$.

Table 1. Assessment and demographic information by group.

	Language impaired	Dyslexic	Control
N	15	17	15
Age	16.02 (3.25)	15.08 (3.32)	14.09 (3.71)
Thinking ability	98.14 (9.6)	105.24 (11.4)	114.53 (12.7)
Verbal ability	86.78 (7.7)	102.58 (10.7)	
CTOPP: PA-composite	86.1 (14.4)	94.7 (11.15)	
CTOPP: RN-composite	90.78 (13.9)	91.41 (20.5)	
CTOPP: PM-composite	88.0 (9.7)	95.1 (12.9)	
WRMT: word ID	86.13 (13.7)	96.5 (9.5)	
WRMT: word attack	91.93 (15.03)	93.6 (7.86)	
WRAT-spelling	86.5 (14.9)	(9.8)	

Note: (1) Thinking Ability = Thinking ability composite from the Woodcock Johnson Tests of Cognitive Abilities-III (WJ-III) for the language-impaired and dyslexic subjects. Two clinical subjects' scores were taken from the Fluid Reasoning Cluster of the WJ-R and one from the Performance Intelligence Quotient of the WISC-III. Score for one language-impaired subject not reported. Scores for controls = Fluid Reasoning Cluster of the WJ-R; (2) Verbal Ability = Verbal Ability composite from the Woodcock Johnson Tests of Cognitive Abilities-III (WJ-III); score missing for one language-impaired subject; (3) one language-impaired subject missing scores on the Comprehensive Test of Phonological Processing (CTOPP) and Wide Range Achievement Test-3 (WRAT-3); (4) One dyslexic subject missing score on the Woodcock Reading Mastery Test-Revised (WRMT-R).

Clinical subjects were selected by conducting an examination of archived records of participants who were evaluated at the University Speech and Hearing Clinic between 2001 and 2005. Individuals had come to the University's Reading Diagnostic Clinic for an evaluation to determine the presence and/or nature of a reading disability. Participants in the study include only those who had normal non-verbal cognitive functioning, normal hearing, normal or corrected vision, no evidence of neurological or sensory disorders and no reported or observed behavioral disturbances.

Standardized spoken language and reading tests were administered to all clinical subjects as part of the diagnostic battery. The evaluation of experimental participants included measures of overall cognitive ability, reading performance and oral language. Assessment instruments were selected based on their psychometric properties, and the combination of tests administered depended on the individual's primary reason for seeking evaluation. Assessment instruments used are listed below.

The *Woodcock–Johnson Tests of Cognitive Abilities-R* (WJ-R; Woodcock & Mather, 1989) or the *Woodcock–Johnson Tests of Cognitive Abilities-III* (WJ-III; Woodcock, McGrew, & Mather, 2002) were used to assess the participants' verbal and thinking abilities. The *Comprehensive Test of Phonological Processing* (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was used to assess phonological awareness, phonological memory, and rapid naming abilities. The *Woodcock–Johnson Reading Mastery Test-Revised* (WRMT-R; Woodcock, 1987) was used to assess word decoding, and single word recognition. The *Wide Range Achievement Test-3* (WRAT-3; Wilkinson, 1993) was used to assess single word spelling. *Test of Word Reading Efficiency* (TOWRE; Torgesen, Wagner, & Rashotte, 1999) and/or the *Gray Oral Reading Test-3* (GORT; Weiderholt, & Bryant, 2001) was used to assess reading fluency. A combination of subtests from the *Comprehensive Assessment of Spoken Language* (CASL; Carrow-Woolfolk, 1999) was used to assess receptive and expressive language.

All tests were administered by graduate students under the supervision of the second author. The second author considered the subjects' developmental history, family history, previous testing and therapy data, and classroom performance in determining diagnosis of either dyslexia or language impairment. No diagnoses were made based on a single test score or discrepancy measure; rather diagnoses were based on patterns of performance on standardized tests, nature of academic problems exhibited, case histories of individual participants and family histories. Participants received a diagnosis of *dyslexia* if they (a) showed deficits in phonological awareness, reading and spelling at the single word level along with deficits in phonological memory, and/or rapid naming, (b) demonstrated a relative strength in listening comprehension and reading comprehension in contrast to weaknesses in word decoding, word identification, and spelling, (c) obtained scores on tests of spoken language that were in the normal range, and (d) had no developmental history of language therapy or diagnosis of language impairment. Many of the individuals who met the criteria for dyslexia had been treated for mild articulation disorders during the preschool years and had a positive family history for reading disability.

A diagnosis of *language impairment* was given when participants (a) reported a history of speech and language therapy or early academic difficulties, and (b) performed at least one standard deviation below average on tests of reading comprehension and listening comprehension and on at least one other task of spoken language (e.g., vocabulary). Because the data were collected retrospectively from a large clinical database, not all participants received an identical test battery and hence reporting of all scores is cumbersome. Psychometric data for tests on which most of the clinical subjects had scores are shown in Table 1. These include the CTOPP (Wagner et al., 1999), the WRMT-R (Woodcock, 1987), and the WRAT-3 (Wilkinson, 1993). *T*-tests showed that the difference between the two groups was significant only for the word identification subtest of the WRMT-R ($p < .05$).

Control subjects were recruited from the community and were compensated for their time. These subjects were normal readers with no history of spoken language or literacy deficits, sensory or neurological deficits as determined by self and/or parental report. Control subjects were determined to be of normal intelligence based on scores from the Fluid Reasoning Cluster of the Woodcock–Johnson Tests of Cognitive Abilities-R (WJ-R; Woodcock & Mather, 1989).

The Thinking Ability scores for all three groups were in the range of normal for the test. A one way analysis of variance (ANOVA) showed a significant main effect for diagnosis $F(2,43) = 7.64$, $p < .001$ on the Thinking Ability scores. The controls were significantly different from the language-impaired ($p < .0001$) and the dyslexic ($p < .03$) subjects. The difference between the two clinical groups was not significant ($p = .09$). The two clinical groups showed significant differences on the Verbal Ability Composite score of the WJ-III, $F(1,30) = 21.17$, $p < .0001$.

Task administration

Participants were read a social science expository passage (see Appendix A) about the ‘people who lived in colonies’ from the Informal Reading

Inventory (Woods & Moe, 1989). The examiner read the passage to the subjects who were told to listen carefully and then verbally retell the text to the examiner. Then the examiner told the student to listen to the text one more time and write what he or she remembered from memory on a piece of lined paper. This repetition of the text by the examiner was used to minimize memory constraints for the writing sample. The subjects were given as much time as they needed to complete their written retelling of the text. Written language samples were analyzed at the discourse, t-unit, sentence, and word levels using a modified protocol developed by Nelson, Bahr, and Van Meter (2004).

Dependent measures

At the discourse level, two variables were analyzed to measure writing productivity: (1) total number of words written, and (2) total number of ideas expressed. These variables have been widely used by researchers as an indication of productivity in both spoken and written language (e.g., Nelson et al., 2004; Nelson & van Meter, 2002; Paul, 2001; Scott & Windsor, 2000). All written samples were entered into a computer database using the Systematic Analysis of Language Transcripts protocol (SALT-v7; Miller & Chapman, 2001). *Total number of words*, calculated automatically by SALT, was the number of words produced in writing by the subject. Proper nouns (e.g., North America) and compound words (e.g., bedroom) were counted as single words in keeping with SALT conventions. Words or phrases that did not pertain to the original paragraph such as "The end" or "that's all I remember" were deleted when calculating total number of words. *Total number of ideas* was calculated so as not to penalize participants who told very concise stories while reproducing ideas/propositions from the original sample. For example the original sample contained sentences such as, "Life for the colonists was difficult" and "There were no electric lights". The first sentence was counted as one idea and the second sentence was counted as another idea. The stimulus paragraph contained a total of 15 ideas. Information produced by the participants that was not present in the original sample was not counted as an idea.

At the T-unit level, three variables were examined: (1) number of T-units, (2) mean length of T-unit, and (3) clause density. *T-units* and *mean length of T-units*, frequently used measures of syntactic complexity, were calculated using the formula proposed by Hunt (1965). A T-unit is one main clause with all subordinate clauses embedded in it. Clauses that begin with the coordinating conjunctions *and, but*, or *or* are considered to comprise a new T-unit. Written language samples were entered into SALT as T-units. The mean length of T-unit was determined by dividing the total number of words in the writing sample by the total number of T-units in the sample. *Clause density*, as suggested by Scott and Stokes (1995), is another index of syntactic complexity that can be used with adolescents. They defined clause density as "a ratio of the total number of clauses (main and subordinate) summed across T-units, and divided by the number of T-units in the sample" (p. 310). Examples of T-units produced by the participants and calculation of clause density are provided in the Appendix A.

Sentence level analyses included examination of the percentage of grammatically correct sentences. Just as length of T-units and clause density provide a general index of syntactic complexity, examination of sentence types provides information on subjects' sentence level skills (Nelson et al., 2004). Examination of T-units has generally been used with populations younger than subjects included in our study. Findings from various studies have been mixed and inconclusive in terms of their ability to evaluate syntactic complexity adequately (Scott, 1989, 1999). Therefore, we decided to examine writing at the sentence level as well. Unlike a T-unit, which is based on a preset definition, the boundaries of a sentence were based on the child's own punctuation (i.e., the presence of a period). However, if a period was omitted but a new sentence was begun with a capital letter, or there was a change of topic in spite of lack of appropriate punctuation, it was also counted as a sentence. It should be noted that more than one T-unit could make up a sentence. For example, "We might think they had it tough/but they believed they had it great", is one sentence but divided into 2 T-units (/indicates division of T-unit).

Sentences produced by participants were divided into grammatically correct or incorrect sentences. A sentence was coded as incorrect if it contained grammatical or lexical errors. Errors affected verb, noun or pronoun inflectional morphology, as well as violations of word order, lack of referents for pronouns, and word choice. *Percentage of grammatically correct sentences* was calculated by dividing the number of correct sentences by the total number of sentences produced by the subject. Following are two examples of grammatically incorrect sentences produced by the subjects: "These first people had to also carry water because there *weren't* electricity." "About 300 years ago the English created 13 colonies *with come* the US in North America."

At the word level, two variables were examined (1) number of different words (NDW), and (2) spelling accuracy. *NDW* is a widely used measure of lexical diversity (e.g., Nelson & Van Meter, 2002;

Nelson et al., 2004, Scott & Windsor, 2000) and has been used to distinguish between language-impaired and normally developing peers (e.g., Watkins, Kelly, Harbers, & Hollis, 1995). *Spelling accuracy*, extensively used in studies examining writing (e.g., Mackie & Dockrell, 2004; Nelson & van Meter, 2002), was calculated by dividing the number of correctly spelled words by the total number of words produced and multiplying by 100. Following are examples of spelling errors, ''Life was very *difficat* (difficult) for the *colnist* (colonists)'', ''They had *hoses* (houses) not like *ares* (ours)''.

The first author and a trained research assistant coded the written samples independently. Both were blind to the participants' diagnosis and age. Interrater reliability ranged from 89% to 98% across transcripts. Scoring differences were settled by consensus following discussion.

Results

Results are presented for the eight variables studied at the discourse, T-unit, sentence, and word levels. Table 2 shows the means and standard deviations for these measures. An analysis of covariance (MANCOVA) was computed for the dependent variables at each level to reduce within group variability due to our extended age range and keeping in mind that language variables are sensitive to age. In each analysis, group (LI, dyslexic, and control) served as the between-subjects factor with age as

Table 2. Mean raw scores and standard deviations for writing variables across groups.

	Language Impaired (n = 17)	Dyslexic (n = 21)	Control (n = 17)
Discourse level measures			
Total words	62.0 (21.5)	80.06 (22.2)	86.60 (21.7)
Total ideas	7.93 (2.5)	9.47 (2.4)	10.87 (2.4)
T-unit level measures			
Number of T-units	6.1 (2.4)	7.88 (2.2)	9.5 (2.2)
Mean length T-unit	10.5 (2.1)	10.8 (2.8)	9.5 (1.5)
Clause density	1.7 (0.3)	1.7 (0.4)	1.44 (0.2)
Sentence level measures			
% Correct sentences	0.68 (0.3)	0.68 (0.2)	0.92 (0.1)
Word level measures			
NDW	46.4 (16.7)	57.3 (16.1)	59.7 (12.1)
Spelling accuracy	93.8 (5.8)	93.3 (6.0)	97.8 (3.5)

the covariate. Where the main effects were significant, pairwise comparisons, adjusted for multiple comparisons using a Bonferroni correction were used to compare the performance of the three groups. Measures of effect sizes are reported using partial eta squared (η^2).

Discourse level measures

Two variables, *total words*, and *total ideas*, were analyzed across the groups at the discourse level. The MANCOVA revealed significant multivariate effects for both diagnosis $F(4,86) = 4.7$, $p < .002$, partial $\eta^2 = .25$ and age $F(2,42) = 6.89$, $p < .003$, partial $\eta^2 = .18$. There was no interaction between age and diagnosis; suggesting that age and diagnosis had similar effects on total number of words and total ideas. While the effects of diagnosis and age were significant for both variables, the results of inter-group comparisons differed somewhat. The LI group produced significantly fewer words in their writing compared to the dyslexic group ($p < .01$) and the control group ($p < .0001$), however, the dyslexic group did not differ significantly from control subjects on total number of words ($p = .19$).

For the number of ideas produced, a continuum of performance was observed across groups; the LI group produced significantly fewer ideas than the control group ($p < .0001$), and differences between the dyslexic and LI group and dyslexic and control group approached significance ($p = .03$ and $p = .04$, respectively).

T-unit level measures

A MANCOVA contrasting diagnosis and covarying age was also performed on T-unit level variables: *number of T-units*, *mean length of T-unit*, and *clause density*. Results of the MANCOVA indicated significant multivariate effects for both diagnosis $F(6, 84) = 2.98$, $p < .01$, partial $\eta^2 = .18$ and age $F(3,41) = 3.37$, $p < .03$, partial $\eta^2 = .19$. There was no interaction between diagnosis and age. However, when looking at individual component tasks, the effects of diagnosis and age were significant only for the number of T-units. The LI group produced fewer T-units than the control group ($p < .0001$). Moreover, the difference between the dyslexic and control groups and the dyslexic and LI groups approached significance ($p < .03$ for both). In contrast, no statistically significant effects of age or diagnosis were noted for average length of T-units or clause density.

Sentence level measures

At the sentence level, an ANCOVA was used because we examined only one dependent variable, *percentage of grammatically correct sentences*. The ANCOVA showed a significant main effect for diagnosis, $F(2,43) = 7.33, p < .002$, partial $\eta^2 = .25$ but not for age $F(1,43) = .92$, $p = .34$. The LI group and the dyslexic group produced significantly fewer grammatically correct sentences than the control group ($p < .002$ for both), but the two clinical groups did not differ significantly from each other ($p = .9$).

While the finding for the LI group was in line with previous research, the finding for the dyslexic group was unexpected. Research suggests that the performance of dyslexics on syntactic tasks differs as the task increases in complexity (e.g., Byrne, 1981; Leikin & Assyag-Bouskila, 2004; Stein, Cairns, & Zurif, 1984). Applied to production of grammatically correct sentences, this could mean a difference in performance between simple and complex sentence production. Hence, in a post hoc analysis, we analyzed the percentage of grammatically correct sentences by examining types of sentences (simple vs. complex) produced. Separate ANOVAs were conducted for each sentence type. Results of the univariate analysis for simple sentence types indicated a significant effect for diagnosis, $F(2,43) = 4.67$, $p < .02$, partial $\eta^2 = .18$ but not age $F(1,43) = .05, p = .83$. Pairwise comparisons showed that the LI group produced significantly fewer simple correct sentences compared to the control group ($p < .004$). However, the dyslexic subjects did not differ significantly from either the LI ($p = .11$) or the control groups ($p = .13$). Figure 1 shows the performance of the three groups on simple and complex sentences.

However, a different pattern emerged for complex sentences. Results of the univariate analysis for complex sentence types showed a significant effect for both diagnosis, $F(2,43) = 8.5, p < .001$, partial $\eta^2 = .28$ and age $F(1,43) = 10.9$, $p < .002$, partial $\eta^2 = .20$. Younger subjects produced fewer complex sentences than older subjects. Moreover, both the LI and the dyslexic groups produced significantly fewer complex sentences than the controls (both ps $< .005$). The difference between the number of complex sentences produced by the two clinical groups was not significant ($p = .37$). To summarize, the LI group produced fewer simple and complex sentences compared to the control subjects, while the dyslexic subjects performed comparably to the control subjects on number of simple sentences but performed comparably to the LI subjects on number of complex sentences.

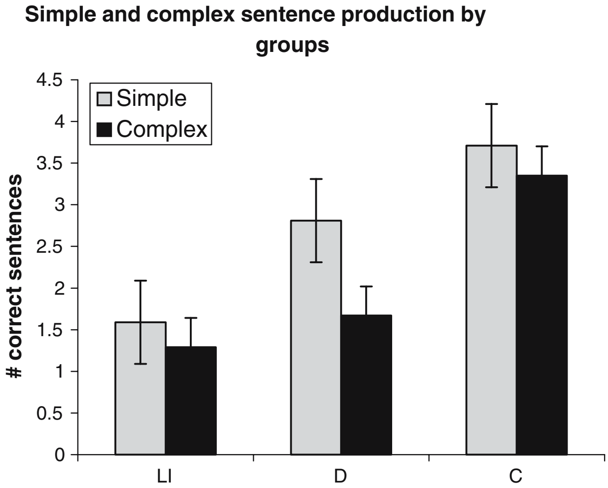

Figure 1. Comparison of simple and complex sentence production for LI—language impaired, D—Dyslexic, and Control groups.

Word level measures

At the word level, *NDW* and *spelling accuracy* were groups. Results of the MANCOVA for these variables showed significant multivariate effects for both diagnosis, $F(6,84) = 3.68$, $p < .003$, partial $\eta^2 = .21$ and age $F(3,41) = 10.38$, $p < .0001$, partial $\eta^2 = .43$, indicating that both variables affected the NDW produced and the spelling accuracy in writing samples. While the effects of group and age were significant for both variables, the results of the inter-group comparisons differed somewhat. The LI group produced significantly fewer different words than both the dyslexic ($p < .009$) and control groups ($p < .001$), but the dyslexic group did not differ from the control group ($p = .31$).

Finally, *spelling accuracy* also differed significantly between groups. The LI group and the dyslexic produced more errors in their spelling than the control group ($p < .003$ for both). No significant difference was found between the spelling accuracy of the language-impaired and dyslexic groups ($p = .9$).

Discussion

In this study we compared writing samples of language-impaired, dyslexic, and typically developing control subjects. Samples were obtained using a retelling paradigm and analyzed at the discourse, t-unit, sentence, and word levels. Four patterns emerged from our findings: (1) no differences were found between the language-impaired, dyslexic, and control groups for mean length of T-units and clause density, (2) language-impaired subjects performed significantly worse than control subjects for total number of words, number of ideas, number of T-units, and NDW, (3) the dyslexic group did not differ significantly from the controls on number of total words and ideas, number of T-units and NDW, and (4) language impaired and dyslexic groups did not differ from each other on spelling accuracy and percentage of grammatically correct sentences but showed significantly poorer performance compared to controls. The findings of this study show greater support for Bishop and Snowling's (2004) hypothesis that the differences between these two clinical groups may lie in the non-phonological dimensions of language. Differences and similarities were found between the dyslexic and language-impaired group compared to control subjects on several of our measures.

The first pattern was one of no differences between all three groups for mean length of T-units and clause density. Studies using T-units to examine competence in syntactic complexity have shown conflicting results. While some studies have reported that children with language impairment have shorter T-units or use fewer words per T-unit in their writing compared to age-matched control subjects (e.g., Loban, 1976; Scott & Windsor, 2000), other studies have failed to demonstrate differences on these measures with language-impaired subjects (Bishop & Clarkson, 2003) and reading disabled students (Houck & Billingsley, 1989; Morris & Crump, 1982). Our findings are consistent with these latter studies. Scott (1989, 1999) reviewed the efficacy of T-units in capturing syntactic complexity and concluded that more refined methods are needed to capture lexical and syntactic variations in writing. The mean length of T-unit for the three groups in our study ranged from 9.2 to 10.5, which is consistent with T-unit data reported in the literature by Loban (1976). This narrow range of T-unit length supports Scott's (1989, 1999) suggestion that T-units might be too unrefined of a measure to capture differences in syntactic complexity. The average clause density data (i.e., number of clauses per T-unit) in this study was also consistent with data reported by Loban (1976). Because clause density measures the addition of subordinate clauses to T-units, it may be subject to the same lack of refinement as the T-unit. It is possible that the clinical groups were using simpler forms of subordination (e.g., nominal infinitive clauses) than later developing structures (e.g., relative clauses) compared to their age matched peers. Due to the small number of clausal embeddings in our sample, the types of clauses used by the two groups could not examined adequately; however, this dimension of sentence complexity should be investigated in future studies designed to elicit numerous opportunities for complex sentence production.

The second pattern showed that the language-impaired subjects performed significantly worse than control subjects for total number of words produced. This is consistent with the results of investigations showing that children with language impairment use fewer words in written discourse, produce shorter stories, and have difficulty with text generation when compared to age-matched controls (Bishop & Clarkson, 2003; Dockrell & Lindsay, 2000; Fey et al., 2004; Mackie & Dockrell, 2004; Scott & Windsor, 2000). As predicted, the third pattern showed that the dyslexic group did not differ significantly from the controls on the measures of total number of words. The performance of the dyslexic group on this measure of productivity and fluency corroborates what researchers have posited in numerous studies over the past decade, dyslexia is a disorder that primarily affects phonological processing leaving higher order skills such as language comprehension and analytical reasoning skills intact (Ramus et al., 2003; Stanovich & Siegel, 1994; Shaywitz, 2003). This pattern of reduced productivity in LI subjects is consistent with existing research and points to differences in the semantic dimensions of written language in these two clinical groups.

The third pattern also applied to total ideas, number of T-units, and NDW, in which language-impaired subjects performed significantly worse than dyslexic subjects who performed worse than normal controls although the difference between the dyslexic and control group did not approach significance. Considering that the stimulus text was presented auditorily, the smaller number of ideas produced may be a reflection of the well documented verbal working memory deficits in these two populations (de Jong, 1998, Ellis Weismer, 1996; Ellis Weismer, Evans, & Hesketh, 1999; Gathercole & Baddeley, 1990, 1993; Kibby, Marks, Morgan, & Long, 2004; Lahey & Bloom, 1994; Snowling, 1991; Torgesen, 1985). The ability to recall propositions could be greatly diminished by working memory deficits. How does one explain the difference in performance between the language-impaired and dyslexic group? In the only study that we are aware of to have compared the memory differences between these two clinical populations, Rispens (2004) found that the LI subjects showed poorer performance than the dyslexic subjects on measures of verbal working memory. Based on the results of that study, it would be reasonable to speculate that the LI subjects may have more pervasive memory deficits than the dyslexic subjects resulting in a decreased ability to recall ideas.

NDW is a reflection of lexical access or vocabulary, which appears to affect both clinical populations, albeit the dyslexic group to a lesser extent than the language-impaired group. Due to their reading difficulties, both groups would probably have reduced exposure to print thereby negatively affecting vocabulary development. Further, given likely deficits in verbal working memory both groups would be expected to have greater difficulty recalling words learned. Additionally, the poorer performance of the LI subjects could result at least in part from their significantly lower verbal scores.

In the fourth pattern, the clinical populations did not significantly differ from each other but differed from the control subjects on spelling accuracy, and percentage of grammatical sentences. As expected, both clinical groups made more spelling errors in their writing samples than the control subjects, a finding that is consistent with previous investigations of children with developmental language disorders (e.g., Bishop & Clarkson, 2003; Mackie & Dockrell, 2004; Nelson & Van Meter, 2002; Treiman, 1997). It is also consistent with findings from dyslexic subjects in which persistent difficulty with spelling is associated with both phonological and orthographic weaknesses (Aaron & Joshi, 1992; Snowling, 2000). Further analysis of spelling errors might provide insight into the nature of spelling errors in these two groups.

Syntactic deficits are the hallmark of language impairment (see Leonard, 1998 for details). The smaller proportion of grammatically correct sentences among language-impaired subjects is consistent with previous examinations of grammatical and syntactic errors in the writing samples of language-impaired children (Fey et al., 2004; Gillam & Johnston, 1992; Mackie & Dockrell, 2004; Scott & Windsor, 2000). However, the finding for subjects with dyslexia was contrary to our predictions. Research on dyslexia has primarily focused on the phonological processing deficits of this population, leaving other components of language largely unexplored, although a few studies have reported grammatical deficits. Our findings are more in line with recent reports of grammatical delay (Altmann, Puranik, Mikell, & Lombardino, 2005; Rispens, 2004) and morphological and morpho-syntactic deficits (Bar-Shalom, Crain, & Shankweiler, 1993; Casalis, Colé, & Sopo, 2004; Joanisse et al., 2000; Mann, Shankweiler, & Smith, 1984; Rispens, 2004; Rispens, Roeleven, & Koster, 2004) in the oral language production of children and adults with dyslexia. Grammatical accuracy has been found to reliably distinguish clinical populations with language based learning disabilities from typically developing children (Fey et al., 2004; Mackie & Dockrell 2004; Scott & Windsor, 2000; Windsor, Scott, & Street, 2000). The results of this study add to current body of evidence.

While both groups showed reduced accuracy in the production of grammatically correct sentences compared to control subjects, when performance on sentence types (simple vs. complex) was examined in this study, two patterns emerged. The language impaired group had difficulty with simple and complex sentence production compared to controls. Research examining syntactic deficits in SLI children has shown that they have difficulty comprehending complex sentences and their sentence production is generally confined to simple sentences (e.g., Bishop, 1982; Van der Lely, 1996). In contrast, the dyslexic group demonstrated comparable performance on simple sentences but showed poorer performance on complex sentence production compared to controls. Other researchers have documented a discrepancy in performance between simpler and more complex syntactic forms in dyslexic individuals (e.g., Byrne, 1981; Leikin & Assyag-Bouskila, 2004; Stein et al., 1984). For example, Byrne (1981) found that dyslexics had no difficulty comprehending simple structures but performed more poorly than controls when comprehending complex structures.

To summarize, the two clinical groups showed differences in their performance on total number of words, NDW, number of T-units, and total ideas pointing to differences in productivity, semantics, and lexical diversity, i.e., the content of language. However, they showed similarities in the form of language, namely syntax and phonology as seen by their performance on the variables of spelling accuracy, percentage of grammatically correct sentences and number of simple sentence produced. Our findings suggest that these groups exhibit similarities in the form of language while showing distinctions in the content of language. Although the dyslexic group showed better performance than the language-impaired subjects on several variables, they performed more poorly than the controls on many variables including grammatical accuracy and number of ideas recalled. When task complexity increased, the dyslexic group showed performance similar to the language-impaired group. As noted by Bishop and Snowling (2004), literacy is a complex interaction of semantic, syntactic, phonological and orthographic skills and varying deficits in these skills can produce different reading outcomes. Our results support Bishop and Snowling's (2004) position that a unidimensional model of reading focused on the phonological aspects of language is insufficient. Syntactic deficits in dyslexia and its role in literacy have received little attention in the past and it is an issue that needs more exploration in future research. Our findings clearly demonstrate that the written language impairments of preadolescents and adults diagnosed with language impairments or dyslexia affect not only their ability to read and spell but also other aspects of their written expression.

This was an exploratory study, thus our findings must be treated with some caution. Our sample size was small and our measures were limited to quantitative analyses. Studies in the future using a large corpus of data from each subject, a larger cohort of subjects, and application of more in-depth exploration of word and sentence types and spelling errors should add to our understanding of the similarities and differences between these two diagnostic classifications of developmental language disorders. More studies examining the processes involved in producing text, as well as studies of instructional strategies for improving writing in these populations are needed to promote optimal academic success.

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Appendix A

Original sample (Woods & Moe, 1989)

About 300 years ago, the English started 13 colonies in North America. These colonies later became our first states.

The people in those colonies had difficult lives. For transportation they often walked. Sometimes they used boats if they lived near water. Since there were no cars, it was hard for the early colonists to travel very far.

The colonial houses were much different from our houses. The houses had one large room with a fireplace. This room was used as a kitchen, a dining room, and a living room. Also it was often used as a bedroom because of the fireplace. There were no electric lights. Water had to be carried into the house.

Life for the colonists was very difficult, yet colonists thought they had a good life.

Note: Writing samples entered into SALT as T-units. CODES- [LE]: Lexical error; [GE]: grammatical errors; [1cl]: 1 clause; [2cl]: 2 clauses etc.; [sc] and [si]: simple correct and incorrect sentence respectively; [cc] and [ci]-complex correct and incorrect sentence, respectively; [spelerr]-spelling error.

Sample 1: Written sample of a dyslexic subject age 15.02 years

C1 About 300 year/s ago the English came to North_America [1cl] [sc].
C2 They made[LE] thirteen state/s [1cl] [si].
C3 For transportation they had to walk.
C4 or if they were by the water they had boat/s [3cl] [cc].
C5 Their house/s were much different than our/s.
C6 all it was, was a big room with a fireplace [2cl] [cc].
C7 They use/ed the room for[GE] dinning[spelerr], a living room, and a bedroom because of the fireplace [1cl] [sc].
C8 Their[spelerr] was no electricity.
C9 so they had to carry water into the house [2cl] [cc].

Discourse level
(1) Total number of words: 75
(2) Number of ideas: 9

T-unit level
(1) Number of T-units: 9
(2) Mean length of T-unit: 75/9 = 8.33
(3) Clause Density: 10/9 = 1.11

Sentence level
(1) Number of sentences (C3 & C4, C5 & C6, and C8 & C9 make one sentence each): 6
(2) % Grammatically correct: 5/6: 83%
(3) Sentence type: 3—simple correct, complex correct, 1—complex incorrect

Word level
(1) Number of different words: 32
(2) Number of spelling errors: 2

Sample 2: Written sample of a language-impaired subject age 14.07 years

C1 3000 year/s ago colionests[spelerr] found[GE] 13 colins[spelerr] in North_America.
C2 and they became state/s [2cl][ci].
C3 It was hard living for them [1cl][sc].
C4 There[spelerr] house/s had one larger[GE] room with a fireplace[.err] [1cl] [si].
C5 it was use/ed for dining, kitchen[GE], living room, and sometime/s a bedroom[1cl] [si].
C6 they had to walk as there were no car/s [2cl] [cc].
C7 there were no car/s [1cl] [sc].
C8 there was no electricity[.err] [1cl] [sc].
C9 they had to carey[spelerr] water to the house [1cl] [sc].

Discourse level	T-unit level
(1) Total no. of words: 66	(1) Number of T-units: 9
(2) Number of ideas: 9	(2) Mean length of T-unit: 66/9 = 7.33
	(3) Clause density: 10/9 = 1.11
Sentence level	Word level
(1) Number of sentences (C1 & C2 make one sentence): 8	(1) Number of different words: 44
(2) % Grammatically correct: 5/8: 62.5%	(2) Number of spelling errors: 4
(3) Sentence type: 4—simple correct, 2—simple incorrect, 1—complex correct, 1—complex incorrect	

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Address for correspondence: Cynthia S. Puranik, Communication Sciences & Disorders, University of Florida, 43 Dauer Hall, P.O. Box 117420, Gainesville, FL, 32611-7420, United states
Phone: +1-352-392-2046; Fax: +1-352-846-0243;
E-mail: cpuranik@csd.ufl.edu