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Complex Syntax Production in Informational Writing by Students With Language Impairment From Diverse Linguistic Backgrounds

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The primary objective of this study was to compare the syntactic complexity of informational texts produced by fifth-grade students (a) with and without language impairment and (b) with and without native English-speaking proficiency on a curriculum-based reading and writing task. Expository writing samples produced by 114 children enrolled in the fifth grade were analyzed at the utterance level for five features of complex syntax, including the frequency of utterances containing complex syntax and specific clause types (conjoined, subordinate, relative, full complement). For each of the four groups, we report frequency counts, means, standard deviations, and ranges of performance across the five syntax measures. Multivariate analysis of variance revealed there were significant group differences on measures. Specifically, children with typical language development, regardless of English proficiency level, wrote more words, utterances, and different word roots than their peers with language impairment. When productivity (i.e., text length) in the writing samples was controlled, multivariate analysis of variance revealed there was a significant difference between groups in use of relative clauses, but not for the use of conjoined, subordinate, or full complement clauses. In particular, English proficient students with language impairment produced a greater proportion of utterances with relative clauses. A post hoc correlation analysis showed moderate, positive correlations among writing cohesion and variables of complex syntax. We consider multiple implications for clinical practice and further research. **Key words:** *complex syntax*, *English proficiency*, *language impairment*, *language sampling*, *writing*

INFORMATIONAL discourse is important in school as a means of acquiring and expressing academic knowledge. It involves the use of explanations, examples, and evidence to support the information being presented, and follows a coherent sequence of ideas to facilitate understanding. Children's knowledge of complex syntactic forms helps them comprehend and produce informational discourse. Sentences that incorporate two or more clauses are considered to

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reflect complex syntax. Previous research has established that levels of syntactic complexity in children's reading and writing experiences vary with discourse genre, grade level, and writing task (e.g., Hall-Mills & Apel, 2015; Puranik et al., 2008). There are also differences in the syntactic complexity of written language produced by children with language impairment (LI), many of whom produce shorter utterances with fewer subordinate clauses compared with their peers with typical language development (Hall-Mills & Apel, 2013; Nippold et al., 2009; Puranik et al., 2007). For students with LI, difficulty acquiring complex syntax necessary to navigate informational text undermines their attainment of grade-level standards for reading comprehension and writing. Additionally, children who are English language learners (ELLs) with limited English proficiency (LEP) can struggle with some of the same early-developing English grammatical forms as do proficient English speakers who have LI (Bedore et al., 2018).

Researchers have noted that syntactic complexity is an important construct in writing, and students who are more proficient writers are more likely to construct complex sentences compared with peers with less proficient writing skill (Jagaiah et al., 2020). Researchers in the past have primarily examined utterance-level complexity (e.g., mean length of utterance, mean length of T-unit, and clause density), whereas very few have examined clause types specifically. Additional analyses of complex syntax in children's informational writing may inform us about the range of performance between subgroups and help clinicians determine children's educational needs.

ROLE OF COMPLEX SYNTAX IN INFORMATIONAL DISCOURSE

Informational or expository texts are the main source of material used in the later grades (Snyder & Caccamise, 2010). Complex syntactic forms are important for children in later grades to comprehend and produce informational text. For example, the English language arts standards (from the Common Core State Standards [CCSS], 2010) require students in the fifth grade to "explain the relationships or interactions between two or more ... ideas or concepts" in informational text and engage their knowledge of text structure to compare two or more informative text types. Prior analyses of science texts read by fifth-grade students indicate there is frequent occurrence of complex sentences, including complement, adverbial, and relative clauses, throughout the texts (Curran, 2020) that help connect and elaborate multiple ideas or concepts. Furthermore, the standards call for students in the fifth grade to "write informative/explanatory texts to examine a topic and convey ideas and information clearly" (CCSS, 2010). Writers must incorporate a variety of complex syntactic forms to "link ideas within and across categories of information using words, phrases, and clauses." Clauses are specifically mentioned in the writing standards as a unit that conveys important information in the informative genre. Subordinate clauses seem particularly important in this genre. As Nippold et al. (2009) noted, subordinate clauses allow the writer to express a variety of ideas, including those that are increasingly abstract. Varied types of subordinate clauses serve different communicative functions, including the expression of beliefs or feelings (nominal or object complement clauses with metacognitive or metalinguistic verbs), concepts of time, purpose, or conditions (adverbial clauses), or a description of the object or subject of a sentence (relative clauses).

Balthazar and Scott (2018) and Scott and Balthazar (2010) explain how children in later grades must be able to unravel a variety of grammatical rules and uses of logical, temporal, and elaborative relationships between main and subordinate clauses while reading, and to produce multiclause utterances incorporating many of the same relationships among clauses in their own writing. Over time, children use a variety of verbs to introduce complement clauses

and a range of subordinating clauses in their writing (Berman & Nir-Sagiv, 2007; Berman & Verhoeven, 2002). Furthermore, production of complex syntax is a predictor of writing quality (Beers & Nagy, 2009, 2011; Crowhurst, 1983). It is expected that writers in later grades will produce sentences with varied sentence structure, complexity, and length while adhering to rules for grammatical accuracy to express their ideas on a topic (Lundine, 2020). Proficient writers arrange words within clauses to produce a coherent thought that is easier for the reader to understand. Across the written product, the range of simple, compound, and complex sentences convey different levels of information and emphasize key relationships among bits of information, concepts, and ideas. On the other hand, poorly constructed sentences can make writing difficult to understand and can cause confusion for the reader or lead the reader to question the writer's understanding of the content expressed, resulting in lower quality ratings.

SYNTACTIC DEFICITS IN CHILDREN WITH LI

Children encounter high cognitive demands during the writing process. Writers must adhere to the genre-specific organizational and structural expectations for communicating ideas (i.e., macrostructure) while attending to the semantic and syntactic demands of the language (i.e., microstructure). Because many children with LI have problems with grammatical aspects of language, they are at a greater risk of difficulty in acquiring the complex syntax necessary at the sentence and discourse levels for written language comprehension and formulation (Leonard, 2014; Marinellie, 2004). Compared with peers without LI, children with LI may make more grammatical errors or use structures limited in variety and complexity (Nippold et al., 2009).

Current theories suggest that the coordination of multiple linguistic skills for writing can be difficult for children with LI due to deficiencies in underlying processes, including syntactic skills (Berninger et al., 2009). Working memory allows a writer to keep track of multiple words, clauses, and content elements while constructing a sentence, and deficits in verbal learning and memory have been documented among children with LI (Archibald, 2018). Deficits in verbal working memory offer a plausible explanation for why children with LI often generate text with simpler sentence structures and have difficulty with more advanced clause types (e.g., subordinate clauses and relative clauses) than their peers.

COMPLEX SYNTAX DEVELOPMENT FOR ENGLISH LANGUAGE LEARNERS

Writing skills among ELLs remain understudied. The lack of linguistically diverse subgroups has contributed to a gap in our knowledge of complex syntax use in informational writing produced by English learners. English learners without LI can struggle with some of the same early-developing English grammatical forms as monolingual children with LI (Bedore et al., 2018). This aspect of differential diagnosis can be challenging for speech–language pathologists.

In prior writing research, the performance of ELLs with LEP was generally poorer than that of non-ELLs on many writing measures, at least for narrative writing (Silverman et al., 2015). For instance, ELLs with ages ranging between 11 and 14 years tend to produce simpler grammatical structures in expository writing compared with their peers, including a lack of subordinating clauses (Danzak, 2011), and seldom use embedded clauses or causal connectives (Crosson et al., 2012). To date, researchers have established that difficulty with verb tense marking can reliably distinguish bilingual children with LI from their bilingual peers with typical language development (Blom & Paradis, 2015; Jacobson & Schwartz, 2005; Verhoeven et al., 2012). Also, as with non-ELLs, the use of specific clause types can distinguish between ELLs with and without LI. For example,

Gutierrez-Clellan and Simon-Cereijido (2007) administered a broad morphosyntax measure including a sentence repetition task with relative, adverbial, and complement clauses to bilingual children with and without LI. English language learners with LI performed significantly lower in English morphosyntax than their peers, and the measure had good sensitivity and specificity levels to distinguish ELLs with and without LI.

LANGUAGE SAMPLE ANALYSIS OF CONNECTED DISCOURSE

Despite the importance of informational text in intermediate grades, very few standardized norm-referenced language tests include a direct measure of students' expository discourse skills (Lundine, 2020; Scott, 2010). Language sample analysis (LSA) is an ecologically valid assessment tool that can be used to inspect students' language production in connected discourse as it relates to the curriculum (Nippold, 2014). Through LSA, we can examine students' written language samples at the microstructure level for word- and clause-level components of language. Consistent with current models of written language (Hall-Mills & Apel, 2015; Puranik et al., 2008), many of the common measures address aspects of writing productivity (e.g., total number of words, clauses, or utterances), grammatical complexity (e.g., mean length of utterance [MLU], subordination index [SI] or clause density), and lexical diversity (e.g., number of different word roots and frequency counts by word type, type-token ratio [TTR]).

CURRENT STUDY

The purpose of the present study was to determine the use of complex syntax in written informational language samples produced by a culturally and linguistically diverse sample of fifth-grade students. To further investigate the factor of linguistic diversity in students' use of complex syntax, we included two groups (one with typical language development and one with LI) of participants who were classified as English learners with LEP who had a primary home language of Spanish or who were native English speakers. Inclusion of students with LEP helps us add to the literature by establishing a range of expected variability in the complex syntactic forms produced by LEP learners (Bedore et al., 2018).

The writing task was a curriculum-based assessment procedure that required students to write based on a source text read by the students. Specifically, we examined the following research questions:

- What forms of complex syntax are used in the informational writing of fifth-grade students on a curriculum-based task?
- How does the informational writing of students with linguistic diversity compare on a variety of productivity measures?
- How does the informational writing of students with linguistic diversity compare in the use of complex utterances and complex clauses?

METHOD

Participants

Participants in this study included 114 students (69 girls, 45 boys; average age 11 years, 1 month) from 33 schools in a large metropolitan school district in the state of Florida in the United States. The racial–ethnic representation of the sample included 13 White, 33 Black, 65 Hispanic, and three multiracial students. Participants were part of a stratified sample drawn from children who were previously recruited for a larger study examining the effects of word knowledge instruction on students' writing skills (Wood & Schatschneider, 2021). The project was approved by the university's Human Subjects Committee (Study #00000666). Participants were selected and grouped according to school district data. English language learner and LI determinations were established through standardized practices within the educational system. Both designations

are defined in the state board of education rules (LI; Florida Department of Education [FLDOE], 2016) or state statute (ELL; FLDOE, 2009) for student identification. A student who is an ELL has a home language other than English (determined by a home language survey) and for whom assessments indicate below average English listening comprehension, speaking, reading, or writing proficiency compared with peers of the same age and grade level (i.e., LEP). Students who are ELLs are enrolled in the ESOL (English for Speakers of Other Languages) program to receive instruction to develop sufficient skills in speaking, listening, reading, and writing English to become English proficient (FLDOE, 2009). A student who is eligible for special education and related services as a student with LI has a disorder in one or more of the basic learning processes involved in understanding or using spoken or written language, which may manifest in significant difficulties in listening comprehension, oral expression, social interaction, reading, writing, or spelling (FLDOE, 2016). Although it is a team of professionals that determines a student's eligibility for special education due to LI, the required evaluation procedures and eligibility criteria are established in state education rule, thus standardizing the evaluation and eligibility process for students in Florida schools (FLDOE, 2016).

Students with prior enrollment in ESOL services who were no longer considered ELL and had exited ESOL services before the start of the study were excluded from the present sample. In Florida, students may be identified with a primary or secondary exceptionality in LI. Students with a secondary exceptionality of LI, whose primary exceptionality was something other than LI (such as autism), were excluded from the sample. The final sample included 57 students who were native English speakers and 57 students whose primary language at home was Spanish and classified as ELL and receiving ESOL services. The four groups were: (1) English proficient first language speakers with typical language development (EPTD), (2) English proficient first language speakers with language impairment (EPLI), (3) Spanish speakers who were ELLs with typical language development (ELLTD), and (4) Spanish speakers who were ELLs with language impairment (ELLLI; see Table 1 for descriptive information).

At the beginning of the school year, the Florida Assessments for Instruction in Reading-Florida Standards (FAIRFS; Foorman et al., 2015) were administered to students in the fifth grade. The FAIRFS has concurrent validity (r = .67-.74) with the Stanford Achievement Test-10th Edition. The silent reading comprehension subtest was a computer-adaptive standardized assessment administered in computer laboratories by classroom teachers. For this subtest, students read a passage and answered multiple-choice questions. There was no time limit, but the subtest takes an average of 15 min. We used scores from this subtest to characterize the general reading performance of students in our sample. Reading comprehension scores were available for the majority (n = 72), but not all participants in the sample. Students with typical language development who were English proficient (EPTD) demonstrated the highest mean score equivalent to the 37th percentile on reading comprehension (M = 37.71, SD = 29.25; within average range), followed by students in the ELLTD group (M = 19.13, SD = 25.37; within average range). Students with LI demonstrated lower average mean scores than their peers with typical language development (EPLI M = 13.5, SD = 16.92; ELLLI M = 12.39, SD = 16.12; more than one standard deviation below the mean, below average).

Procedure

Participants' handwritten expository writing samples were obtained by English language arts teachers as part of a mandatory curriculum-based assessment in the first 9 weeks of the school year. Participants were instructed to read two English passages (with a Flesch–Kincaid grade level of 6.4) about the benefits of fitness, and then to plan and write an essay in English to explain how

Table 1. Demographic characteristics of the sample

Factor	Total Sample	Typical Language		Language Impairment	
		EPTD	ELLTD	EPLI	ELLLI
Age (year; month)	11; 1	10; 8	11; 1	10; 7	11; 0
Gender					
n	114	30	30	27	27
Male	45	12	15	17	19
Female	69	18	15	10	8
Race					
White	13	9	0	4	0
Black	33	14	0	19	0
Hispanic	65	6	29	3	27
Multiracial	3	1	1	1	0

Note. ELL = English language learner; EP = English proficient; LI = language impairment; TD = typical language development.

fitness can contribute to unexpected outcomes. The first passage contained 405 words and explained the unexpected outcomes of fitness. The second passage contained 589 words and provided information about fitness benefits for two individuals who overcame physical limitations to excel in sports. Teachers allowed up to 120 min for students to work independently on this reading and writing task. The writing samples were collected from the teachers by researchers. Writing samples with 50 or more words were selected for analysis.

Transcription and coding

Undergraduate research assistants majoring in speech–language pathology were trained to transcribe the handwritten writing samples using standard conventions of the Systematic Analysis of Language Transcripts (SALT) software program (Miller et al., 2019). For each writing sample, the research assistants compared the accuracy of typed and paper copies, and there was 98% agreement at the word level on a subset (20%) typed independently by multiple research assistants. Consistent with previous research on written language, utterances were segmented into T-units, which were defined by the main clause with any subordinate clauses (Hall-Mills & Apel, 2015; Koutsoftas & Gray, 2012). Next, each sample was scored for the SI, a standardized measure of clause density (the ratio of total clauses to total T-units), where the total clauses per utterance include both independent and dependent clauses (Brimo & Hall-Mills, 2018). Then each sample was also coded for occurrence of utterances with complex syntax (CS) and the following clause types: conjoined clause (CC), subordinating clause (SC), relative clause (RC), and full propositional complement clause (FPC), using a standardized protocol described elsewhere (see Arndt & Schuele, 2013; Brimo & Hall-Mills, 2018). Utterances with only one main clause were considered to contain simple syntax. In contrast, utterances that included two or more clauses with either two main clauses combined with a coordinate or subordinate conjunction or one clause that was dependent on the other clause were coded as having complex syntax (CS). Given the T-unit segmentation method, a broken utterance code was used to indicate any instances in which two independent clauses (and thus two separate T-units) were conjoined with a coordinate conjunction. Only the T-unit containing the conjunction received the (CC) code. A code summary with definitions and examples is provided in Table 2.

We also analyzed the samples for basic descriptive properties via analytic measures (e.g., productivity measures including total

Table 2. Definitions and examples of syntax codes

Syntax Code	Definition With Example
Complex syntax utterance (CS)	T-unit with two or more clauses (either two main clauses combined with a coordinate or subordinate conjunction or one clause is dependent on the other clause). His coach told[FPC] him to hide in the woods[SI-2][CS].
Conjoined clause (CC)	Two independent clauses are connected by a coordinating conjunction. That is why fitness is important and[CC] how our body can be healthy[SI-3][CS].
Subordinate clause (SC)	A dependent clause with a subject and predicate that requires combination with the main clause to form a complete sentence. He went to get ordinary ski poles because[SC] he wanted more independence[SI-3][CS].
Relative Clause (RC)	A clause that contains the immediate modification of a noun as indicated by a relative marker (includes subject, other, and nominal relative clauses). Try a sport that[RC] will make you happy[SI-2][CS].
Full propositional-complement clause (FPC)	A clausal complement that is a finite-embedded clause acting as a complement for cognitive or mental state verbs. He thought[FPC] that his bamboo pole was too restrictive[SI-2][CS].

words, total utterances, number of different words based on a count of unique word roots, and mean length of T-unit). Once the samples were reliably coded for complex syntax, we analyzed them using the Standard Measures, Code Summary, and Subordination Index reports generated by the SALT program. The values of the descriptive and dependent variables were transferred from the SALT reports to an SPSS data file.

Writing cohesion was measured using Coh-Metrix, an online tool for written language analysis (McNamara et al., 2013). Coh-Metrix has been used and validated in other recent written language analyses (Troia et al., 2019). We measured cohesion to approximate how well the students' papers fit informational writing expectations. Although automated scoring is best when used in conjunction with human scoring for writing quality, it affords an efficient analysis of a large corpus of language sample data as a standalone procedure. Prior to this analysis, the transcribed writing samples were converted to txt (text) files, with all prior coding removed and spelling errors corrected per the Coh-Metrix requirements. Writing samples were then analyzed by Coh-Metrix and scores were extracted for a measure of cohesion called the narrativity index. Although the present study did not focus on written narratives, the narrativity index is broadly considered a measure of discourse-level cohesion based on word familiarity (low- vs. high-frequency words), syntactic simplicity, and overlap across sentences of words and phrases. Low narrativity scores were presumed to reflect better informational cohesion. The scores for our participants are reported as percentile ranks.

Reliability

We calculated interrater reliability for T-unit segmentation, SI codes, and complex syntax codes. Three graduate students were trained to 95% agreement using practice sets prior to coding the samples produced by participants in the present study. The coders were blind to group assignment for participants. A

randomly selected set of 25% of samples from each of the four groups were double coded. Coders were blind to each other's coding of the same sample. The first author reviewed the coding from both coders to calculate the interrater reliability. The interrater reliability had a mean across groups of 95% for T-unit segmentation, 100% for complex utterance coding, and 97% for SI scoring and complex clause coding, with no reliability scores below 90%.

Analysis

An a priori G*power analysis was conducted (Faul et al., 2007) using a large effect size of .40 and a power of 0.8 in line with Cohen's (1992) guidelines. It was determined that a multivariate analysis of variance (MANOVA) with four groups and five dependent variables would require a total sample size of 63. Therefore, the design was sufficiently powered for the analysis. Statistical analyses were performed in SPSS. To address the first research question, we calculated descriptive statistics to describe the range of performance for use of complex syntax in the writing samples across the four groups. For the second question of the study, we examined group performance on analytic measures of writing by conducting a MANOVA. To address the third research question, we conducted a MANOVA to examine group differences for five dependent variables of complex syntax (proportions of utterances with complex syntax and conjoined, subordinate, relative, or full propositional complement clauses). Before performing MANOVA, we confirmed assumptions had been met for the analysis through the following process: (a) we checked univariate and multivariate normality (Mahalanobis distances) and for outliers, (b) scanned scatterplots for linearity, (c) reviewed correlations for evidence of multicollinearity, and (d) used Box's test for homogeneity of variance–covariance matrices.

Because writing productivity was expected to vary between groups, the analytic measures of writing for complex syntax were converted from frequency counts to proportions to control for utterance productivity to address the third research question. For example, the number of utterances with complex syntax was divided by the total number of utterances to determine the proportion of utterances with complex syntax in a writing sample. The effect size index of partial η^2 was interpreted with the following values (Ellis, 2010): .01 (small), .06 (medium), and .14 (large). In a post hoc analysis, we also explored the relationships between writing cohesion, reading comprehension, and complex syntax variables for the full sample and within each group via correlational analyses.

RESULTS

Complex syntax use in informational writing

To address the first research question, we report the frequency counts with means, standard deviations, and ranges of performance for each of the four groups on five measures of complex syntax (see Table 3). The average number of utterances containing complex syntax was 11.21 with a range of 8.67-13.90 across the four groups. Participants used an average of 5.60 conjoined clauses (full sample range of 4.30–6.90). Across the full sample, there was an average of 5.19 subordinate clauses with a range of 3.74–6.77. Participants seldom used relative clauses, with a full sample mean of 1.55 and range of 1.23–1.90. The average number of full propositional complement clauses was 4.31, with a range of 2.96–6.07.

Group differences in written language performance

Our second research question addressed the comparison between groups for standard analytic measures of writing (see Table 3). Across the four groups there were an average of 196.61 total words (range 164.63–243.07), 17.68 total utterances (range 14.82–20.70), 100.97 different words (range 87.44–121.90), and 11.19 for mean length of T-unit (MLTU;

Table 3. Descriptive statistics for dependent measures

Variable	Total Sample ($N = 114$)	Typical Language		Language Impairment	
		EPTD ($n = 30$)	ELLTD ($n = 30$)	EPLI ($n = 27$)	ELLLI ($n = 27$)
Syntax					
# Complex syntax utterances	11.21 (5.37)	13.90 (5.24)	12.53 (5.33)	8.67 (4.32)	9.30 (4.86)
Proportion complex utterances	0.64 (0.17)	0.67 (0.15)	0.66 (0.14)	0.61 (0.20)	0.60 (0.17)
# Conjoined clauses	5.60 (4.37)	6.90 (4.77)	5.97 (3.70)	4.30 (4.15)	5.04 (4.58)
Proportion conjoined clauses	0.31 (0.18)	0.32 (0.17)	0.33 (0.17)	0.27 (0.16)	0.31 (0.18)
# Subordinate clauses	5.19 (3.68)	6.77 (4.02)	5.63 (3.77)	4.41 (2.86)	3.74 (3.28)
Proportion subordinate clauses	0.30 (0.19)	0.33 (0.16)	0.29 (0.16)	0.33 (0.24)	0.25 (0.20)
# Relative clauses	1.55 (1.62)	1.73 (1.51)	1.23 (1.55)	1.90 (1.78)	1.37 (1.64)
Proportion relative clauses[a]	0.09 (0.10)	0.08 (0.07)	0.06 (0.08)	0.15 (0.14)	0.08 (0.09)
# Full propositional complement clauses	4.31 (3.76)	6.07 (4.43)	3.97 (3.03)	2.96 (3.80)	4.07 (3.03)
Proportion full propositional complement clauses	0.64 (0.17)	0.67 (0.15)	0.66 (0.14)	0.61 (0.20)	0.60 (0.17)
General writing performance: Analytic measures					
# Words[a]	196.61 (91.23)	243.07 (96.98)	203.16 (82.73)	164.63 (80.32)	168.70 (83.28)
# T-units[a]	17.68 (7.26)	20.70 (6.35)	19.00 (6.94)	14.82 (7.38)	15.63 (6.98)
# Different words[a]	100.97 (34.81)	121.90 (34.30)	103.49 (30.81)	87.44 (34.87)	88.37 (28.47)
Mean length of utterance	11.19 (2.56)	11.52 (1.91)	10.69 (1.99)	11.67 (3.46)	10.88 (2.67)
Subordinate index (SI)	2.17 (0.53)	2.29 (0.41)	2.12 (0.34)	2.19 (0.79)	2.09 (0.51)
Type-token ratio	0.55 (0.11)	0.53 (0.07)	0.54 (0.11)	0.57 (0.11)	0.58 (0.14)
Writing cohesion					
Coh-Metrix narrativity PR	81.05 (16.15)	84.93 (11.85)	76.56 (18.98)	82.46 (14.18)	79.64 (18.72)

Note. Means and standard deviations for dependent measures of complex syntax. ELL = English language learner; EP = English proficient; LI = language impairment; PR = percentile rank; TD = typical language development.
[a]Statistically significant group differences.

range 10.69–11.67). The mean SI score was similar between the groups, with a sample mean of 2.17 (range 2.09–2.29). Multivariate analysis of variance revealed there was a significant main effect for group (Wilks' $\Lambda = 0.76$, $F_{(21,299.18)} = 1.95$, $p = .01$, partial $\eta^2 = .11$). A significant univariate effect emerged for total words ($F_{(3,110)} = 5.11$, $p = .002$, partial $\eta^2 = .12$), total utterances ($F_{(3,110)} = 4.62$, $p = .004$, partial $\eta^2 = .11$), and the number of different word roots ($F_{(3,110)} = 7.24$, $p < .001$, partial $\eta^2 = .17$). There were no

Table 4. Correlation matrix for writing cohesion and complex syntax measures ($n = 114$)

Variable	1	2	3	4	5	6	7
1. Writing cohesion	–						
2. Reading comprehension	.12	–					
3. Proportion complex utterances	.38**	.05	–				
4. Proportion conjoined clauses	.07	.08	.02	–			
5. Proportion subordinate clauses	.34**	.14	.44**	.09	–		
6. Proportion relative clauses	.10	− .05	.26**	− .04	.00	–	
7. Proportion full propositional complement clauses	.25**	.01	.11	− .05	-.04	.04	–

Note. Writing cohesion measured by the narrativity percentile rank from Coh-Metrix.
**$p < .01$.

significant effects for MLTU ($F_{(3,101)} = 0.99$, $p = .40$, partial $\eta^2 = .03$), TTR ($F_{(3,110)} = 1.23$, $p = .30$, partial $\eta^2 = .03$), or SI ($F_{(3,110)} = 0.87$, $p = .46$, partial $\eta^2 = .02$). Post hoc tests revealed the following significant differences between the groups for the total words, utterances, and number of different word roots. The EPTD group used a similar number of words, utterances, and unique word roots as their ELLTD peers, but more than both LI groups. The EPLI and ELLLI groups performed similarly to each other on the productivity measures (e.g., total words, T-units, different words, MLTU, TTR, and SI).

To determine whether group differences existed in the use of complex syntax (i.e., the third research question), we performed a second MANOVA with the five syntactic-dependent variables (complex utterances and four clause types). Proportion scores were entered for the syntax variables (e.g., proportion of utterances with complex syntax vs. number of utterances with complex syntax) to control for sample length. There was a significant main effect for group (Wilks' $\Lambda = 0.77$, $F_{(15,293.02)} = 1.88$, $p = .02$, partial $\eta^2 = .08$). A significant univariate effect emerged for utterances with RC ($F_{(3,110)} = 4.02$, $p = .009$, partial $\eta^2 = .10$). There were no significant effects for utterances with complex syntax ($F_{(3,110)} = 1.13$, $p = .34$, partial $\eta^2 = .03$), CC ($F_{(3,110)} = 0.53$, $p = .66$, partial $\eta^2 = .01$), SC ($F_{(3,110)} = 0.94$, $p = .42$, partial $\eta^2 = .03$), or FPC ($F_{(3,110)} = 2.42$, $p = .07$, partial $\eta^2 = .06$). Post hoc tests revealed significant differences between groups for the proportion of utterances with RC. Participants in the EPTD group produced a similar proportion of utterances with RC as participants in the ELLTD and ELLLI groups. The EPLI group produced the largest proportion of utterances with RCs, with mean differences of 0.06 (EPTD), 0.08 (ELLTD), and 0.07 (ELLLI).

In a post hoc analysis, we explored the relationships between reading and writing variables via a multiple correlation analysis. Table 4 includes the correlation matrix for the full sample and includes correlations for writing cohesion, reading comprehension, and the complex syntax variables. Writing cohesion had a moderate positive correlation with the proportion of complex utterances ($r = .38$, $p < .001$), the proportion of subordinate clauses ($r = .34$, $p < .001$), and the proportion of full propositional complement clauses ($r = .25$, $p < .001$). Writing cohesion did not significantly correlate with the proportion of conjoined clauses ($r = .07$, $p = .48$) or proportion of relative clauses ($r = .10$, $p = .32$). The FAIRFS reading comprehension score was not significantly correlated with any other variables.

The correlation matrix for each subgroup includes the same comparisons minus the

Table 5. Correlation matrices by group for writing cohesion and complex syntax measures

Variable	1	2	3	4	5	6
EPTD group						
1. Writing cohesion	–					
2. Proportion complex utterances	.65**	–				
3. Proportion conjoined clauses	.40*	.36*	–			
4. Proportion subordinate clauses	.32*	.48**	.15	–		
5. Proportion relative clauses	-.15	.07	− .02	.40*	–	
6. Proportion full propositional complement clauses	.31	.16	− .14	.10	.18	–
EPLI group						
1. Writing cohesion	–					
2. Proportion complex utterances	.39*	–				
3. Proportion conjoined clauses	.07	− .09	–			
4. Proportion subordinate clauses	.54**	.55**	− .08	–		
5. Proportion relative clauses	.36	.66**	− .25	.55**	–	
6. Proportion full propositional complement clauses	.31	.23	− .10	.10	.07	–
ELLTD group						
1. Writing cohesion	–					
2. Proportion complex utterances	.01	–				
3. Proportion conjoined clauses	.02	− .10	–			
4. Proportion subordinate clauses	.01	.17	.21	–		
5. Proportion relative clauses	.08	.01	− .06	.25	–	
6. Proportion full propositional complement clauses	.14	.16	.09	.04	.28	–
ELLLI group						
1. Writing cohesion	–					
2. Proportion complex utterances	.43*	–				
3. Proportion conjoined clauses	− .11	− .11	–			
4. Proportion subordinate clauses	.41*	.48*	.13	–		
5. Proportion relative clauses	− .03	.09	.32	.03	–	
6. Proportion full propositional complement clauses	.15	− .13	− .12	− .35	− .05	–

Note. Writing cohesion measured by the narrativity percentile rank from Coh-Metrix. ELLLI = English language learner, language impairment; ELLTD = English language learner, typical development; EPLI = English proficient, language impairment; EPTD = English proficient, typical development.
*$p < .05$; **$p < .01$.

reading comprehension scores (as reading comprehension scores were not available for a significant portion of the English learner groups; see Table 5). As with the correlation analysis for the full sample, writing cohesion had moderate positive correlations with the proportion of complex utterances for the EPTD, EPLI, and ELLLI groups. Writing cohesion related significantly to the proportion of subordinate clauses for both LI groups: EPLI ($r = .54, p = .005$); ELLLI ($r = .41, p < .05$), and the EPTD group ($r = .32, p = .04$). Additionally, writing cohesion correlated with the proportion of conjoined clauses for the EPTD group ($r = .40, p = .03$). Writing cohesion did not correlate significantly with any variables within the ELLTD group.

DISCUSSION

The purpose of the present study was to determine the use of complex syntax in written

informational papers produced by a culturally and linguistically diverse sample of fifth-grade students using a curriculum-based assessment procedure, and to compare the performance of participants in the English language proficiency and exceptionality status groups. The results reveal several key findings. This study contributes normative data that can help practitioners working with linguistically diverse children with LI in the later grades. Descriptive statistics indicated that the writers in this sample produced all four of the clause types we examined (e.g., conjoined, subordinate, relative, and full propositional complement). Relative clauses were used least frequently. There were significant group differences in standard analytic measures of writing, favoring the typical language development (TD) groups, who wrote more words, utterances, and word roots than their peers with LI. Language impairment status, but not LEP status, influenced the overall productivity levels of students' informational writing. Finally, once we held constant productivity levels, the analyses indicated that there were significant differences among groups for use of relative clauses but not for the other clause types. There was a marginal difference in the proportion of utterances with RCs produced by the EPLI group compared with the other groups (6%–8% more utterances with RCs). Across the full sample, participants rarely incorporated RCs in their informative writing; all participant groups produced an average number of 1.23 to 1.90 RCs in their entire writing samples. There were no significant differences in productivity measures between the EPLI and ELLLI groups. However, the mean number of words and utterances was the lowest for the EPLI group. When the number of RCs was divided by the number of utterances, the proportion of RCs for the EPLI group was higher than for the other groups. In this instance, the increased proportion of RCs is not equivalent to more diverse syntax. Writing samples elicited from the EPLI group contained more RCs across fewer utterances than the other groups, resulting in more redundant sentence structure throughout.

There are at least two clinically relevant findings about RCs. The first clinical implication is that fifth-grade students who vary in English proficiency and language performance may be underutilizing RCs in their informational writing and would benefit from explicit instruction focused on this clause type. The second clinical implication here is that an increase in the number of RCs used in and of itself is not necessarily the goal of instruction or intervention. Proficient writers can incorporate a range of complex clause types without resorting to a redundant sentence pattern across a text.

Comparisons to previous studies

Although our study was exploratory in nature, there are a few prior studies with which we can draw comparisons with the present findings. First, our results align with previous findings that indicate there is a gap in written language productivity for children with LI compared with their peers without disabilities (Koutsoftas & Gray, 2012; Puranik et al., 2007). Regarding analytic measures of language production, children with LI with or without LEP in this study produced fewer words, utterances, and word roots than their peers during an informational writing task. This is consistent with previous research (Koutsoftas & Gray, 2012). We also documented that children without LI, regardless of their English proficiency, had similar levels of writing productivity.

Second, the lack of significant group differences in the use of FPCs aligns with other findings of no significant differences in the use of FPCs among school-age children with and without developmental language disorder (Marinellie, 2004; Owen Van Horne & Lin, 2011). Writers may use FPCs to enhance the level of detail or nuance to information. For example, FPCs may be used to elaborate on a specific idea or point ("I thought this way because . . . "), express an opinion or attitude ("I believe fitness is good for you."), or describe an action in greater detail (e.g., "He decided to try skiing instead of running."). Because FPCs necessitate the use of cognitive state verbs (e.g., metaverbs such as think,

say, know, and want), the lack of FPC use by our participants may reflect limitations in metaverb knowledge rather than lack of knowledge of clause structure. Children in our sample rarely used FPCs in their informational writing, suggesting that additional instruction to build knowledge and use of cognitive state verbs within FPCs would be appropriate.

Third, our participants in the EPTD group produced an average of two RCs (also reported as 18% of the total utterances) in the informational writing task, which contrasts with the findings of Nippold et al. (2005), whose 11-year-old participants with typical language included RCs in 12% of their written utterances in a persuasive writing task. In both studies, relative clauses were similarly defined, coded, and calculated as a function of frequency across utterances, and the utterances were segmented as T-units. However, caution is warranted when comparing results generated through dissimilar writing tasks across genres (i.e., informational vs. persuasive), as the differences in the rate of RC use may be due in part to variations in the writing task and text structure. Nippold and colleagues provided their participants a set of black and white photographs of animals participating in a circus and an introductory paragraph that modeled the persuasive text structure by stating three opposing views in a controversy regarding animals in the circus. Participants were then instructed to write an essay addressing their own view of the controversy with reasons to support their opinions within a 20-min time limit. Our informational writing task instructed participants to first read two passages on the topic of fitness and write in response to a prompt related to the content of the passages. Our task paired reading with writing, and our participants had more time to write. The additional writing time likely accounts for the greater productivity levels in our participants' writing compared with Nippold's participants (e.g., total words = 243 vs. 146; total utterances = 20 vs. 13 for our EPTD group vs. Nippold's TD group).

Fourth, the finding of moderate, positive correlations of the narrativity score with some of the grammar variables (proportion of complex utterances, subordinate clauses, and conjoined clauses) supports the role of syntax in establishing text cohesion. The narrativity score is based in part on syntactic simplicity and overlap of words and phrases across sentences. This finding aligns with prior research that indicates there is a predictive relationship between the production of complex syntax and writing quality (Beers & Nagy, 2009, 2011).

Another caveat to the comparison between studies is the use of raw frequency counts versus proportions of clause types. Because we found group differences in writing productivity measures, we converted the raw counts of clause types to the proportion of occurrences of each clause type across the total number of utterances in the sample. In this way, we controlled the overall sample length and the productivity factor to examine the use of complex syntax more specifically. Not all researchers control for sample length and language productivity, suggesting that comparisons between studies can be inaccurate. This poses a difficulty in efforts to establish a criterion reference for complex syntax production in informational writing. Therefore, more research should account for differences in methods and control for sample length and other productivity factors.

Limitations and future considerations

Some limitations should be noted. First, we did not have data to determine the relative severity of LI for individual participants. All participants in the EPLI and ELLLI groups were students with active Individualized Education Programs for LI, indicating that they needed special education to access and make progress in the general education curriculum where the writing tasks took place. It would be worthwhile to examine whether and to what extent the severity of LI affects the use of complex syntax in academic writing tasks. Second, we obtained one written sample per child, and thus cannot be

certain that writers who could produce a greater variety of complex clauses were able to do so with the task at hand. Eliciting multiple written samples per student would allow researchers to examine the consistency of complex syntax use. Moreover, there are limitations in comparing the results from studies that employ different tasks to elicit written language and utilize different measures of syntactic complexity. The writing task used in the present study was directly rooted in curriculum-based content and provided a curriculum-relevant assessment task, and we utilized standard analytic measures of complex syntax. Given the range of syntactic complexity measures (Jagaiah et al., 2020) and variations in elicitation methods, additional research is warranted to compare the complex syntax generated by writers across different elicitation and analysis methods.

Another limitation was that we did not measure students' comprehension of the reading passages used in the reading–writing task. Students with LI have a higher risk of difficulty with reading comprehension (Catts et al., 2006), and informational text writing relies on reading skills (Hebert et al., 2018). Thus, it is possible that students with better passage comprehension are more likely to produce more complex written responses. We did, however, have reading comprehension scores from a standardized measure of reading for some, but not all, of the participants. The reading comprehension scores from the FAIRFS were included in the correlation analysis to explore the relationships between reading and writing variables, and reading scores were unrelated to other measures in this sample, thus making it less likely that reading was a major factor influencing performance. However, further studies are needed to expand on this issue. Finally, we had limited information regarding the prior language and learning experiences of participants who were ELLs. Researchers who wish to explore the influence of prior linguistic experiences on children's writing would want to gather additional data, such as information on the English learners' exposure to written Spanish, location of prior education, date of entry for ESOL services, and type of writing instruction received.

CONCLUSION

This study has documented the use of complex clauses in the informational writing of fifth-grade children with and without language impairment and different levels of English proficiency. Comparisons of complex syntax production between the four groups of participants and for specific clause types are novel aspects of this study. The findings contribute to our current knowledge of the language functioning of school-age children to complete curriculum-relevant writing tasks. Additional work may yield further answers on how syntactic complexity varies between subgroups and writing tasks, which would inform us about the expected range of performance and help us better determine and meet children's educational needs.

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