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Linguistic Predictors of Single-Word Spelling in First-Grade Students With Speech and/or Language Impairments

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Abstract

The purpose of this study was (a) to compare the single-word spelling performance of first graders across four groups that varied by speech and language status; and (b) to determine the linguistic predictors of first-grade spelling for children with speech and/or language impairment compared to children with typical development. First-grade children ($N = 529$) completed measures of spelling, early word reading, expressive vocabulary, phonological awareness, and morphosyntactic knowledge. Children with language impairment, with or without speech impairments, demonstrated lower spelling performance than children with typical development; children with speech impairment only did not differ from children with typical development. In addition, early word reading and phonological awareness predicted spelling performance, regardless of group. Study findings indicate that language status, but not speech status, is a risk factor for low spelling performance in first grade, and that first-grade spelling instruction should focus on developing early word reading and phonological awareness.

Keywords

written language, literacy, language disorders, communication disorders, exceptionalities

With the recent adoption of the Common Core State Standards (CCSS; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010), many states are experiencing increased accountability for their students' writing outcomes. The CCSS focus heavily on writing skills and this focus begins in kindergarten. As early as first grade (the grade of interest in the present study), students are expected to independently write narratives, informative texts, and opinion pieces, as well as use conventional spellings for words that have common spelling patterns and high-frequency irregular words (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). Despite this increased focus on writing instruction, however, writing outcomes for students in the United States are generally low, with only 32% of eighth graders with typical development scoring at a proficient or higher level (National Center for Education Statistics [NCES], 2012). Writing outcomes of children with disabilities are substantially worse; only 5% of these students scored at a proficient or higher level. One vital component of writing is transcription, or spelling skills (Flower & Hayes, 1981). The current work is focused on the spelling skills of the second largest group of children served as students with disabilities in the U.S. public schools: children with speech and/or language impairment (LI).

Our Theoretical Approach to Writing

The Simple View of Writing (Berninger et al., 2002; Juel, 1988) and the Cognitive Process Model of Writing (Flower & Hayes, 1981) inform our theoretical approach in this study. Each of these theoretical approaches includes a strong role for spelling in the writing process. According to the Simple View of Writing, written expression is the product of transcription and ideation (Berninger et al., 2002; Juel, 1988). That is, effective written expression depends on the writer's ability to use correct spelling and written conventions in addition to his or her ability to use language to

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convey thoughts and ideas (Kim et al., 2017). The Flower and Hayes (1981) cognitive process model of written expression echoes this view. In the Flower and Hayes model, translation skills, which include spelling, comprise one important component of writing ability.

For elementary school students in particular, Abbott and Berninger (1993) argued that transcription is the central component of writing. Indeed, spelling is an important contributor to elementary school students' writing ability. In the elementary grades, transcription skills account for 25% of the variance in compositional quality and 66% of the variance in compositional fluency (Berninger, 1999), and spelling appears to be the most likely constraint on compositional quality in early elementary school (Berninger et al., 2002). The relation between spelling and writing ability is observable as early as kindergarten (Kim et al., 2011). Therefore, the current work is focused on spelling.

Our Theoretical Approach to Spelling

Specific to spelling, the present investigation was motivated by a linguistic repertoire theoretical approach to spelling acquisition (Apel et al., 2004). The linguistic repertoire theory posits that children are able to draw from multiple areas of linguistic knowledge—for example, phonological awareness, orthographic knowledge, semantic knowledge, and morphosyntactic knowledge[1]—across the entire spelling acquisition period. According to the linguistic repertoire theory, spelling any particular word involves an individual child drawing from his or her linguistic knowledge to spell that word. Two factors influence the area(s) of linguistic knowledge that the child draws upon: (a) the child's level of linguistic knowledge in that particular area and (b) the linguistic structure of the target word.

One linguistic skill that has long been considered an important underlying factor for spelling skill in children is phonological awareness, the ability to analyze the sounds of spoken language (Mattingly, 1972). Children must be able to analyze the phonemes that make up words before they are able to match graphemes to a word's component phonemes. Even before formal spelling instruction, young children demonstrate the ability to analyze sounds in words and this analysis is represented in their spelling attempts (e.g., Read, 1971). One example of this representation of sound structure in early spelling attempts can be seen in preschool attempts to spell initial consonant blends with voiceless consonants. These young children are more likely to used voiced consonants in initial spelling attempts (e.g., *sdop* for stop), based on sound structure rather than conventional spelling (Hannam et al., 2006).

Another linguistic skill that has received attention as a precursor of spelling skill is orthographic pattern knowledge. Orthographic pattern knowledge involves knowledge of language-specific rules for representing spoken language in text and includes alphabet knowledge and knowledge of orthographic constraints (Apel, 2011). Alphabet knowledge includes knowledge of letter names and letter sounds, and knowledge of orthographic constraints includes knowledge of spelling patterns, for example, that double consonants can occur at the end but not beginning of words. Unsurprisingly, orthographic pattern knowledge is a very strong predictor of young children's spelling ability (e.g., Schwartz & Doehring, 1977). In this article, we use the term orthographic knowledge to refer to prereading knowledge of letter–sound relations. As orthographic pattern knowledge is also a precursor to early reading skills, and first graders have skills that bridge these two developmental skills within orthographic knowledge, the combined orthographic knowledge/early word reading to indicate a combination of letter–sound relation and decoding of words.

Semantic knowledge is an additional linguistic skill that has potential influence on young children's spelling abilities. Semantic knowledge includes the number of words in a child's lexicon, as well as the child's ability to learn new words. The findings on the relation of semantic knowledge and young children's spelling have been mixed. Even within the same research group, some studies have found that semantic knowledge predicts spelling (e.g., Apel et al., 2012), whereas others have not found a predictive relation (e.g., Apel & Lawrence, 2011).

A fourth linguistic skill that has been implicated in spelling is morphosyntactic knowledge. Morphosyntactic knowledge is the understanding of the morphological structure of words, particularly inflectional and derivational structure. Much research has reported that knowledge of morphological and syntactic features influences young children's spelling abilities (Apel et al., 2012; Treiman et al., 1994). One example of this representation of morphosyntactic structure in early spelling attempts can be seen in elementary school children's attempts to spell words with flaps. In words with flaps that contain two morphemes (e.g., *dirty*), children are more likely to correctly represent the flap than in words that contain a flap but only one morpheme (e.g., *city*; Treiman et al., 1994).

Spelling Performance of Children With SI and/or LI

Approximately 1.3 million students in the United States receive special education services under the primary diagnosis of speech impairment (SI) and/or language impairment (LI), making it the second most common category of disability services in the U.S. public education system (U.S. Department of Education, 2017). Students served under this diagnosis category as a whole score lower than children with typical development on measures of single-word spelling (Bishop & Adams, 1990; Catts et al., 1999; Werfel et al., 2019; Young et al., 2002). Similar to writing

performance, the spelling performance of children with LI is consistently lower than that of children with typical development (Bishop & Adams, 1990; Mackie & Dockrell, 2004; Puranik et al., 2014; Silliman et al., 2006; Werfel et al., 2019). Also similar to writing performance, although children with SI as a whole perform more poorly than children with typical development on measures of single-word spelling (e.g., Peterson et al., 2009), this difference appears to be driven by children with co-morbid LI but not isolated SI (e.g., Bishop & Adams, 1990; Lewis et al., 2002; Lewis & Freebairn, 1992). As language, writing, and spelling skills are impaired in the group of students with SI and/or LI, and because spelling skills are a vital component of the writing process, it is important to understand how underlying linguistic knowledge influences spelling in this population.

Multiple Linguistic Predictors of Spelling in Elementary School Children With and Without SI and/or LI

Typical Development

Research has shown the importance of linguistic skills to the spelling performance of elementary school children with typical speech and language skills. Multiple linguistic skills, along with early word reading, have been implicated in spelling acquisition for these children; of interest in the current work is phonological awareness, orthographic knowledge, semantic knowledge, and morphosyntactic knowledge (Al Otaiba et al., 2010; Apel et al., 2012; Nagy et al., 2006; Plaza & Cohen, 2003; Walker & Hauerwas, 2006; Werfel, et al., 2019). Each linguistic factor—orthographic knowledge, phonological awareness, semantic knowledge, and morphosyntactic knowledge—is a significant unique predictor in some studies; however, specific findings have been mixed.

When researchers have explored the concurrent role of multiple linguistic predictors of young children's spellings, findings have been mixed. For example, for children with typical language (TL), Apel et al. (2012) reported that only morphosyntactic knowledge was a predictor of spelling. Similarly, Nagy et al. (2006) reported a significant effect of morphosyntactic knowledge on older children's spellings. However, Walker and Hauerwas (2006) reported that phonological awareness, orthographic pattern knowledge, and morphological knowledge predicted young children's spellings. Similar to Walker and Hauerwas, Al Otaiba et al. (2010) reported that phonological awareness and orthographic pattern knowledge predicted children's spelling. Plaza and Cohen (2003) reported that phonological awareness and morphosyntactic knowledge predicted young children's spellings. For children with LI, Werfel et al. (2019) reported that phonological awareness and orthographic knowledge predicted spelling for children with LI, but morphosyntactic knowledge and orthographic knowledge predicted spelling for children with TL, suggesting that children with LI present with different patterns of performance than children with TL, at least in Grades 2 through 4.

Orthographic knowledge appears to be the strongest and most consistent predictor of spelling for children with TL in the early elementary grades. For example, Abbott and Berninger (1993) reported that orthographic knowledge was directly implicated in spelling and that phonological awareness contributed to spelling indirectly in first grade. In addition, instruction in letter-sound knowledge improves spelling skills for first graders with TL, and increased skill in early word reading results in faster growth in word spelling accuracy (Foorman et al., 1991). Other researchers have reported that morphosyntactic knowledge predicts spelling in first grade even after accounting for children's phonological awareness abilities (Plaza & Cohen, 2003).

Language Impairment

A growing body of research also has demonstrated the importance of linguistic skills to the spelling performance of children with LI. First, children with LI have lower phonological awareness skills compared to children with typical development (e.g., Boudreau & Hedberg, 1999; Joffe, 1998; Kamhi et al., 1985), and Young et al. (2002) and Werfel et al. (2019) have reported that phonological awareness contributes to their spelling proficiency. Second, orthographic knowledge, including both orthographic pattern knowledge and early word reading, may be an area of relative strength for children with LI; for example, Mackie and Dockrell (2004) reported that children with LI and language-matched children did not differ in proportion of orthographically inaccurate spellings, and Catts et al. (2005) reported that children with LI without concomitant dyslexia achieved word reading scores well within the average range. Third, children with LI exhibit semantic deficits in the form of smaller vocabulary size, more difficulty learning new words, and difficulty with lexical access and/or retrieval (McGregor et al., 2002). Research on the relation of semantic knowledge and spelling in children with LI has been mixed. Some researchers have reported that semantic knowledge predicts spelling in this population (van Weerdenburg et al., 2011), whereas other researchers have reported no relation (McCarthy et al., 2012). Finally, research on the relation of morphosyntactic knowledge and spelling in children with LI has been mixed. Some researchers have reported significant contributions of this skill to spelling (e.g., Silliman et al., 2006) but others have found no relation between morphosyntactic knowledge and spelling for children with LI (e.g., Werfel et al., 2019). In terms of reading, syntax skills have been reported as a predictor of children with LI not

having literacy difficulties (Botting et al., 2006). Given that spelling words are most often presented in a syntactic context in spelling assessments (i.e., presented in the context of an example sentence: *dog. The dog barks. dog.*) and that children with LI have deficits in syntax, there is a need to further explore the role of morphosyntactic knowledge in single-word spelling for this population.

Speech Impairment

Much less research has examined the multiple linguistic factors in spelling for children with SI. Apel and Lawrence (2011) reported that single-word spelling was related to phonological awareness, and orthographic knowledge, but not semantic knowledge in children with SI. Likewise, Peterson et al. (2009) reported that phonological awareness but not semantic knowledge predicted spelling in children with SI (orthographic knowledge and morphological knowledge were not studied). As with children with LI, to our knowledge, the relation of syntactic knowledge and spelling in children with SI has not been explored previously.

More research is needed to clarify the role of each linguistic predictor in spelling for children with SI and/or LI. As spelling is dependent on an individual's linguistic knowledge and children with LI experience compromised linguistic knowledge, it is no surprise that they score lower than peers with TL on single-word spelling measures (Bishop & Adams, 1990; Young et al., 2002). Much less, however, is known about the linguistic predictors of spelling for this population. Two studies provide compelling preliminary evidence that the relation of linguistic knowledge and spelling ability may differ for children with LI and children with TL. First, the spellings of elementary school children with LI contained proportionately more phonologically inaccurate and orthographically inaccurate spellings than the spellings of children with TL (Mackie & Dockrell, 2004). In addition, the spelling errors of elementary school children with LI represented diffuse difficulty with linguistic components, with equally distributed phonological, morphological, and orthographic errors, whereas the spellings of children with TL primarily were represented by orthographic errors, with fewer errors in the other categories (Silliman et al., 2006). Such findings lead us to hypothesize that linguistic knowledge may be differentially associated with spelling accuracy across children with LI and children with TL.

Purpose of this Investigation

The purpose of this study was two-fold: first, to compare the single-word spelling performance of first graders across four groups: children with typical speech and language skills, children with SI only, children with LI only, and children with SI and LI; and second, to determine the linguistic predictors of first-grade spelling for children with SI and/or LI compared to children with typical development. As such, our research questions were as follows:

Does single-word spelling performance differ across SI and/or LI status over the first-grade year?

Do linguistic predictors of single-word spelling differ for first graders with and without SI and/or LI?

Method

Participants and Setting

This study was part of a larger examination of two different types of response to intervention (RTI) models conducted in one school district beginning to implement RTI in a mid-size city in the southeast of the United States that was funded by the National Institute of Child Health and Human Development. A total of seven schools were recruited with help from the district office to represent at-risk populations. Six schools served an economically diverse range of students (free and reduced lunch [FARL] participation ranged from 42.8% to 89.9%). One school was a high-performing Blue Ribbon school serving a fairly high socioeconomic neighborhood (only 15.8% of students at the school received FARL). In this district, most students were native English speakers, only a few students were limited English proficient (0.4%–2.8%). A total of 529 first graders participated; of these the school personnel had identified 23 students with SI, 16 with LI, and 11 students had both SI and LI; the remaining 479 were typically developing. Nonverbal intelligence did not differ between groups ($p = .24$; see Table 1). Table 1 contains demographic information for each group.

Larger Study RTI Context and Design

For a more detailed description of the larger study and the effects, see Al Otaiba et al. (2014). Briefly, all first-grade students were randomly assigned within classrooms to either a Typical RTI condition, consistent with district policy in that all students began in Tier 1 for 8 weeks. In the Typical condition, students who did not demonstrate adequate response to instruction (continuing to manifest a deficit in early literacy skills and slow growth for subsequent 8-week intervals) could progress into a more intensive tier of literacy intervention. By contrast, in the second condition, which we termed *DynamicRTI*, students with the weakest skills were fast-tracked immediately to Tier 2 or Tier 3 intervention depending on their scores on screeners: teacher judgment, letter-sound fluency, sight word fluency, and two timed word reading subtests from a standardized measure of reading (described in the

Table 1. Demographic Information for Participants.

Group	*n*	*M* age (*SD*)	*M* nonverbal IQ (*SD*)	% Male	% Hispanic	% Minority	% Free and reduced lunch	% Retained
TD	479	6;2 (0;4)	93.12 (12.40)	53	5.8	59.5	36.5	6.3
SI	23	6;4 (0;6)	92.95 (15.96)	83	0	39.1	43.5	0
LI	16	6;4 (0;5)	90.00 (10.84)	81	6.3	75.0	68.8	31.3
SI + LI	11	6;3 (0;5)	85.60 (12.03)	64	9.1	36.4	36.4	18.2

Note. LI = language impairment; *SD* = standard deviation; SI = speech impairment; TD = typical development.

measures section). Eligibility for Tier 2 versus Tier 3 was based on teacher judgment plus level of severity on these measures relative to local norms. In the current data set, there was no effect of RTI condition on spelling outcomes ($p = .21$). In addition, the time × condition interaction was not significant ($p = .59$). There was, however, an effect of impairment status on spelling outcomes ($p > .001$), as well as an interaction effect of time × impairment status ($p = .03$). Therefore, in the analyses reported herein, participants were grouped by impairment status but not RTI condition.

Measures

Trained research staff assessed all consented participating students either in their own classroom or in a quiet area near their classroom in the context of the larger study. We describe a subset of measures selected for this study. These include students' spelling using a standardized word spelling test in Fall and Spring and several predictors of spelling including orthographic knowledge/early word reading, phonological awareness, expressive vocabulary, and syntactic awareness in Fall.

Outcome Measure: Spelling

The standardized spelling subtest of the *Woodcock–Johnson Tests of Achievement–Third Edition* (WJ-III; Woodcock et al., 2001) was selected as the outcome measure because it ranges from asking students to perform prewriting skills such as drawing lines or tracing letters and progresses to letter writing and spelling words correctly. Reliability estimates were .90 for the WJ-III Spelling. Standard scores were calculated based on each student's raw score and their chronological age at the time the test was administered.

Linguistic Predictor Measures

Four linguistic predictor measures were also administered. Based on previous research, we evaluated the predictive ability of orthographic knowledge/early word reading, phonological awareness, expressive vocabulary, and syntactic awareness.

Orthographic knowledge/early word reading. The Letter-Word Identification subtest from the WJ-III (Woodcock et al., 2001) was selected to assess orthographic knowledge and early word reading, which requires students to identify letters and then to read words of increasing difficulty; the test manual reports reliability was .91 for this age group.

Phonological awareness. The Elision subtest of the Comprehensive Test Of Phonological Processing (CTOPP; Wagner et al., 1999) measures the extent to which the student can say a word and then say what is left after dropping out designated sounds, including syllables and phonemes. The test manual reports test–retest coefficients ranging from .70 to .92.

Semantic knowledge. The Picture Vocabulary subtest of the WJ-III (Woodcock et al., 2001) requires students to name pictured objects that increase in difficulty. Split-half reliability of this subtest was estimated in the test manual as .77. Vocabulary standard scores are reported descriptively and used in analyses.

Morphosyntactic knowledge. The Grammatic Completion subtest of the *Test of Oral Language Development-3 Primary* (TOLD; Newcomer & Hammill, 1997) assesses students' ability to use English morphological forms to complete sentences. The student listens to a sentence that is read aloud and is asked to complete the sentence with a correct morphological form. Reliability is .90 according to the test manual.

Data Analysis

The first research question addressed group differences in spelling performance of first-grade students with SI and/or LI across the first-grade year (Fall to Spring). We conducted a repeated measures analysis of variance (RM ANOVA) with Spelling raw score as the dependent variable, time (Fall, Spring) as the within-group variable, and group (TD, SI, LI, SI + LI) as the between-group variable was conducted. The second research question addressed the linguistic predictors of spelling in children with SI

Table 2. Standard Scores on Study Measures by Speech/Language Status Group.

Group	Fall spelling SS (*SD*)	Spring spelling SS (*SD*)	Orthographic knowledge/early word reading SS (*SD*)	Phonological awareness SS (*SD*)	Semantic knowledge SS (*SD*)	Morpho-syntacitc knowledge SS (*SD*)	Nonverbal intelligence SS (*SD*)
TD	103.64 (13.61)	109.66 (15.16)	106.44 (15.68)	9.81 (3.20)	101.51 (10.64)	8.39 (2.93)	92.62 (10.69)
SI	96.48 (13.55)	103.87 (14.72)	98.30 (14.99)	8.57 (2.71)	96.48 (10.09)	6.76 (3.03)	101.90 (14.31)
LI	90.75 (14.68)	94.56 (9.95)	94.13 (11.06)	5.81 (2.14)	92.38 (7.13)	5.92 (1.56)	91.43 (10.01)
SI + LI	88.73 (19.88)	89.91 (20.27)	91.27 (7.99)	7.64 (2.50)	91.45 (13.82)	4.50 (4.72)	92.50 (11.71)

Note. LI = language impairment; *SD* = standard deviation; SI = speech impairment; SS = standard score; TD = typical development.

Table 3. Raw Scores on Study Measures by Speech/Language Group.

Group	Fall spelling raw (*SD*)	Spring spelling raw (*SD*)	Orthographic knowledge/early word reading raw (*SD*)	Phonological awareness raw (*SD*)	Semantic knowledge raw (*SD*)	Morphosyntactic knowledge raw (*SD*)
TD	18.81 (4.01)	25.49 (5.25)	27.36 (9.08)	6.62 (4.34)	19.25 (3.13)	10.85 (7.18)
SI	16.96 (2.96)	23.70 (4.33)	23.09 (6.82)	5.13 (2.69)	17.96 (2.84)	8.53 (6.88)
LI	15.19 (3.51)	20.13 (3.54)	20.56 (5.80)	1.75 (2.08)	16.63 (2.06)	6.08 (4.64)
SI + LI	18.55 (4.05)	19.82 (6.37)	19.73 (6.21)	3.91 (2.59)	16.64 (3.91)	5.83 (6.71)

Note. LI = language impairment; *SD* = standard deviation; SI = speech impairment; TD = typical development.

and/or LI and children with typical development. For these analyses, the SI only, LI only, and SI + LI groups were collapsed because no differences between these groups were observed in the analysis above. A series of multiple regression analyses with Spring Spelling as the dependent variable were performed: in the first model, only group was included as a predictor; in the second model, the linguistic variables were included as predictors, and in the third model group by linguistic variable interactions were included.

Results

Table 2 displays descriptive scores for study variables. Standard scores were not used in the following analyses; however, we report the standard scores in Table 2 as descriptive information about the four groups of students. Table 3 displays the description of raw scores of study variables that were used in the following analyses.

Single-Word Spelling Performance Across SI/LI Status

Again, to address the first research question, a RM ANOVA with Spelling raw score as the dependent variable, time (Fall, Spring) as the within-group variable, and group (TD, SI, LI, SI + LI) as the between-group variable was conducted. Owing to unequal sample sizes across groups, we ran Levene's test of homogeneity of variances, which indicated no difference in variances across groups

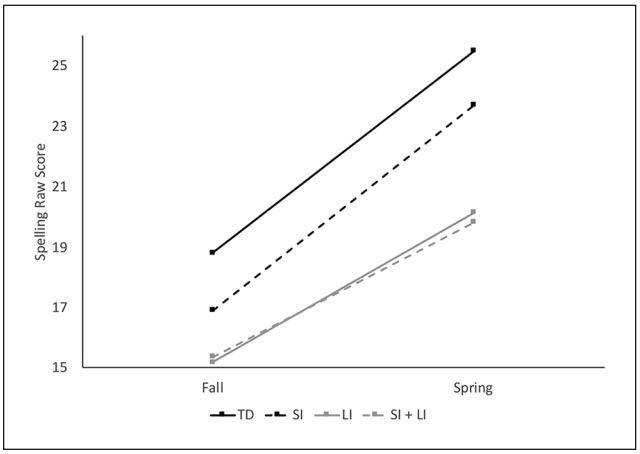

Figure 1. Growth in spelling performance from fall to spring by group.

(p = .134–.605). The overall RM ANOVA indicated a main effect of time, F (1, 523) = 252.942, $p < .001$, η_p^2 = .326, a main effect of group, F(3, 523) = 10.25, $p < .001$, η_p^2 = .056, and an interaction effect of time and group, F(3, 523) = 3.17, p = .024, η_p^2 = .18 (see Figure 1). The students with TL (with or without SI) exhibited greater growth over the year than students with LI (with or without SI). Follow-up Tukey honestly significant difference (HSD) tests indicated that children with TD scored higher than children with LI only ($p < .001$; d = 1.20) and children with SI + LI ($p < .001$; d = 0.97) but not children with SI only (p = .200; d = 0.37). None of the speech and/

Table 4. Correlations for Research Question 2 Measures for Children With Speech and/or Language Impairment (Below Diagonal) and Children With Typical Development (Above Diagonal).

Measures	1	2	3	4	5
1. Spring spelling	–	.759**	.569**	.360**	.255**
2. Orthographic knowledge/early word reading	.686**	–	.620**	.436**	.286**
3. Phonological awareness	.597**	.523**	–	.493**	.311**
4. Semantic knowledge	.430**	.328*	.459**	–	.472**
5. Morphosyntactic knowledge	.330	.077	.401*	.490**	–

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

or LI groups differed from each other (p values = .23–.31; d values = .04–.54).

Linguistic Predictors of Single-Word Spelling Across SI/LI Status

The second research question addressed the linguistic predictors of spelling in children with SI and/or LI and children with typical development. For these analyses, the SI only, LI only, and SI + LI groups were collapsed because no differences between these groups were observed in the analysis above. Table 4 displays correlations of study variables for all participants with speech and/or LI below the diagonal and children with typical development above the diagonal.

Table 5 displays results of a series of multiple regression models with Spring Spelling as the dependent variable. In Model 1, group was entered as the only predictor variable. The reference group was children with typical development. Group was a significant predictor of Spring Spelling when considered individually, accounting for approximately 4% of the overall variance. In Model 2, the Fall linguistic raw scores—orthographic knowledge/early word reading, phonological awareness, semantic knowledge, and morphosyntactic knowledge—were entered as additional predictor variables. Model 2 accounted for 60.4% of the variance in Spring Spelling. Orthographic knowledge/early word reading and phonological awareness were unique predictors of spelling ($p < .001$) but semantic knowledge and morphosyntactic knowledge were not unique predictors of spelling ($p = .79$ and .41, respectively). Orthographic knowledge/early word reading accounted for 38.44% of the unique variance, and phonological awareness accounted for 4.2%. In Model 3, interaction effects of the linguistic variables and group were entered as additional predictor variables. Model 3 did not explain any variance beyond Model 2, and none of the linguistic factor x group interactions were significant ($p = .40–.83$).

Discussion

This study examined two research questions pertaining to single-word spelling performance of first graders who differ across SI and/or LI status. First, we evaluated the single-word spelling performance of children in four groups across the first-grade year: TD, SI, LI, and SI + LI. Our findings indicated that first graders' spelling outcomes improved over time, that children with TD outperformed children with LI and children with SI + LI, and that children with TD exhibited greater improvement over the year than children with LIs. Second, we evaluated the linguistic predictors of single-word spelling in first graders. Our findings indicated that orthographic knowledge/early word reading and phonological awareness were unique predictors of spelling for first graders, but semantic knowledge and morphosyntactic awareness were not. In addition, no group interaction effects were observed, indicating that predictors did not vary across children's SI and LI status.

Group Differences in Spelling Performance

In this study, children with TD outperformed children with LI and children with SI + LI but not children with SI on measures of single-word spelling in first grade. Most studies that have reported children with SI as at-risk for spelling difficulties have not controlled for children's language abilities. When children with SI + LI are considered separately from children with SI but TL abilities, it is clear that LI, but not SI, puts children at-risk for poorer spelling abilities. These findings are consistent with previous research on spelling in children with SI and children with LI (Bishop & Adams, 1990; Lewis et al., 2002; Lewis & Freebairn, 1992; Puranik et al., 2014). It is interesting to note that group differences in spelling performance are relatively consistent with research on word reading and oral reading fluency. Converging findings demonstrated that young children with LI are at high risk for developing reading difficulties (e.g., Bishop & Adams, 1990; Catts & Kamhi, 1999). However, some research indicates that children with SI perform similarly to students without SI (e.g., Bishop & Adams, 1990), while findings from other studies have shown that only students with SI that persists across the elementary years are at greater risk for reading difficulties (e.g., Bird et al., 1995; Nathan et al., 2004; Puranik et al., 2008). Thus, this study adds to a growing body of evidence that language, but not

Table 5. Multiple Regression Model for Spring Spelling Score.

Model	R^2 adj	R^2 change	Predictor variables	*B*	*SE B*	β	*t*	*p*
1	.042	.045	Group	3.922	.917	.211	4.279	.000
2	.604	.564	Group	.329	.611	.018	.539	.590
			Linguistic factors					
			Orthographic knowledge/early word reading	.378	.024	.646	15.579	.000
			Phonological awareness	.218	.053	.179	4.106	.000
			Semantic knowledge	−.018	.067	−.011	−.273	.785
			Morphosyntactic knowledge	.022	.027	.030	.821	.412
3	.604	.004	Group	6.089	4.945	.328	1.231	.219
			Linguistic factors					
			Orthographic knowledge/early word reading	.382	.025	.652	15.440	.000
			Phonological awareness	.209	.054	.172	3.852	.000
			Semantic knowledge	−.034	.070	−.020	−.484	.629
			Morphosyntactic knowledge	.016	.028	.021	.565	.573
			Interactions					
			Orthographic knowledge/early word reading × group	.031	.146	.035	.215	.830
			Phonological awareness × group	.181	.254	.043	.710	.478
			Semantic knowledge × group	.229	.272	.215	.844	.399
			Morphosyntactic knowledge × group	.072	.115	.037	.626	.532

speech, impairment seems to lead to difficulties in spelling along with reading.

Multiple Linguistic Predictors of Spelling in First Graders

For children with TD and children with SI and/or LI, fall linguistic variables generally were related to spring spelling performance. These correlational findings lend initial support to concluding that the relation of linguistic knowledge and single-word spelling is similar across speech and/or language status for first-grade students. Furthermore, in the multiple regression analysis, none of the interactions of linguistic factors and group were significant. This finding suggests that when linguistic knowledge variables are considered concurrently, linguistic knowledge appears to predict single-word spelling performance in first-grade students similarly regardless of speech and/or language status.

The multiple regression models suggested that group status explains approximately 4% of the variance in first-grade single-word spelling, and adding the concurrent linguistic factors measured herein to the model explained an additional 56% of the variance in first-grade single-word spelling. This predictive power is driven largely by orthographic knowledge/early word reading, which accounted for approximately 38% of the unique variance in spelling, and phonological awareness, which accounted for 4% of the unique variance in spelling. Semantic knowledge and morphosyntactic awareness did not emerge as unique predictors of spelling in first-grade students. These findings align with previous research that suggests that orthographic knowledge, including early word reading, is the most robust predictor of spelling for young elementary school students (Abbott & Berninger, 1993) and that semantic knowledge does not uniquely predict early spelling performance (Apel & Lawrence, 2011; Peterson et al., 2009). Although findings for children with typical development consistently find morphosyntactic knowledge to be a predictor of spelling performance (e.g., Apel et al., 2012; Treiman et al., 1994), previous findings in the area of morphosyntactic prediction of spelling of children with speech and LIs had been mixed. These findings additionally add support to the perspective that early morphosyntactic knowledge (e.g., inflected morphology) may not be a unique predictor of early spelling for children with SI and/or LI (e.g., Werfel et al., 2019).

These findings also converge with the linguistic repertoire theory of spelling (Apel et al., 2004), which suggests that students draw on different types of linguistic knowledge based on the demands of the word structure and the skills of the students. For both groups, multiple linguistic factors were related to spelling abilities, as evidenced by the correlational analyses. Children who had lower skills in the linguistic areas tended to have lower spelling skills as well. This study adds to increasing evidence in support of the repertoire theory, as well as evidence that the theory applies to students with SI/LI, as well as those who have typical speech-language development.

Educational and Clinical Implications

For educators, the findings of this study have implications for early instructional targets for children with TD and for

children with SI and/or LI. First, CCSS specify that spelling instruction should occur in first grade but provide little specific detail on what that instruction should entail. Our findings suggest that emphasis on orthographic knowledge, early word reading skills, and phonological awareness development may be beneficial as the focus of early spelling instruction. Second, we did not find differences in the linguistic prediction of spelling across groups. Therefore, spelling instructional targets may not need to differ from the general education curriculum for first-grade students with SI and/or LI. It is important to note, however, that children in the impairment groups generally scored below children with TD on the linguistic measures. Perhaps instruction for these students should include more intensity than is necessary for children with TD on these instructional targets. These hypotheses should be directly examined in instructional/intervention research designs.

For speech-language pathologists, the findings of this study provide guidance in selecting assessment protocols and intervention goals for students on their caseloads. First, the findings suggested that children with SI only as a group are not at greater risk for spelling impairment than children with TD. Therefore, spelling should be targeted only on a case-by-case basis for this group of children. For children with LI, however, spelling should be a standard treatment target. Second, the findings of this study suggest that early intervention should particularly target orthographic knowledge/early word reading and phonological awareness with spelling skills in mind. These areas are both within the scope of practice and expertise of speech-language pathologists, who should be part of the early spelling intervention team for students with SI and/or LI.

Limitations and Directions for Future Research

As with any study, the findings reported here should be interpreted with the following limitations in mind. First, the data set used was an extant database, so we were limited to predictor and outcome measures collected as part of the larger study. Second, because this was a community-based sample and not a clinical sample, there was a relatively small number of students in each impairment group compared to children with TD, which made comparing all four groups in the multiple regression model difficult. To preserve power, we collapsed the three impairment groups in the model. Future work should attempt to include sufficient numbers of students in each group to make inclusion of all groups separately in regression models feasible. Finally, in this study, school personnel assessed and determined whether students had LI or SI and we did not examine how persistent these impairments were. Future research is needed to replicate findings when researchers assess students' linguistic skills.

Conclusion

This study compared the single-word spelling performance of first graders across four groups of first-grade students who varied across speech and language status and determined the linguistic predictors of first-grade spelling for children with SI and/or LI compared to children with typical development. Children with LI, either in isolation or comorbid with SI, demonstrated lower spelling performance than children with TD; children with SI only did not differ from children with TD. In addition, orthographic knowledge/early word reading and phonological awareness predicted first-grade spelling performance, regardless of group. Study findings indicate that language status, but not speech status, is a risk factor for low spelling performance in first grade, and that first-grade spelling instruction should focus on developing students' orthographic knowledge and phonological awareness.

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Note

1. We use the term "morphosyntactic knowledge" here to highlight the connection and overlap of morphological knowledge, the combining morphemes using inflection or derivation to create new word forms, and syntax, the combining of word forms to create phrases. Knowledge of this overlap is required to complete tasks of morphological awareness, which typically ask individuals to produce an inflected or derived form to complete a phrase or sentence.

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