The Nature of Written Language Deficits in Children With SLI

RESEARCH NOTE

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Children with specific language impairment (SLI) have associated difficulties in reading decoding and reading comprehension. To date, few research studies have examined the children's written language. The aim of the present study was to (a) evaluate the nature and extent of the children's difficulties with writing and (b) investigate the relationship between oral and written language. Eleven children with SLI were identified (mean age = 11 years) and were compared with a group of children matched for chronological age (CA; mean age = 11;2 [years;months]) and language age (LA; mean CA = 7;3). All groups completed standardized measures of language production, writing, and reading decoding. The writing assessment revealed that the SLI group wrote fewer words and produced proportionately more syntax errors than the CA group, but they did not differ on a measure of content of written language or on the proportion of spelling errors. The SLI group also produced proportionately more syntax errors than the LA group. The relationships among oral language, reading, and writing differed for the 3 groups. The nature and extent of the children's written language problems are considered in the context of difficulties with spoken language.

KEY WORDS: SLI, writing, syntax, fluency

Children with specific language impairment (SLI) experience problems with the acquisition and processing of oral language. The most commonly used core criterion to identify children with SLI is that their language problems cannot be explained in terms of other cognitive, neurological, or perceptual deficits (Bishop, 1992). Their problems are characterized by a protracted rate of language development as well as difficulties with particular subcomponents of the language system (see Bishop, 1997, and Leonard, 1998, for reviews). These problems also affect the processing of written text. Difficulties with word decoding and understanding written texts have been reported in a number of studies (Bishop & Adams, 1990; Botting, Crutchley, & Conti-Ramsden, 1998; Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998), although studies examining the children's written skills are rare. The current study aims to address this gap by considering the written language skills of children with SLI in relation to chronological-age (CA)- and language-age (LA)-matched peers.

Producing Written Text and the Potential Impact of Oral Language Problems

Writing is a complex skill involving a number of linguistic and nonlinguistic processes. Much of our understanding of the writing process has been based on the model developed by Hayes and Flower (1986; Hayes, 1996). In this model, the skilled writer is conceptualized as using the three recursive skills of translation, planning, and reviewing to produce text. The model was derived from work with adults and therefore does not address how children become good writers. Swanson and Berninger (1994) have adapted the model to address how children learn to write. In children, it is known that translation skill (i.e., putting your words on the page) develops first, with planning and reviewing emerging later, once translation skills are well embedded. Young children's writing includes very little that can be classed as either planning or reviewing (Bereiter & Scardamalia, 1987). There is, therefore, evidence that investigations that focus on the initial stages of writing ought to be at the translation level.

The translation process can be split into two components: *text generation* and *transcription* (Berninger, 1999). Text generation involves turning ideas into units of language—into the words, sentences and larger units of discourse produced within working memory—whereas transcription comprises "the cognitive and physical acts of forming written (as opposed to spoken) representations of text" (McCutchen, 1995, p. 128). Handwriting processes, for example, would fall under transcription. For all children, the process of learning to write fluently and coherently is an extended process. Perera (1984) carried out an in-depth analysis of the structure of children's writing. She distinguished some of the characteristics of younger writers, describing their texts as often muddled and incoherent as the writer lost his/her train of thought, leading to repetitions, failure of agreement between tenses, and inconsistent use of pronouns. Young writers were also described as being more likely to use *and* rather than other connectives, to use simple active verbs, and to use constructions more acceptable in speech. In sum, developing text generation skills in typical learners is an extended process that is mirrored by a range of errors in their written text, errors that are no longer common in their oral language. Text generation is reported by teachers as being particularly difficult for children with SLI (Dockrell & Lindsay, 2000).

There are a number of reasons to predict that children with SLI will experience difficulties with writing and text generation specifically. The high cognitive demands placed on the individual in creating written text may overload a language system that is, arguably, reduced in processing capacity (Ellis Weismer, Evans, & Hesketh, 1999; Montgomery, 2000; Windsor & Hwang, 1999). Such difficulties would lead to reduced length of texts and higher levels of errors than those of age-matched peers. There are also reasons to predict particular patterns of errors in the written text itself. The reduced lexical knowledge experienced by some children with SLI may directly affect the children's written output. More advanced writing is associated with a greater number of different words (Beard, 1986), increases in the number of adjectives (Wells & Chang, 1986), and an increased number of adverbs and adverbial phrases (Perera, 1984). Thus, limits in vocabulary are likely to influence both the length and content of the written texts of children with SLI. In contrast, the grammatical complexity of the written output may be influenced by the morphological (Leonard, Eyer, Bedore, & Grela, 1997) and the syntactic problems experienced by the children (van der Lely & Christian, 2000; van der Lely & Ullman, 2001). Grammatical difficulties may manifest themselves in writing through, for example, the construction of simple sentences and the omission of prepositions, articles, and verbs. Associated problems with phonology and reading may also affect writing through increased numbers of spelling errors (Clarke-Klein, 1994; Lewis & Freebairn, 1992; Treiman, 1991) or the lack of experience with written narratives (Fitzgerald & Shanahan, 2000). Thus, there are a variety of indirect reasons to predict that children with SLI will experience difficulties with generating written text. The relationship between oral language performance and written language performance requires systematic investigation to identify specific vulnerabilities and to guide evidence-based interventions.

Previous Research on the Written Language Skills of Children With Language Impairment

Three studies provide direct evidence of the written language performance of children with language learning difficulties (LLD). Gillam and Johnston (1992) studied both spoken and written narratives of 9–12-year-old children with and without LLD. The sample consisted of 10 children with LLD and three matched comparisons: a group matched for CA, a group matched for LA (as measured by performance on a sentence-imitation task), and a group matched for reading age. The children were asked to produce both a spoken and a written story in response to a picture. The results indicated that producing a written narrative was significantly more difficult than producing an oral narrative. This was true for all groups, with fewer morphemes and prepositions occurring in written as compared with spoken narratives.

No differences were found among the groups on vocabulary, content, organization, or the number of prepositions. The only measure that differentiated the LLD group from all the comparison groups in the writing measure was the number of grammatical errors in complex T-units, that is, sentences that include a main clause and a subordinate clause (Hunt, 1970). These results support the view that the children are experiencing a particular vulnerability in linguistic form, as evidenced by their grammatical errors.

More recently, two further studies (Scott & Windsor, 2000; Windsor, Scott, & Street, 2000) have explored in greater detail the written language of children with LLD. In the first study, 20 students with LLD, many of whom were receiving or had received special education for a spoken language impairment, were matched with CA and LA matches. LA scores for matching were derived from a composite expressive and receptive language measure (age-appropriate version of the Test of Language Development—2; Hammill & Newcomer, 1988; Newcomer & Hammill, 1988). Participants produced oral and written summaries of two educational videos. The task was designed to reflect typical classroom demands, and the "children were asked to summarize new and extensive information" (Scott & Windsor, 2000, p. 336). As in the Gillam and Johnston (1992) study, it was the percentage of written utterances containing grammatical errors that clearly separated the children with LLD from their LA-matched peers. In a related study, with the same sample group, the key aspect that differentiated the children with LLD and their LA-matched peers was the total number of verb composite errors (Windsor et al., 2000). Windsor et al. argued that this finding complemented similar findings for spoken language, as omission of *-ed* is a particular deficit in the spoken language of children with SLI (Marchman, Wulfeck, & Ellis Weismer, 1999; Rice, Wexler, & Cleave, 1995). These three studies provide important empirical evidence of the impact of children's oral language difficulties on written language, when they are asked to produce a story or relate information. For the majority of measures, performance is commensurate with that of LA-matched peers but not that of CA-matched peers. Moreover, the results highlight specific limitations with written syntax beyond those of LA-matched peers for children with LLD. These limitations may characterize the children's core linguistic deficit.

Given the range of language-related difficulties experienced by children with SLI, it is important to consider the extent to which these conclusions are valid with different language-impaired populations and for different types of language comparisons. All three studies described have included participants with LLD; however, these children's difficulties may not be specific to language, reflecting more general difficulties in generating written text experienced by children with learning disabilities (Graham, 1990; MacArthur & Graham, 1987). This broader sample may obscure the impact of the language-processing deficits and minimize the correlates of oral language problems. By corollary, the ways in which language matches are identified raise conceptual issues. Participants can be matched on an overall LA measure, as in Scott and Windsor (2000) and Windsor et al. (2000), or on a more specific measure, such as sentence repetition, as in the Gillam and Johnston (1992) study. Neither of these matches would capture the ability to generate ideas in oral language. Matching children a priori on their production of oral narratives and then testing their performance on written narratives is a further way to identify linguistic features of writing that are central to the children's problems. In addition, as suggested by Windsor et al., investigations of the written text of children with language difficulties should include an analysis of the types of errors made as well as the frequency of errors.

Purpose

The current study develops previous work by exploring the delays and differences in the written output of children with SLI. We consider whether the written narratives of children with SLI can be distinguished from those of children matched by a similar level of oral narrative ability and those of their age- and nonverbal-ability-matched peers. Specific research questions centered on (a) the pattern of performance across the three groups in terms of fluency, content, and accuracy of written text; (b) the interrelationships among oral language, reading, and writing performance; and (c) the nature of the errors produced by children with SLI. We hypothesized that the children with SLI would perform as well on a measure of fluency and content of written language as a language comparison group matched on expressive narrative language. Given the reduced levels of oral language of the children with SLI, we predicted that their performance would be significantly poorer than chronologically matched children on these dimensions. It was further predicted that the children with SLI would have specific difficulties with grammar and spelling in relation to both CA and LA comparison groups.

To evaluate these predictions, a writing assessment that examined each of the elements of written language was identified. To provide a robust test of these predictions, a stimulus that did not require additional processing or that placed demands on working memory (Bishop, 1997; Gathercole & Baddeley, 1990) was chosen. The Picture Story Language Test (PSLT; Myklebust, 1965) assessed the written samples, as it met all the following criteria. The assessment directly measures

children's ability to generate a piece of original discourse by asking the children to produce a story in response to a visual prompt. Appropriate comparisons can be made across different ages. In addition, the measure includes an analytic scoring scheme examining content, productivity, and syntax, thereby addressing the three writing dimensions of concern for the present study. This type of scoring has been shown to introduce a higher level of reliability than those based only on one general holistic score (Westby & Clauser, 1999). An assessment that incorporated a visual prompt was chosen to ensure that the children's poor literacy or memorial skills did not compromise performance. As a direct comparison with the PSLT, the Bus Story Test of Continuous Speech (Renfrew, 1985) was chosen to measure oral language abilities. The Bus Story measures narrative ability and has been shown to be an indicator of early language ability that has strong relationships with future language and literacy performance (Stothard et al., 1998).

Method

Participants

The total sample consisted of 33 children, 11 children in each of three matched groups: (a) 8 boys and 3 girls (mean age 11 years, range 9;8–12;3) who were diagnosed with SLI and were attending a special language school; (b) 11 typically developing children matched for CA and gender (mean age 11;2, range 10;0–12;3); and (c) 11 typically developing children matched for gender and LA on the Bus Story (mean age 7:3, range 6:0–9:8).

For all participants with SLI, their diagnosis was confirmed by assessment with the Clinical Evaluation of Language Fundamentals—Revised (CELF–R; Semel, Wiig, & Secord, 1987). All children with SLI had total language scores on the CELF–R that were more than 2 *SD* below the mean (British standardization).[1] Nonverbal scores on Raven's Progressive Matrices (Raven, Court, & Raven, 1983) were within the average range, that is, above the 25th percentile. These data confirmed the diagnosis of SLI. The Bus Story Test of Continuous Speech (Renfrew, 1985) was used to document each child's expressive narrative language. An example of each group's transcript is given in Appendix A. Participants achieved an age-equivalent score of 6;8 (range 4;6–8;5) on the Bus Story. Children's reading skills were assessed on the Wechsler Objective Reading Dimensions (WORD; Rust, Golombok, & Trickey, 1993). As expected, reading skills were delayed (mean reading age 7:2, range 6:0–9:0).

The two groups of comparison children attended a local primary school. They had no identified language or learning difficulties and were selected by teachers as having attained average scores on curriculum assessments. The three groups did not differ in nonverbal ability, as measured by the raw scores on Raven's Progressive Matrices, $F(2, 30) = 0.80$, $p = .46$. The CA comparison children were matched within an average of 2 months to the children with SLI, $t(20) = 0.54$, $p = .59$. The LA comparison children were matched to the children with SLI on LA scores from the Bus Story information score. All the children were matched within an average of 3.5 months. The LA matches did not differ significantly from the children with SLI on the Bus Story information measure raw scores, $t(20) = 0.66$, $p = .50$, or on the Bus Story sentence length raw scores, $t(20) = 1.15$, $p = .26$. The LA and SLI groups were also matched on the WORD reading test within a 3-month age-equivalent window. Performance on the raw scores of the WORD reading test did not differ, $t(20) = 0.20$, $p = .84$. Table 1 contains scores for the three groups of children on the language, reading, and cognitive measures.

Instruments

There were two language assessments administered to the children as part of this study: the Bus Story Test of Continuous Speech (Renfrew, 1985) and the CELF–R (Semel et al., 1987). The Bus Story Test involves the examiner telling the child a story while the child looks through accompanying pictures. The child then retells the story, which is audiotaped and transcribed. The oral narratives are scored for the amount of correct information; this yields an Information score. The maximum score is 40 for recalling key items, such as the referents and actions performed, in the correct order. In addition, the Bus Story also yields a Sentence Length score. The CELF–R is a language test covering a range of language functions including phonology, syntax, semantics, memory, and word finding. This measure provides both an expressive and receptive language score, which is totaled to yield an overall language score.

The WORD (Rust et al., 1993) is an individually administered test of single-word reading accuracy. The test provides standard scores and reading age equivalents. Raven's Progressive Matrices (Raven et al., 1983) is a nonverbal ability test, which presents the child with a series of patterns from which a piece is missing. The child is instructed to look at the pattern and select the piece that can complete it.

The PSLT (Myklebust, 1965) was used to assess the children's written skills. The PSLT is a standardized writing assessment for children and older adolescents between the ages of 6 and 17 years. It incorporates a visual prompt, which enables the children to generate a piece of original text.

[1]The British standardization of the CELF–R is commonly used as part of the identification process for SLI in the United Kingdom.

Table 1. Results of standardized tests used for identification and matching.

	SLI group (n = 11)	CA group (n = 11)	LA group (n = 11)
Bus Story			
Information raw score			
M	29.82	32.82	26.73
SD	4.64	4.90	6.60
Range	18–34	23–40	16–34
Length			
M	10.20	14.26	9.25
SD	1.44	2.71	2.15
Range	7.4–12.6	11–19.2	5.1–13.6
WORD raw score			
M	22.82	40.27	23.64
SD	8.44	6.45	10.44
Range	10–35	32–48	5–35
Standard score			
M	72.45	96.27	99.27
SD	9.10	11.77	6.83
Range	59–92	83–111	89–117
Raven's Progressive Matrices raw score			
M	31.36	29.91	30.43
SD	3.35	2.55	1.72
Range	25–35	26–34	28–33
CELF–R raw score			
M	31.55	—	—
SD	8.32		
Range	21–48		
Standard score			
M	65.91	—	—
SD	10.45		
Range	50–85		

Note. SLI = specific language impairment; CA = chronological age; LA = language age; WORD = Wechsler Objective Reading Dimensions; CELF–R = Clinical Evaluations of Language Fundamentals—Revised. Dashes indicate that the test was not completed.

Procedure

Each child was tested individually over a period of 4 to 5 days. Clare Mackie administered each assessment, at a separate time and according to the standard format. For the PSLT, the child was asked to look at the picture carefully and then to write a story about it. The picture was placed in a central position where it could be easily seen throughout the task. The PSLT states that if a child asks questions, for example, "Should it have a title?" the reply should be nondirective, as in, "If you want the story to have a title, it can" (Myklebust, 1965, p. 93). The children were allowed 30 min to complete the story. Time taken to complete the written text was recorded. At the end, the examiner, with the child, read the story out loud to ascertain the child's meaning. This also enabled the examiner to decipher any words spelled incorrectly. The order of the assessments was counterbalanced across participants, with half the children undertaking the language assessments first and the other half undertaking the writing measure first.

Writing Analysis

The PSLT contains three scales: Productivity, Syntax, and Abstract–Concrete, which examines written content. Productivity is measured through the total number of words written.

The Syntax scale provides a total count of errors in grammatical construction and morphological features. Within each of these categories, error types, additions, omissions, and substitutions are scored in relation to grammatical construction, for example., omission of a word that is obligatory to the context (e.g., *A boy [is] playing with toys*) and inflectional morphology (e.g., addition of a grammatical inflection, *There are toys shoes*). The picture and the children's written narrative provided sufficient information to support the classification of error

types into omissions or substitutions. The reliability of the coding was established separately (see below). The final error score was divided by the total number of words, which allowed the error analysis to be corrected by the length of the writing sample.

For the PSLT, content is evaluated by means of the Abstract–Concrete scale, which consists of five levels to be used in rating the level of abstract thought or ideation. For example, Level 1 would be assigned for a series of unrelated letters or words, while Level 4 and 5 would be assigned for stories in which the picture served as a point of reference rather than being central to the story itself. Factors of language proficiency are ignored; only the content or quality of the ideation is evaluated.

Fluency. Each child was allowed 30 min to complete the writing task, but not all children used the allocated time. To produce a fluency measure based on output, the time each child had taken to complete the PSLT was divided by the total number of words to represent a measure of fluency.

Classification of spelling errors. Initially, all spellings were determined to be correct or incorrect. Those that were incorrect were further categorized according to phonological and orthographic accuracy. A scoring scheme initially developed by Bruck and Waters (1988) and Bruck, Treiman, Caravolas, Genesee, and Cassar (1998) was used to further analyze error patterns. This scheme allowed for an analysis of error patterns when children were producing different word types rather than a standardized spelling assessment. The spellings were classified as either phonologically inaccurate or as orthographically inaccurate. Each error therefore received two ratings. A phonologically inaccurate error was defined as not having a possible phoneme-to-grapheme correspondence in English, for example, *clars* instead of *clouds*. Typically, these errors involved the substitution of wrong sounds, insertion of phonemes, or deletion of phonemes. An orthographically inaccurate error was defined as a misspelling containing a sequence of letters that was illegal, which would include positional restriction, for example, *wusz* instead of *once*.

Coding reliability. Reliability checks were performed on 100% of writing samples, on all scales, by Clare Mackie and a postgraduate research officer and, in the case of the Abstract–Concrete scale, by an additional researcher, who was a trained primary school teacher. All of the writing samples were scored for all scales. The procedures for scoring followed the detailed instructions in the PSLT. In the case of an interrater disagreement, Clare Mackie's scores were used. Mean reliability for the Syntax scale was 89% and that for the Abstract–Concrete scale was 92%. With regard to judging whether a word was spelled correctly, reliability was also 100%. Across all spelling error categories, mean reliability was 91%.

Results

Patterns of Differences in Writing Task Performance Across the SLI, CA, and LA Groups

Examples of matched SLI, CA, and LA comparison groups' writing samples are shown in Appendix B. Table 2 presents the performance of the groups on the writing test. Results of a one-way analysis of variance (ANOVA), corrected for Type I error using a Bonferroni correction (using a probability level of .01), revealed a statistically significant difference among the three groups on the total number of words written, $F(2, 30) = 7.35$, $p = .003$, partial $\eta^2 = .32$. A series of Tukey honestly significant difference post hoc analyses indicated that the children with SLI were producing significantly fewer written words than the CA group ($p = .002$) but not the LA group ($p = .61$). The LA group did not differ significantly from the CA group ($p = .027$).

The mean writing time for the SLI group on the writing task was 14 min 55 s ($SD = 5.68$); that for the CA group was 13 min 13 s ($SD = 4.10$); that for the LA group was 15 min 45 s ($SD = 4.72$). There was no statistically

Table 2. Performance on the writing task: Length, fluency, content, syntax, and spelling errors.

	SLI group ($n = 11$)	CA group ($n = 11$)	LA group ($n = 11$)	p
Total no. words				.003
M	39.9	91.00	53.18	
SD	30.49	33.86	32.89	
Range	3–124	49–173	20–130	
Fluency (words per minute)				.002
M	3.23	7.94	3.69	
SD	2.44	4.27	2.40	
Range	0.15–8.27	4.45–18.60	1–8.60	
Content				.042
M	9.09	14.55	12.36	
SD	3.96	5.07	4.84	
Range	4–18	7–12	7–19	
Proportion of syntax errors				.001
M	.194	.017	.040	
SD	.172	.014	.033	
Range	.00–.67	.00–.04	.00–.11	
Proportion of spelling errors				.007
M	.156	.031	.162	
SD	.185	.031	.127	
Range	.00–.60	.00–.09	.00–.26	

Note. SLI = specific language impairment; CA = chronological age; LA = language age.

significant difference among the groups, $F(2, 30) = 0.89$, $p = .42$, on the time taken to complete the writing task. Fluency of writing across the groups, based on the number of words produced per minute, was statistically significantly different, $F(2, 30) = 7.42$, $p = .002$, partial $\eta^2 = .33$. The children with SLI were producing significantly fewer written words than was the CA group ($p = .004$) but not the LA group ($p = .94$). The LA group also wrote fewer words than the CA group ($p = .01$). Thus, in terms of both total number of words and fluency, the children with SLI differed significantly from their CA peers but not their LA peers. Surprisingly, there was no statistically significant difference among groups on a measure of content, $F(2, 30) = 3.54$, $p = .042$.

The mean total number of syntax errors differed significantly across groups, $F(2, 30) = 6.67$, $p = .004$, partial $\eta^2 = .30$, with the SLI group producing more errors ($M = 5.91$, $SD = 4.35$) than the CA group ($M = 1.64$, $SD = 1.29$) and the LA group ($M = 2.45$, $SD = 2.21$). To reflect a true syntax error score, the total number of errors divided by the total number of words was used to create a proportion score. The groups differed statistically significantly in the proportion of syntax errors produced, $F(2, 30) = 9.98$, $p = .001$, partial $\eta^2 = .39$. Post hoc tests revealed that the SLI group produced statistically significantly more errors than both the CA group ($p = .001$) and the LA group ($p = .003$). There was no statistically significant difference between the CA group and the LA group ($p = .86$) in their proportion of syntax errors.

To reflect an error rate in spelling, the total number of words written was divided by the total number of words spelled incorrectly. Due to unequal variance, the Kruskal–Wallis test was used to compare the proportion of spelling errors. The groups differed statistically significantly in the proportion of spelling errors produced, $\chi^2(2, N = 33) = 9.88$, $p = .007$, partial $\eta^2 = .19$. When comparing the groups individually, the Mann–Whitney test was used. There were no statistically significant differences between the SLI and the CA groups, $U(11) = 32.00$, $p = .06$, or between the SLI and the LA groups, $U(11) = 48.00$, $p = .43$. However, the LA group produced statistically significantly more errors than the CA group, $U(11) = 11.00$, $p = .001$, Cohen's $d = 1.65$.

Patterns of Relationships Between Measures of Oral and Written Language

To examine the relationship between the written measures and the children's oral language ability, partial correlation analyses were carried out separately for the three groups of participants, controlling for age. All correlations were corrected for Type I error using a Bonferroni correction (using a probability level of .006). All correlations are presented in Table 3 for the SLI group, Table 4 for the CA group, and Table 5 for the LA group.

As Table 3 shows, for the SLI group, there were no statistically significant correlations between oral language and any measure of writing, between reading and oral language, or between the different measures of written language. However, there was a statistically significant negative relationship between word reading and the proportion of spelling errors produced, $r(11) = -.82$, $p = .002$, indicating that the higher the score on word reading, the lower the proportion of spelling errors were produced. No other relationships approached significance.

Patterns for the two comparison groups differed from that for the children with SLI. For the CA group, there were no statistically significant correlation between the oral language measures and any measure of writing at the .006 corrected level. However, there was a trend for content to be associated with total words written, $r(11) = .76$, $p = .01$. Thus, the higher the score on the Content scale, the more words the children wrote. The small sample size may explain the lack of relationship revealed between the measures.

The LA matches also did not demonstrate any statistically significant correlations among word reading,

Table 3. Correlations among oral language, reading, and writing measures for the SLI group.

Measure ($n = 11$)	1	2	3	4	5	6	7	8
1. Bus Story Information	—							
2. Bus Story Sentence Length	.52	—						
3. Word reading	.08	.12	—					
4. Total words	−.17	.05	.25	—				
5. Content score	.14	.29	−.28	.58	—			
6. Proportion of syntax errors	.16	.23	.52	−.11	−.10	—		
7. Proportion of spelling errors	.22	−.21	−.82*	−.11	−.29	−.53	—	
8. Fluency (words per minute)	.25	.26	.58	.48	.10	−.28	−.35	—

Note. SLI = specific language impairment.
*$p < .006$.

Table 4. Correlations among oral language, reading, and writing for the CA group.

Measure (n = 11)	1	2	3	4	5	6	7	8
1. Bus Story Information	—							
2. Bus Story Sentence Length	.69	—						
3. Word reading	.26	.09	—					
4. Total words	−.02	−.41	−.52	—				
5. Content score	−.06	−.17	−.72	.76	—			
6. Proportion of syntax errors	−.29	−.38	−.40	.31	.62	—		
7. Proportion of spelling errors	−.13	−.19	−.66	.55	.61	−.16	—	
8. Fluency (words per minute)	.48	.03	−.04	.51	.55	.45	.09	—

Note. CA group = chronological-age-matched group.

oral language, and any measure of writing. However, a positive relationship was revealed between the total number of words and fluency per minute, $r(11) = .80$, $p = .005$. In addition, there were trends indicating positive relationships between content and total words, $r(11) = .76$, p = .011, and between scores on the two language measures: the Bus Story Information score and the Bus Story Sentence Length score, $r(11) = .77$, $p = .009$.

None of the groups demonstrated a statistically significant relationship between oral language, as measured by the Bus Story, and written language or between written content and written word production.

Spelling Errors

For this level of analysis, only the phonologically and orthographically inaccurate errors are discussed. The SLI group ($M = .58$, $SD = .43$) produced proportionately more phonologically inaccurate errors than both the CA ($M = .09$, $SD = .18$) and the LA ($M = .37$, $SD = .34$) groups. In addition, for orthographic errors, the SLI group ($M = .34$, $SD = .38$) produced proportionately more orthographically inaccurate errors than the CA ($M = .01$, $SD = .03$) and the LA ($M = .22$, $SD = .31$) groups. Results of a one-way ANOVA, corrected for Type I error using a Bonferroni correction (using a probability level of .01) revealed a statistically significant difference between the groups in the proportion of phonologically inaccurate errors, $F(2, 30) = 5.88$, $p = .007$, partial $\eta^2 = .28$. Post hoc tests revealed a statistically significant difference between the SLI and CA groups ($p = .005$) but not the SLI and LA groups ($p = .32$) or the CA and LA groups ($p = .14$). For the proportion of orthographically inaccurate spelling errors, no statistically significant difference was revealed among the groups, $F(2, 30) = 3.75$, $p = .035$, partial $\eta^2 = .20$, at the corrected .01 level. Post hoc tests showed a trend toward a statistically significant difference between the SLI group and the CA group ($p = .03$) but no differences between the SLI and LA groups ($p = .63$) or between the CA and LA groups ($p = .20$).

Specific Syntax Measures

As we have shown, the major difference between the children with SLI and their LA-matched peers is in terms of the proportion of syntax errors produced. To explore these differences further, this section compares the children's performance on the two aspects of the Syntax scale: word usage and word endings. Within each of these categories, the specified error types included

Table 5. Correlations among oral language, reading, and writing for the LA group.

Measure (n = 11)	1	2	3	4	5	6	7	8
1. Bus Story Information	—							
2. Bus Story Sentence Length	.77	—						
3. Word reading	.21	.11	—					
4. Total words	.16	.13	.60	—				
5. Content score	.23	.03	.44	.76	—			
6. Proportion of syntax errors	.06	.41	.32	.27	.19	—		
7. Proportion of spelling errors	−.65	−.41	−.44	−.05	−.01	−.03	—	
8. Fluency (words per minute)	.39	.42	.40	.80*	.62	.31	−.23	—

Note. LA group = language-age-matched group.
*$p < .006$.

additions, omissions, and substitutions. Table 6 contains the proportion and raw scores of whole-word addition, omission, and substitution errors. As Table 6 shows, children with SLI produced more errors of all types in comparison with both CA and LA matches.

The Kruskal–Wallis test was used, owing to unequal variance, and data were corrected for the possibility of a Type I error using a Bonferroni correction (with a probability level of .01). The three groups differed statistically significantly in the proportion of whole-word addition errors produced, $\chi^2(2, N = 11) = 10.56, p = .005$, partial $\eta^2 = .23$. Comparisons among the groups using the Mann–Whitney test demonstrated that there was a trend toward children with SLI producing more whole-word addition errors than the CA group, $U(11) = 24.00, p = .016$, partial $\eta^2 = .29$, but not the LA group, $U(11) = 55.00, p = .75$. The LA group produced more whole-word addition errors than did the CA group, $U(11) = 18.00, p = .004$, partial $\eta^2 = .31$. The groups also differed in the proportion of whole-word omission errors produced, $\chi^2(2, N = 11) = 10.26, p = .006$, partial $\eta^2 = .15$. There was a trend for the SLI group to produce a greater proportion of whole-word omission errors than the CA group, $U(11) = 24.00, p = .016$, partial $\eta^2 = .10$, and at a statistically significant level for the LA group, $U(11) = 21.00, p = .008$, partial $\eta^2 = .19$. There was no statistically significant difference between the CA and the LA group, $U(11) = 47.00, p = .40$. In contrast, there was no statistically significant difference among the three groups on the proportion of whole-word substitution errors, $\chi^2(2, N = 11) = 2.60, p = .27$.

Table 6. Mean proportions of and total whole-word errors as part of the Syntax scale.

Errors	SLI group (*n* = 11)	CA group (*n* = 11)	LA group (*n* = 11)	*p*
Addition				.005
M	.029	.001	.025	
SD	.032	.003	.026	
Range	.00–.10	.00–.01	.00–.09	
Total	16	1	17	
Omission				.006
M	.100	.009	.004	
SD	.191	.011	.007	
Range	.00–.67	.00–.03	.00–.02	
Total	21	9	3	
Substitution				.270
M	.023	.004	.008	
SD	.033	.008	.010	
Range	.00–.10	.00–.02	.00–.03	
Total	10	4	6	

Note. SLI group = group with specific language impairment; CA group = chronological-age-matched group; LA group = language-age-matched group.

A descriptive analysis of the whole-word syntax errors made by the SLI group revealed that the majority of the errors were verbs, specifically copula and auxiliary forms of *be* (e.g., omissions of *is, are,* or *were; n* = 8). There were 5 omissions of prepositions (*with*) and pronouns (*he, they*). In addition there were 2 omissions of conjunctions (*and*) and one omission of a definite article (*the*). The CA-matched group produced 9 whole-word omissions, with 5 instances of a preposition, a single instance of an auxiliary verb, an intransitive verb, a pronoun, and an indefinite article. The LA group produced only 3 whole-word omission errors; none of these were verb errors; all were pronouns.

Table 7 contains the performance of the groups on the proportion and raw scores of word-ending errors. Because no word-ending addition errors were produced by the LA group, a *t* test was performed between the SLI and CA group; no statistically significant difference was revealed between the two groups, $t(20) = 1.87, p = .85$, on the proportion of word-ending addition errors. In contrast, there was a difference among the three groups in the proportion of omission-of-word-ending errors, $F(2, 30) = 4.34, p = .022$, partial $\eta^2 = .22$, although not statistically significant at the .01 level. Post hoc tests revealed a trend toward a difference between the SLI group and both the CA group ($p = .043$) and the LA group ($p = .04$), however, not at the corrected .01 level. There was no statistically significant difference between the CA and the LA groups ($p = .99$). The SLI group omitted 8 word endings that included the progressive *-ing,* 1 past tense *-ed*, 2 cases of third-person singular, and a further 6 omissions of the plural *-s*. The CA and LA groups produced only omissions of the plural *-s*, with the CA group

Table 7. Mean proportions of and total of word-ending errors as part of the Syntax scale.

	SLI group (*n* = 11)	CA group (*n* = 11)	LA group (*n* = 11)	*p*
Addition errors				.85
M	.002	.002	—	
SD	.007	.004		
Range	.00–.02	.00–.01		
Total	1	2		
Omission errors				.022
M	.041	.002	.001	
SD	.064	.005	.004	
Range	.00–.17	.00–.02	.00–.01	
Total	17	3	1	

Note. SLI group = group with specific language impairment; CA group = chronological-age-matched group; LA group = language-age-matched group. Dashes indicate that none of this particular type of syntax error was produced. No groups produced any substitution errors.

producing 3 instances and the LA group producing only 1 instance.

Discussion

The purpose of this study was to investigate the written compositions produced by school-age children with SLI, in comparison with their CA- and LA-matched peers. Our first aim was to evaluate the pattern of written performance across the three groups. Second, we aimed to investigate the relationship among the children's oral language, reading, and writing. Third, we aimed to examine the nature of the written errors produced by the children with SLI. It was predicted that the children with SLI would be delayed in their written language skills relative to their CA-matched peers. In contrast, it was expected that content and length of the children's written narratives would be equivalent to those of their LA-matched peers but significantly reduced in relation to CA-matched peers. In addition, it was predicted that the children with SLI would experience greater problems with grammar and spelling than their LA-matched peers. The children's oral language skills, as measured by the Bus Story, were expected to be positively related to the content and length of their written output.

Assessment of Written Language Performance Across the Three Groups

All groups spent a similar amount of time producing their texts; thus, there was no evidence to indicate that the children's performance was constrained by a time limitation. As predicted, the SLI group produced written stories that were shorter than those of the CA-matched group but not the LA-matched group. This was in keeping with studies citing productivity as a problem for children with language difficulties (Scott & Windsor, 2000) and learning difficulties (Graham, 1990). However, in contrast to earlier work (Scott & Windsor, 2000), the children with SLI also produced fewer words per minute than their CA peers but not their LA peers. These differing results in the rate of written production may reflect the reduced processing resources found in the oral language of the children with SLI. Alternatively, the different tasks used in this study may have reduced the processing demands for the typically developing children so that they were able to produce their written work more fluently and automatically. Thus, there is preliminary evidence that the children with SLI were having more difficulty generating text than children of a comparable chronological age. Although the amount of text produced was similar to that of LA peers, note that the children with SLI had on average 4 more years of formal education and by corollary significantly more practice (and instruction) in writing than the LA matches. Despite differences in generating text, the content, as assessed by the current measures, was equivalent across the three groups, although there was a trend suggesting that the SLI group was producing fewer ideas than the CA group. It would therefore appear that the children in the SLI group were capable of producing abstract and imaginative stories, albeit more slowly. In contrast to the length and content of the texts, specific problems were evident in the children's written syntax. On this measure, both LA and CA peers were performing more accurately than the children with SLI.

Surprisingly, there was no statistically significant difference between the children with SLI and the two comparison groups on the proportion of spelling errors produced. Qualitative analysis from reports of the SLI children suggested that they wrote words that they could spell rather than attempt words that they could not spell. Children would explicitly note that they could not spell a word and choose a similar but simpler word to spell. No such statements were recorded from any child in the CA or LA groups. Thus, the lack of difference in spelling accuracy may reflect a strategy used by the children with SLI rather than a similar level of spelling performance per se. This interpretation is further supported by the types of errors produced by the three groups of children. These errors revealed that the children with SLI made more phonological errors than both the CA and the LA groups. Research has accumulated that shows the importance of phonological processing deficits in causing the literacy difficulties of children. These deficits are common in children with SLI and appear to be revealed in the specific difficulties with the phonological component of their spellings but not in their overall performance on the current task.

Relationships Among Oral Language, Reading, and Writing

Assessments of the relationships among language, literacy, and word reading for the three groups revealed unpredicted patterns. No relationships were found in any of the three groups between the oral language measures and the written language measure. Both the small sample size and the measures chosen (or the lack of sensitivity of the measures) may explain these results. It is also possible that the relationship between language and writing is mediated by other factors, and there was an indication that relationships did exist between other measures and writing.

Reading accuracy, as measured by the WORD, was negatively associated with spelling errors for the SLI group, confirming the conventional link between reading and spelling (Caravolas, Hulme, & Snowling, 2001).

There were a number of interrelationships between the writing measures for both the LA- and CA-matched peers. For the CA group, there was a trend for content to be related to the total amount of words written. For the LA group, both fluency and content were related to the amount of written text, revealing that the more written text the children produced, the higher their score on the Content scale. For the children with SLI, no associations were evident either between the writing measures or between reading and writing. Such a pattern of results suggests that there are other specific elements of the writing task that are influencing performance for these children. This potential disparity in performance is evident when we consider the nature of the children's written errors.

Nature of Written Errors Produced by the SLI Group

The only statistically significant difference between the children with SLI and their LA-matched peers was on the measure of syntax. The Syntax scale was divided between whole-word and word-ending errors, and further divided among addition, omission, and substitution errors. Both the SLI and the LA group produced more whole-word addition errors than the CA group. The majority of these addition errors were of the conjunctive *and*, which reflects developmental patterns in writing described by Perera (1984). She has shown how connectives such as *and* are used repeatedly to outline a chronological sequence and to keep the discourse moving forward by young writers. Perera has argued that as children mature linguistically, their dependence on coordination decreases, and the results of the current study corroborate these findings in a group of children with SLI.

The omission of whole words was an area that the SLI group produced more errors than both the CA group and, at a statistically significant level, the LA group, but there was no statistically significant difference between the LA and CA groups. This finding indicates that as in oral language, the omission of whole words within writing is a specific difficulty for children with SLI. Many of the whole-word omission errors produced by the SLI group were auxiliary verbs, particularly the auxiliary *be*. Research has revealed that for children with SLI, verb usage within their spoken language is particularly problematic (Fletcher & Peters, 1984; Watkins, Rice, & Moltz, 1993), and recently, studies have focused on the omission of auxiliary forms of *be* (Grela & Leonard, 2000). The results of this writing analysis indicate that difficulties in auxiliary verbs are perpetuated in the children's written language. However, the children also omitted prepositions and pronouns, indicating that errors are not specific to verbs and mirroring difficulties found in the oral language of some children with SLI (Plaza & le Normand, 1996).

Errors for the children with SLI were not restricted to whole words. The findings also demonstrate difficulties with inflectional morphology. Within the Syntax scale, the additions, omissions, and substitutions of word endings were evaluated. It was again revealed that the only measure that differentiated the children with SLI from their CA- and LA-matched peers was that of omission of word endings. No difference was revealed between the CA and LA groups on this measure. The SLI group made more omissions of progressive inflection *-ing,* third-person singular, regular plural *-s* errors, and omissions of past tense *-ed*.

To what extent can the children's difficulties with inflectional morphology be explained by spelling difficulties? Children with SLI produced proportionately more inaccurate phonological and orthographic sequences than their LA- and CA-matched peers, thus demonstrating a marked vulnerability with spelling that could not be accounted for by LA or reading age alone. Current models of spelling highlight the role of phonology in both phonological (Bruck & Waters, 1988) and orthographic (Treiman & Cassar, 1996) contributions to accurate spelling. The children's difficulties may stem from an underlying phonological deficit (Fowler & Liberman, 1995). Inflectional morphemes would be particularly affected because of their low perceptual salience. Studies of children's spelling have shown that they fail to represent the second and third consonants of a cluster if they are not salient (Treiman, 1993). This could account for the omissions of third-person singular *-s* produced by the SLI group. However, this would not account for the omissions of the progressive *-ing* produced by the SLI group. Morphological factors in spelling may also contribute to the difficulties experienced with inflected forms (Hauerwas & Walker, 2003; Nunes, Byrant, & Bindman, 1997; Treiman & Cassar, 1996). Thus, deficits in both phonological and morphological awareness may contribute to omissions of inflectional morphology in the written language of children with SLI. This explanation would be consistent with recent research suggesting that children use phonological, morphological, and orthographic strategies when engaged in spelling (Treiman & Bourassa, 2000). However, the current study does not identify the specific causal mechanism for these spelling patterns. Although the negative correlation between word reading and spelling accuracy does highlight the importance of accurate reading decoding and spelling for the SLI group, it is unclear whether this association is best explained by phonological awareness or orthographic familiarity. There is a need to investigate the writing of children across a range of contexts that can elucidate the relationship among spelling, reading, written syntax errors, and aspects of oral language difficulty.

The range of errors produced by the children is not easily explained by any single theory of linguistic deficit

of SLI. Children's errors were not restricted to obligatory tense marking or omissions of the copula and auxiliary, as would be predicted by the extended optional infinitive theory proposed by Rice et al. (1995). In contrast, errors in inflections were evident, in equal proportions, for nouns and verbs. Specifically the progressive *-ing* and the plural *-s* morpheme were absent in the children's writing. It has been argued that both are relatively unaffected in the children's oral language (Bishop, 1994; Rice & Wexler, 1996). Thus, while the omission of word-ending errors in this sample is consistent with reports stating that children with SLI also have difficulty with both noun and verb morphology in their spoken language (Conti-Ramsden & Windfuhr, 2002; Leonard, McGregor, & Allen, 1992) and recently in written narratives (Windsor et al., 2000), explanations based on oral language deficits alone cannot explain the children's written language problems. In addition, omissions of prepositions, pronouns, and conjunctions point to limitations with processing that may reflect differential attention and difficulties with revision skills. These skills may be particularly vulnerable when core transcription skills are not automatic and spelling is compromised. Thus, the results of the present small-scale study suggest that children with SLI are vulnerable to a range of limitations that affect their written language, which are not confined to delays with tense markers and are important in text generation. These difficulties with written grammar and morphology separate their performance from both CA-matched and LA-matched peers.

Limitations and Future Research

The results of the current study indicate that children with SLI have specific deficits in written language in comparison with CA- and LA-matched peers. The nature of the error patterns suggests that children with SLI experience specific problems with productivity, syntax, and spelling but not content. In addition, the use of verbs was compromised, but omissions of plural inflections and other word forms were also evident. Children with SLI have the ability to produce imaginative stories, but not the linguistic and cognitive resources to translate their ideas into written language. The data also suggest that the children's reviewing skills are reduced, possibly as a result of limited processing resources.

These conclusions need to be considered in conjunction with the methods used in the current study and the level at which the difficulties experienced by the children with SLI were described. The results need to be replicated on a larger sample of children where there is a greater likelihood to detect differences and to provide information about patterns within the different groups. A sequence of pictures may elicit a response that is more cohesive and goal directed than a single visual prompt (Hooper et al., 1994). The content of the children's written narratives, but not their spelling and grammar (Cole & McLeod, 1999), may have been limited by the stimuli. The reduced fluency of the children with SLI may further differentially affect tasks requiring a more cohesive and goal-directed written piece, with potentially further detrimental effects on grammar and spelling.

Children with SLI are a heterogeneous group of children, and further work should consider both the ways in which specific linguistic deficits affect the production of written text and different assessments of their specific written difficulties. For example, to what extent then do children who have difficulties with morphology and argument structure in oral language (King & Fletcher, 1993; Thordardottir & Ellis Weismer, 2002) differ from children whose deficits are specific to vocabulary or phonology? A more fine-grained analysis of the children's oral language difficulties should be complemented by a similar analysis of the children's written language. Confirmation of the deficits and the ways in which they manifest themselves across a range of writing tasks would further our understanding of SLI and the writing process more generally. Moreover, such data could inform clinical practice and educational interventions.

The current study extends previous work with students with LLD in implicating oral language problems as a risk factor in producing written text for children with SLI. These children did not have specific problems in generating ideas. They did, however, have marked difficulties in the grammar of writing. The nature of their errors was different from that of their CA- and LA-matched peers, indicating a specific vulnerability with inflectional morphology and producing grammatical sentences. This raises questions for further research examining the links between oral language and writing.

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Appendix A. Extract of Bus Story transcripts for all three groups.

Group With Specific Language Impairment

Once upon a time there was a naughty bus
and he broke down
and the driver fixed him
but he ran away
on the way he met a train
and he was very angry
he was trying to beat him
but he went through the tunnel and on to the town
He was going to try to run over people
and they just quickly ran out of the way
he was still on the road

Chronological-Age-Matched Group

Once upon a time there was a bus driver
he was trying to mend it but the bus ran away
on the way he met a train they are all racing and making funny faces at each other
the train was a bit of a person who never liked losing so he went under the tunnel
the bus went into town
the bus was in the city
and the policeman blew his whistle and said stop
he ran people over

Language-Age-Matched Group

Once upon a time there was a naughty bus
the naughty bus ran away
and then he meets a train
and they make funny faces
and then the train went into a tunnel
and the bus felt all alone
he met a policeman
and the policeman blew his whistle and is shouting "stop, stop"

Appendix B. Sample of writing pieces from the three groups for matched participants.

Group With Specific Language Impairments

The boy play where his toy
The boy is sitting on table
The boy is 5 years old
The boy is play where old toy
The boy like football

Chronological-Age-Matched Group

There is a boy in this picture and he is making a movie with his toys. He is concentrating hard and careful. He is living in a very old house long ago with toys on the table. He seems to be very quiet and must be talking in his head. It looks as though that he is interested in making up movies, with his toys. The boy looks very young and does not have a school to work in, however, he does have books on the shelf beside him. He looks very sad and seems lonely because he looks like he does not have any friends.

Language-Age-Matched Group

One day a boy was playing with his toys and he had a ghost friend and the ghost friend was called Bob and the boy was called Jamie and they lived together in a big house with 6 bedrooms and they can almost fit a dozen cow in it. One day the boy went to bed a dreamed that he had a dozen cows. He went down to the kitchen and in the kitchen there was a dozen cows.