Research Article

The Potential of Past Tense Marking in Oral Reading as a Clinical Marker of Specific Language Impairment in School-Age Children

Krystal L. Werfel,^a Alison Eisel Hendricks,^a and C. Melanie Schuele^b

Purpose: The purpose of this study was twofold. The first aim was to explore differences in profiles of past tense marking in oral reading of school-age children with specific language impairment (SLI). The second aim was to explore the potential of past tense marking in oral reading as a clinical marker of SLI in school-age children.

Method: This study examined oral readings of connected text to describe the frequency and type of reading errors on regular and irregular past tense verbs for 21 children with SLI as compared to 30 children with typical language in Grades 2 and 3. Each past tense verb token was categorized into 1 of 6 mutually exclusive response types: (a) correctly marked past tense, (b) overmarked past tense, (c) bare stem, (d) other verb inflection, (e) nonverb, or (f) no response. Performance across groups was compared. Additionally, classification statistics were calculated at

several cutoffs for regular past tense accuracy and regular past tense finiteness marking.

Results: For regular past tense, there was a significant group difference on accuracy. Children with SLI were less accurate at marking past tense when in oral reading than typical language peers; other response types did not differ. For irregular past tense, there were no group differences. In addition, there was a significant group difference on finiteness marking; this difference was driven by regular but not irregular verbs. A cutoff of 90% for regular past tense accuracy yielded moderate sensitivity and specificity; no cutoff for regular past tense finiteness marking yielded sensitivity above 70%.

Conclusions: Regular past tense accuracy in oral reading provides promise as a clinical marker for diagnosing SLI in school-age children.

Children who meet the diagnostic criteria for specific language impairment (SLI)¹ often enter elementary school unidentified. For example, Tomblin et al. (1997) reported that only 29% of parents of an epidemiological sample of kindergarten children who met SLI diagnostic criteria had been informed that their child had a problem with speech or language acquisition. Perhaps more alarming, among those children in the SLI group who did not have concomitant speech sound deficits, only 9% had

received intervention services (Zhang & Tomblin, 2000). If SLI were a fleeting phenomenon with no lasting consequences, this underidentification would create little cause for concern. These early language learning difficulties, however, persist well into adolescence and adulthood (Tomblin & Nippold, 2014). Associated negative consequences include lower educational outcomes (Catts, Fey, Tomblin, & Zhang, 2002) and difficulties with psychosocial adjustment (Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). For example, Werfel and Krimm (2017) reported that in a clinical sample, only 16% of elementary school children diagnosed with SLI demonstrated typical reading skills. Of the children with SLI who had reading difficulties, the majority displayed deficits across reading skills, that is, in

^aUniversity of South Carolina, Columbia

^bVanderbilt University, Nashville, TN

Correspondence to Krystal L. Werfel: werfel@sc.edu

Krystal L. Werfel was affiliated with Vanderbilt University at the time of data collection.

Alison Eisel Hendricks is now affiliated with University at Buffalo, The State University of New York.

Editor-in-Chief: Sean Redmond

Editor: GERALYN TIMLER

Received April 2, 2017

Revision received July 25, 2017

Accepted August 17, 2017

https://doi.org/10.1044/2017_JSLHR-L-17-0115

¹We use the term *specific language impairment* (National Institute on Deafness and Other Communication Disorders, 2017) to refer to the most common form of developmental language disorder, in which language skills are affected in children who have normal hearing and no other developmental delays.

Disclosure: The authors have declared that no competing interests existed at the time of publication.

decoding and reading comprehension. Hence, there is a vital need for valid and reliable methods of identifying language impairment in school-age children (Rice, Hoffman, & Wexler, 2009).

Screening measures are one method used to identify individuals who likely have SLI. These screening measures must have high sensitivity—the degree to which a measure accurately categorizes individuals who actually have the disorder as having the disorder—and high specificity—the degree to which it categorizes individuals who do not have the disorder as not having the disorder—as well as overall high diagnostic accuracy, which includes sensitivity and specificity (see Dollaghan, 2007). Oetting, Gregory, and Riviere (2016) suggested that for screening measures, sensitivity should be optimized over specificity; that is, it is preferable to have a child with typical language (TL) fail the screening than a child with SLI pass the screening.

Effective screening measures often utilize clinical markers of the disorder of interest. A clinical marker is a symptom or performance that aids in identifying the presence or absence of a disorder. Researchers have focused their attention on the identification of clinical markers for language impairment across the lifespan. In this research, finiteness marking in various spoken language tasks (e.g., production and judgment) has emerged as a strong clinical marker of SLI from preschool to adulthood (Conti-Ramsden, 2003; Conti-Ramsden, Botting, & Faragher, 2001; Poll, Betz, & Miller, 2010; Rice & Wexler, 1996).

Clinical Markers of SLI in Preschool Children

For preschool children, finiteness marking in spoken language has long shown promise as a clinical marker for SLI (Bedore & Leonard, 1998; Rice & Wexler, 1996; Tager-Flusberg & Cooper, 1999). Finiteness marking, or specification of grammatical tense, has an unusually protracted course of development for children with SLI (Bishop, 1994; Eyer & Leonard, 1994; Fletcher & Peters, 1984; Leonard, Caselli, Bortolini, McGregor, & Sabbadini, 1992; Marchman, Wulfeck, & Weismer, 1999; Rice, Wexler, & Cleave, 1995; Rice, Wexler, & Hershberger, 1998). As a group, children with SLI inconsistently omit finite markers in spontaneous language and in elicited tasks through the age of 8 years; these omissions for peers with TL are nearly nonexistent by the age of 5 years (Rice et al., 1998; Weiler, 2016). Thus, finiteness marking is argued to be a useful clinical marker in preschool and very early school-age children because it reliably differentiates young children with SLI from their typical peers (Tager-Flusberg & Cooper, 1999). For example, Bedore and Leonard (1998) correctly classified preschool children with SLI (age range: 3;7 to 5;9) with 85% sensitivity and 100% specificity based on a verb morphology composite that included regular past tense, third-person singular *-s* inflection, as well as copula and auxiliary *BE* forms. In the Test of Early Grammatical Impairment (TEGI), Rice and Wexler (2001) capitalized on the weakness in finite verb morphology (i.e., past tense and third-person singular) for children with SLI to develop a screening

measure for SLI that has high sensitivity and specificity in late preschool and early school-age years (e.g., kindergarten and first grade).

The Need for a School-Age Clinical Marker

Omissions of finiteness markers in spoken language become infrequent for many children with SLI in the later elementary grades. The SLI group mean for overt finiteness marking in spoken language begins to more closely approximate peers with TL (e.g., Rice et al., 1998). Although group differences remain, the mean group difference narrows, and the overlap in performance of individual children with SLI and children with TL increases (Marchman et al., 1999; Rice et al., 1998). Thus, the low rate of finiteness marker omissions in spoken language for school-age children with SLI reduces the effectiveness and efficiency of finiteness marking in spoken language as a clinical marker as children progress through elementary school. As a result, Rice et al. have highlighted the need for school-age clinical markers of SLI (Rice et al., 2009; Rice, Tomblin, Hoffman, Richman, & Marquis, 2004).²

Vulnerabilities related to finiteness marking appear to remain, however, in other more challenging linguistic tasks, particularly in tasks that involve written language. For example, Windsor, Scott, and Street (2000) reported that 10- to 12-year-old students with language learning disabilities (LLDs) had omissions of finiteness markers in their written language at a much higher rate than chronological-age peers. They noted that regular past tense was particularly problematic, with a mean error rate of 26% for the LLD group as compared to less than 2% for chronological-age peers. In our own clinical practice and assessment, we have observed that children with SLI make errors in finiteness marking when reading orally; for example, they inconsistently produce bare stems (e.g., *jump*) for overtly marked finite verbs (e.g., *jumped* and *jumps*). We have observed that the prevalence of these finiteness marker omissions appears proportionately more frequent in their oral reading than in their spoken language. Thus, we hypothesize that marking of finiteness in oral reading may be a valid clinical marker for SLI in older elementary students. To our knowledge, this error pattern has not been reported in the literature. However, Gillam and Carlile (1997) reported that 8- to 11-year-old children with SLI (mean age = 10;3) had more oral reading errors as compared to typical readers matched for single-word reading proficiency (mean age = 7;11). For the SLI group, 62% of sentences with oral reading errors resulted in ungrammatical sentences, but only 40% of sentences with oral reading errors resulted in ungrammatical sentences for the typical readers. Notably, omissions of finiteness markers could yield an ungrammatical sentence (e.g., *he jump on the bike* read aloud for *he jumped on the bike*). Interestingly, Laing (2002) found

²Beyond the scope of this study, but necessary to note, some clinical markers of language impairment may likely vary across dialect as well as age (see Oetting et al., 2016 for more information).

no difference in the rate of oral reading morphological errors between third graders with SLI and third graders with TL; however, this analysis was not specific to finiteness marking.

Psychometrically sound screeners that utilize clinical markers of SLI for school-age children would meet multiple research and clinical needs. First, classroom teachers are often unsure when to refer a child for language assessment (Jessup, Ward, Cahill, & Keating, 2008; Williams, 2006). The subtlety of SLI symptoms for some children may make it difficult for teachers to initiate referrals with confidence. Second, when concern is raised about a school-age child's oral language skills, there are currently no widely accepted methods of screening to determine whether a full diagnostic language assessment is warranted. Although universal screening for math and reading disabilities is becoming routine (Gersten et al., 2012), the lack of a robust clinical marker for school-age language impairment makes universal screening difficult. With these factors in mind, a quick screener for SLI in school-age children that utilized a reliable clinical marker and could be administered by a range of education professionals would represent a substantial advancement for clinical and research practices. An effective school-age screener could have a substantial impact on the underidentification of SLI.

The Current Study

In this study, we begin to explore our hypothesis that finiteness marking in oral reading is a reliable clinical marker of SLI in school-age children. One value of finiteness marking in oral reading as a clinical marker of SLI is that the task could be reliably administered and validly scored by a wide range of educators who are experienced in noting oral reading errors. That is, administration of the task would not require the efforts of speech-language pathologists but instead could be administered widely by classroom teachers or paraprofessionals, or specifically by school psychologists when children are referred for general learning difficulties. It is common for screening measures to be administered by professionals who routinely interact with members of the target population (e.g., nurses routinely conduct newborn hearing screening rather than audiologists). Although the most commonly used screening measures for language impairment focus on identifying language impairment in preschool children, there exist a few screening measures for identifying language impairment in school-age children (e.g., Diagnostic Evaluation of Language Variation–Screening Test, Seymour, Roeper, & de Villiers, 2003; Clinical Evaluation of Language Fundamentals–Fifth Edition Screening Test, Wiig, Secord, & Semel, 2013). The screening measures that do exist require approximately 15–20 min per student to administer and require qualifications that would exclude paraprofessionals and many classroom teachers from administering them.

To explore finiteness marking in oral reading as a clinical marker of SLI for school-age children, we focus on past tense marking, supported by developmental data

and convenience. Of all finiteness markers in English, the growth trajectory for past tense marking lags behind other finite markers (Rice & Wexler, 2001; Rice et al., 1998). Thus, linguistic vulnerability may be most evident for school-age children in a task that taxes past tense knowledge and performance. In addition, the data we had available for analysis involved reading passages with a sufficient number of past tense exemplars but not other types of finiteness markers.

We addressed two study aims. The first aim was to explore differences in profiles of past tense marking in oral reading of school-age children with SLI. The second aim was to determine if past tense marking in oral reading is a useful clinical marker of SLI in school-age children who speak dialects of English in which past tense marking is obligatory. As such, we addressed three research questions:

- (a) In oral reading of connected text, are children with SLI less accurate than peers with TL on reading irregular and regular past tense verbs?
- (b) In oral reading of connected text, do children with SLI produce a higher rate of bare stems (i.e., nonfinite forms) for regular and irregular past tense verbs as compared to peers with TL?
- (c) In oral reading of connected text, what is the diagnostic accuracy of two past tense verb variables: (a) percent accuracy and (b) percent finiteness marking?

The source of the data for this study was Werfel (2012); research participants completed oral reading passages on the Woodcock Reading Mastery Tests–Third Edition (WRMT-III; Woodcock, 2011). It is important to note that the oral reading fluency passages on the WRMT-III were not designed to test our hypothesis but provided sufficient data to conduct an exploratory study. On the basis of the extant literature on the speaking, reading, and writing skills of children with SLI, we hypothesized that the children with SLI would be less proficient at reading past tense verbs accurately as compared to their TL grade peers. We further hypothesized that the most frequent error in oral reading of past tense verbs would be producing a nonfinite form where a finite form was provided in the printed text (e.g., read *jump* for *jumped*, read *ride* for *rode*). Thus, as in oral language, children with SLI would produce fewer verbs marked for finiteness as compared to TL grade peers. We did not make any a priori hypotheses about the sensitivity and specificity of a screener using oral reading of past tense as a clinical marker. Instead, we note that to provide initial evidence worthy of additional research, a screener that utilizes a clinical marker should show at least moderately strong evidence of classification of children with SLI to the SLI group but not classification of children with TL to the SLI group.

Method

All study procedures were approved by the Vanderbilt University Institutional Review Board.

Participants

Fifty-one children participated in the study: 21 second and third graders with SLI (mean age = 8;9, SD = 9 months) and 30 second and third graders with TL (mean age = 8;6, SD = 9.6 months). The two groups did not differ on maternal years of education (SLI mean = 14.87, SD = 2.51; TL mean = 15.12, SD = 1.87; p = .46). Participants were recruited from public and private elementary schools in middle Tennessee to participate in a broader study on the linguistic basis of literacy skills (Werfel, 2012). In public schools, speech-language pathologists sent consent forms home with children with an individualized education program who received special education services as a child with a speech impairment, language impairment, or specific learning disability.³ Children with diagnoses other than speech, language, or literacy impairment were not eligible to participate. In private schools, the principal or special education director sent consent forms home with children who had language assessment scores from their most recent annual assessment that met our research criteria for SLI (described below), as well as children whose teachers and/or parents were concerned about language impairment or specific learning disability. To obtain a control sample of grade-level peers, children with TL were recruited from the classrooms of the SLI participants. For each participant with SLI, consent forms were sent home to three children in the same classroom who were judged by the teacher to have TL and literacy development. All children with TL who returned consent forms were included in the study. This procedure was not possible in one private school that served only children with special needs. No participants attended schools in which nonmainstream American English dialects, in which past tense marking is variable were widely spoken.

Participant inclusionary criteria included (a) speaking only English at home, (b) passing a hearing screening bilaterally prior to participation, and (c) obtaining a standard score of 85 or greater on the Test of Nonverbal Intelligence–Fourth Edition (TONI-4; Brown, Sherbenou, & Johnsen, 2010). Participants were categorized as either SLI participants or TL participants based on the Core Language Index from the Clinical Evaluation of Language Fundamentals–Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003). SLI participants had a Core Language Index below 85, whereas TL participants had a Core Language Index of 90 or greater. Thus, our research criteria for SLI was Core Language Index below 85 + normal nonverbal intelligence. Table 1 summarizes the group means, standard deviations, and ranges for inclusionary measures.

To describe participants' general reading abilities, we administered subtests to calculate the Basic Skills (Word Identification and Word Attack) and Reading Comprehension (Word Comprehension and Passage Comprehension) composites on the WRMT-III (Woodcock, 2011). On both

Table 1. Means (standard deviations) and ranges on inclusionary variables by an experimental group.

Variable	SLI	TL	<i>p</i>	<i>d</i>
Age in months	105.29 (9.05) 88–122	101.10 (9.86) 84–119	ns	0.44
CELF-4 core language SS	72.81 (10.07) 40–82	107.37 (10.23) 90–124	< .001	3.40
TONI-4 SS	97.62 (7.88) 85–115	105.50 (7.92) 92–121	< .01	1.00

Note. SLI = specific language impairment; TL = typical language; SS = standard score; ns = not significant; CELF-4 = Clinical Evaluation of Language Fundamentals–Fourth Edition (Semel et al., 2003); TONI-4 = Test of Nonverbal Intelligence–Fourth Edition (Brown et al., 2010).

reading composites, children with SLI performed more poorly than children with TL (p < .001). For Basic Skills, children with SLI had a mean composite of 80.38 (SD = 14.27), whereas children with TL had a mean composite of 102.83 (SD = 16.79; d = 1.44). For Reading Comprehension, children with SLI had a mean composite of 81.14 (SD = 12.02), whereas children with TL had a mean composite of 105.67 (SD = 14.76; d = 1.82). We additionally determined how many children in each group had decoding-only difficulties, defined as a standard score below 85 on one or both of the WRMT-III Basic Skills measures and a standard score of 85 or above for WRMT-III Reading Comprehension. This analysis revealed that three children in each group met diagnostic criteria for dyslexia. Finally, we performed Pearson correlations between the CELF-4 Core Language Score and WRMT-III Basic Skills Composite for each group. Language and word reading skills were significantly positively correlated for children with TL (r = .518) but not for children with SLI (r = .247).

Procedure

As a part of the larger study on the linguistic basis of literacy skills (Werfel, 2012), participants completed a language, reading, and writing assessment battery. Participants were assessed in a quiet room at their elementary schools. The current study involved a secondary analysis of the audio recordings of oral readings of passages from the Oral Reading Fluency subtest of the WRMT-III. Consistent with the standardized administration of the WRMT-III, each participant read at least two passages based on individual reading ability as determined by the time required to read the first passage administered; participants who exceeded the allotted time for the first passage administered read an additional passage. Given the ages and reading levels of participants, participants read either Passages A and B (12 SLI, 15 TL), Passages B and C (8 SLI, 14 TL), or Passages A, B, and C (1 SLI, 1 TL). Passages A, B, and C on the WRMT-III include multiple lexical verbs marked for past tense, allowing for the secondary analysis to address the research questions posed. Regular verbs marked

³In Tennessee, speech impairment and language impairment are separate special education eligibility categories.

for past tense with the allomorph /t/ or /d/ that were followed by a word that began with the phoneme /t/, /d/, or /ð/ (e.g., *asked to*, *liked the*) were removed from the analysis (Passage A: $n = 0$, Passage B: $n = 2$, Passage C: $n = 2$) because these contexts did not allow for reliable transcription of the presence or absence of finiteness marking. Auxiliary verbs and copula *BE* verbs were not included in this analysis, either when they were the target word (see Appendix A) or the child's response ($n = 4$). The analysis of regular verbs includes six tokens from Passage A, six tokens from Passage B, and nine tokens from Passage C. The analysis of irregular verbs includes three tokens from Passage B and four tokens from Passage C; Passage A contained only one irregular verb, so it was excluded from analysis. Appendix A provides a list of the past tense verbs by passage.

Orthographic Transcription

A research assistant familiar with the study procedures and trained in phonetic and orthographic transcription transcribed the past tense verb targets from audio recordings of the participants' oral readings. To verify transcription reliability, the first author separately transcribed 30% of the samples in each experimental group, following the same procedures. Interrater reliability was 91% for Passage A, 90% for Passage B, and 88% for Passage C. The interrater reliability was judged as satisfactory; thus, the research assistant's transcriptions were used for analysis.

Coding

The research assistant categorized each participant's oral reading for each past tense verb token into one of six mutually exclusive response types: (a) correctly marked past tense, (b) overmarked past tense, (c) bare stem, (d) other verb inflection, (e) nonverb, (f) no response. Table 2 defines the six response types with examples. The first author reviewed the research assistant's coding of response types item by item (100% review), noting any disagreement.

Disagreements were rare and were resolved by consensus; the data entered into analysis reflected the consensus assignment of response types.

Variable Derivation

For each participant, response type proportions were calculated for the proportion of child responses for each of the six response types separately for regular and irregular verbs (see Table 2). Response type proportion was the number of verb tokens categorized as each type divided by the total number of verb tokens. The six response type proportions for regular verbs were calculated for all participants. The six response type proportions for irregular verbs were calculated only for those participants who read Passages B and C (8 SLI, 14 TL).

In addition, three past tense finiteness variables—regular, irregular, and overall—were derived to consider how child readings of past tense targets align with the extensive oral language literature on finiteness marking (i.e., third research question). The numerator for each of these variables was production of types (a) and (b) in Table 2—those verb productions marked for tense disregarding whether the correct form for past tense was used; the denominator was production types (a), (b), and (c) in Table 2—those targets produced in a manner that yielded an obligatory context for past tense (cf. Rice & Wexler, 2001). Note the omission of (d), (e), and (f) responses from the derivation of these variables; these were categories of child responses that did not yield an obligatory context for past tense. An illustration using a hypothetical example child is provided in Appendix B.

Results

This study represents an initial evaluation of oral reading of marked past tense verbs by second- and third-grade children with SLI as compared to TL grade peers.

Table 2. Categories for oral readings of past tense text targets.

Response type	Definition	Regular verb examples	Irregular verb examples
(a) Accurate	Child read the past tense text target with the correct past tense form	<i>played, wanted</i>	<i>spent, went, did</i>
(b) Overmarked	Child read the past tense text target as marked for tense but double marked a regular past tense verb (i.e., two allomorphs produced) or regularized the bare stem of an irregular verb (e.g., <i>blowed</i>) or the past tense form of an irregular verb (e.g., <i>blewed</i>)	<i>playeded, wanteded</i>	<i>spended, goed, doed</i>
(c) Bare stem	Child read the past tense text target as a verb not marked for tense	<i>play, want</i>	<i>spend, go, do</i>
(d) Other verb inflection	Child read the past tense text target with a nonpast tense inflectional ending	<i>playing, wants</i>	<i>spending, goes, doing</i>
(e) Nonverb	Child produced a word that was not a verb; that is, child misread the past tense token by substituting a nonverb word	<i>people, class</i>	<i>where, pan</i>
(f) No response	Child did not produce a word for the target word (e.g., omitted the verb token when reading)	<i>No response</i>	<i>No response</i>

Analyses focused on the identification of differential group performance and initial consideration of the strength of past tense marking in oral reading as a clinical marker of SLI in school-age children.

Comparison of Response Types by Children With SLI and Children With TL

To address the first and second research questions, we compared the proportional frequency of the six response types across participant groups. Regular verbs were considered separately from irregular verbs. To test for differences in the profiles of past tense production in oral reading of children with SLI and children with TL, we compared the group means for proportions of each of six response types using a series of independent-samples *t* tests.

Regular Verbs

Six comparisons were conducted for regular verbs; using a Bonferroni correction for multiple comparisons, the adjusted alpha level was $\alpha = 0.008$. Table 3 displays means, standard deviations, *p* values, and effect sizes for each response type on regular verbs. Children with SLI produced proportionately fewer accurate readings of past tense regular verbs than children with TL; none of the other response types yielded statistically significant group differences. These results support further exploration of past tense marking in oral reading as a clinical marker, and thus, the third research question of diagnostic accuracy for regular past tense was addressed (see below).

Irregular Verbs

Only participants (8 SLI, 14 TL) who read Passages B and C contributed to the irregular verb analysis, as Passage A did not contain enough irregular verbs for analysis. Comparisons were not conducted for irregular verb response types of overmarked responses or other verbal responses because no children in the SLI or TL groups produced these responses for irregular verbs. Thus, four comparisons were conducted; using a Bonferroni correction for multiple comparisons, the adjusted alpha level was $\alpha = 0.0125$. Table 4 displays means, standard deviations,

Table 3. Means (standard deviations) for proportion of response types for regular past tense verb targets by participant group.

Response types	SLI	TL	<i>p</i>	<i>d</i>
(a) Accurate	.60 (.33)	.92 (.09)	.000	1.32
(b) Overmarked	.01 (.05)	.00 (.00)	ns	0.28
(c) Bare stem	.16 (.16)	.06 (.08)	ns	0.79
(d) Other verb inflection	.06 (.14)	.01 (.04)	ns	0.49
(e) Nonverb	.08 (.12)	.01 (.02)	ns	0.81
(f) No response	.09 (.21)	.00 (.01)	ns	0.61

Note. Significance level = $p < .008$. SLI = specific language impairment; TL = typical language; ns = not significant. Letters [e.g., (a)] are referenced to Table 2.

Table 4. Means (standard deviations) for proportion of production types for irregular past tense verb targets by group.

Response type	SLI	TL	<i>p</i>	<i>d</i>
(a) Accurate	.95 (.06)	.96 (.08)	ns	0.14
(b) Overmarked	.00 (.00)	.00 (.00)	—	—
(c) Bare stem	.04 (.05)	.03 (.05)	ns	0.20
(d) Other verb inflection	.00 (.00)	.00 (.00)	—	—
(e) Nonverb	.00 (.00)	.01 (.03)	ns	0.47
(f) No response	.01 (.04)	.00 (.00)	ns	0.35

Note. Significance level = $p < .0125$. SLI = specific language impairment; TL = typical language; ns = not significant. Letters [e.g., (a)] are referenced to Table 2.

p values, and effect sizes for each response type on irregular verbs. There were no statistically significant differences. In contrast to regular past tense verbs, there was no significant group difference in the proportional frequency with which children produced an accurate past tense marking on irregular verbs. Thus, there was no support for further analysis of irregular past tense accuracy as a clinical marker.

Comparison of Past Tense Finiteness Marking in Oral Reading by Children With SLI and Children With TL

To address the third research question, we compared the proportional frequency with which participants in each group produced a finite verb, regardless of whether they marked finiteness accurately (e.g., *goed* would be recorded as marked for finiteness as would *went*, but not *go*). As finiteness marking has proven to be a clinical marker with high sensitivity and specificity in the oral language of preschool children with SLI, we conducted an analysis comparing the proportion of productions marked for finiteness in the oral readings of our school-age samples. Table 5 displays means, standard deviations, *p* values, and effect sizes of past tense finiteness marking for regular, irregular, and overall tokens by groups. Independent-samples *t* tests were conducted to determine whether the groups differed on oral reading finiteness marking on past tense verbs. There was a significant difference between groups for overall past tense finiteness marking in oral reading; children with SLI produced proportionately fewer verbs marked for finiteness

Table 5. Means (standard deviations) for proportion of finiteness marking of verb targets by group.

Verb type	SLI	TL	<i>p</i>	<i>d</i>
Regular verbs	.75 (.28)	.94 (.08)	.009	0.92
Irregular verbs	.91 (.16)	.98 (.05)	ns	0.59
Overall	.82 (.22)	.95 (.06)	.015	0.81

Note. Significance level = $p < .016$. SLI = specific language impairment; TL = typical language; ns = not significant.

as compared to children with TL ($d = 0.81$). An examination of regular and irregular verbs separately revealed that this group difference was driven by regular but not irregular verbs.

Regular Past Tense Accuracy and Finiteness Marking in Oral Reading as a Clinical Marker

Our second research aim was to explore the potential of past tense marking as a clinical marker of SLI in school-age children. An effective clinical marker should be able to accurately identify children with the disorder as having the disorder (true positives) as well as accurately identify children without the disorder as not having the disorder (true negatives). As noted previously, the analyses for the second research question revealed that irregular past tense marking was not different across groups, and thus, irregular past tense marking did not show potential as a clinical marker. Thus, the third research question considered only child readings of regular past tense verbs.

We first calculated sensitivity (the true positive rate), specificity (the true negative rate), and diagnostic accuracy at five cutoffs for regular past tense accuracy as well as finiteness marking. Figure 1 illustrates the distribution of regular past tense accuracy within each group. Table 6 reports sensitivity, specificity, and diagnostic accuracy at each cutoff for past tense accuracy. A cutoff of 80% yielded the highest diagnostic accuracy, 82%, with 71% sensitivity and 90% specificity. A cutoff of 95% yielded the highest value for sensitivity, 86%, but the specificity of 47% was

quite low, as was the diagnostic accuracy of 63%. Thus, this screening cutoff would catch most children with SLI but would refer too large a proportion (i.e., over half) of children with TL for further assessment. The 90% cutoff yielded only a small trade-off from the 95% cutoff for sensitivity (81%) but a substantial boost for specificity (73%). Thus, in this data set, the 90% cutoff was judged as the most efficient cutoff.

In contrast to regular past tense accuracy, finiteness marking of past tense verbs in oral reading does not appear to be a viable clinical marker for school-age children, as it did not yield sufficient sensitivity and specificity. Table 7 reports sensitivity, specificity, and diagnostic accuracy at each cutoff for finiteness. A cutoff of 80% yielded the highest diagnostic accuracy, 76%, with acceptable specificity of 93% but quite low sensitivity at 50%. Regardless of cutoff, sensitivity never exceeded 70% for finiteness. The analyses indicated that past tense accuracy, with its greater sensitivity and specificity, shows greater promise as a clinical marker of language impairment than finiteness marking.

We also calculated the positive and negative likelihood ratios for accuracy and finiteness marking for regular past tense verbs (see Tables 6 and 7). Likelihood ratios take both sensitivity and specificity into account and are useful for determining the diagnostic accuracy for disorders such as SLI, which are of low incidence in the population (Dollaghan, 2007). The positive likelihood ratio (LR+) represents the probability that a child who is identified as having the disorder, in fact, has the disorder,

Figure 1. Distribution of individual children's performance on regular past tense accuracy by children with specific language impairment (solid figures) and typical language (open figures). Each figure represents one child.

Table 6. Classification accuracy statistics for regular past tense accuracy.

Accuracy cutoff	Sensitivity	Specificity	Diagnostic accuracy	Positive likelihood ratio	Negative likelihood ratio
70%	48%	97%	76%	14.29	0.54
75%	52%	90%	75%	5.24	0.53
80%	71%	90%	82%	7.14	0.32
85%	71%	80%	76%	3.57	0.36
90%	81%	73%	76%	3.04	0.26
95%	86%	47%	63%	1.61	0.31

whereas the negative likelihood ratio (LR–) represents the probability that a child who is classified as not having the disorder, in fact, does not have the disorder. LR+ and LR– values of 1 suggest that the measure provides no reliable information about whether the child has the disorder or not. Larger LR+ values represent higher confidence of positively identifying a child with impairment, whereas lower LR– values represent higher confidence of accurately identifying a child without impairment. For LR+ values, > 10 are considered optimal, and values > 3 are considered moderately accurate. For LR– values, < .1 are considered optimal, and values < .3 are considered moderately accurate (Dollaghan, 2007). Note that LR+ and LR– are on different scales. For example, the improvement of LR– of .5 to .3 represents a larger improvement in classification accuracy than an improvement of LR+ of 1.3 to 1.5.

Likelihood ratios are presented in Tables 6 and 7 for each of the five cutoff points. When considering accuracy, the 70% cutoff produced the largest LR+ (14.29), whereas the 90% cutoff produced the smallest LR– (0.26). Both the 85% and 80% accuracy cutoffs produced LR+ scores that reflect moderate accuracy, and all cutoff scores between 80% and 95% produced LR– scores that reflect moderate accuracy. In contrast, when considering finiteness marking, LR+ values reflected moderate accuracy at some cutoff scores. However, there were no cutoff scores that produced moderate LR– for the finiteness marking analysis.

Discussion

The purpose of this preliminary investigation was twofold: (a) to explore differences in the marking of past tense in oral reading by children with SLI and peers with TL and (b) to explore the potential of past tense marking (accuracy and finiteness marking) in oral reading as a clinical marker of SLI in school-age children. Researchers have

suggested that although school-age children with SLI may not commit overt finiteness marking errors in oral language at a high rate, they continue to struggle with finiteness marking in more complex linguistic tasks, such as written language (Windsor et al., 2000). On the basis of these findings, along with research showing that finiteness marking is an effective clinical marker of SLI in preschool children, we hypothesized that children with SLI would be less accurate at marking past tense in an oral reading task than their peers with TL. In addition, we hypothesized that past tense marking in oral reading has the potential to serve as a clinical marker of SLI in school-age children. The study results supported these hypotheses.

Accuracy and Error Types Across Regular and Irregular Past Tense

First, differences emerged on children's accuracy of finiteness marking between regular and irregular past tense verbs. Children with SLI produced a smaller percentage of correctly marked regular past tense verbs in oral reading than peers with TL. However, the groups did not differ in the percentage of other production types, including bare stems, overmarked responses, or the use of other verb inflections (e.g., third-person singular). In contrast, children with SLI and children with TL were not significantly different on the percentage of responses in any category type (correct or errors) for irregular verbs. Thus, it appears that oral reading of regular past tense marking, but not irregular past tense marking, has the potential to serve as a clinical marker of SLI in school-age children.

Second, children with SLI also were less likely than children with TL to mark finiteness on past tense verbs, irrespective of accuracy. This difference seems to be driven by performance on regular past tense verbs but not irregular past tense verbs. That is, group differences were significant

Table 7. Classification accuracy statistics for finiteness marking.

Accuracy cutoff	Sensitivity	Specificity	Diagnostic accuracy	Positive likelihood ratio	Negative likelihood ratio
70%	30%	97%	70%	9.00	0.72
75%	35%	93%	70%	5.25	0.70
80%	50%	93%	76%	7.50	0.54
85%	50%	90%	74%	5.00	0.56
90%	55%	83%	72%	3.30	0.54
95%	70%	53%	60%	1.50	0.56

for regular past tense verbs but not for irregular past tense verbs.

Taken together, these results support our prediction that school-age children with SLI struggle with past tense marking in oral reading tasks. This difficulty, however, is limited to regular past tense marking; irregular past tense marking appears to be intact during oral reading for school-age children with SLI. This finding lends preliminary support to the use of regular past tense marking in oral reading as a potential clinical marker for SLI in school-age children.

Potential of Regular Past Tense Marking as a Clinical Marker of SLI in School-Age Children

Our third research question explored further the clinical marker potential of regular past tense marking in oral reading. We calculated classification statistics to explore the promise of an oral reading screener that utilizes a clinical marker for (a) regular past tense marking accuracy and (b) past tense finiteness marking. As previously discussed, an effective screener should accurately classify children with and without the disorder of interest. Although the past tense finiteness marking analysis has theoretical implications in SLI, it did not yield sufficient sensitivity and specificity to be used as a clinical marker. Similar patterns emerged in the likelihood ratios, with LR– values reflecting less than moderate accuracy across multiple cut-scores. The regular past tense accuracy analysis, however, provided moderate sensitivity and specificity and, therefore, has the potential to serve as a clinical marker of SLI. A 90% accuracy cutoff in regular past tense marking in oral reading on the WRMT-III provided the best combination of sensitivity, specificity, diagnostic accuracy, and positive and negative likelihood ratios. Although lower accuracy cutoffs yielded higher overall diagnostic accuracy, we consider the 90% accuracy cutoff in this data set as the most favorable for a screening tool, as it has sufficiently high sensitivity to be used as an initial step toward developing a screener for SLI in school-age children. Given that the measure used in this study was not designed to measure past tense marking, our results suggest that regular past tense marking in school-age children could be a quite promising clinical marker when measured with oral reading passages designed particularly for this purpose.

Although the classification accuracy statistics for this analysis were promising, they were not ideal for an effective screener without further modifications. It is important to reiterate that these passages were not designed to assess past tense marking. With that in mind, there were a number of limitations to the current study. According to the standardized administration, participants read different passages based on their reading level. This means that participants attempted different numbers of past tense types and tokens based on their grade level and reading ability. Moreover, several of the past tense verbs had to be excluded from analysis, because they were followed by words that resulted in coarticulation that limited our ability to determine

whether past tense was marked. In light of these limitations, the results of this analysis most likely underestimate the utility of past tense marking in oral reading as a clinical marker of SLI. This study highlights the need for additional research in this area.

To further explore the potential for regular past tense marking in oral reading as a clinical marker of SLI in school-age children, the first author's laboratory is currently creating and validating oral reading passages that are designed specifically to assess past tense marking. Our future studies will address the limitations of the current project in several ways. First, all participants will be given passages with the same number and allomorph type of verbs. Second, future research will evaluate morphophonology. For example, Marchman et al. have shown that children with SLI and children with TL are more likely to omit past tense marking in spoken language on words with stem-final alveolars (e.g., *skate*, *need*; Marchman, 1997; Marchman et al., 1999). A preliminary post hoc analysis in our data revealed the opposite pattern in oral reading. We compared percent accuracy of tense marking on three words with stem-final alveolars (*wanted*, *started*, *pointed*; mean = 89.21; range = 84.25–97.62) and three randomly selected words without stem-final alveolars, matched for passage (*showed*, *answered*, *practiced*; mean = 71.43; range = 47.62–83.33). There was no overlap in means between the two types, and Cohen's *d* effect size was 1.15, indicating a large effect. There is a need for research that further explores the role of morphophonology in past tense marking in oral reading. Third, it is important to control words that follow verbs to minimize the confound of coarticulation; judgment accuracy on verbal production of past tense is much easier when the word following the regular past tense verb does not begin with an alveolar (e.g., contrast *picked apples* with *picked tulips*). With continued development and validation of a regular past tense oral reading screener, we believe there is potential to decrease the underidentification of SLI in school-age children.

Consideration of Why Oral Reading of Regular (But Not Irregular) Past Tense Verbs Functions as a Clinical Marker

Understanding why a particular behavior is a clinical marker for a disorder may not be critical from a practical standpoint. That is, it is simply the presence or absence of the marker that is of practical importance. From a theoretical standpoint, however, understanding why a behavior serves as a clinical marker may be informative to a greater understanding of the disorder. Deficits in finiteness marking in spoken language are a clinical marker for SLI as well as a characteristic of the disorder. Our data additionally suggest vulnerability in finiteness marking in oral reading for children with SLI. Although oral reading involves producing phonological representations of orthographic representations, children access syntactic, morphological, and lexical knowledge when reading aloud. Thus, the past tense errors of children with SLI may result because in

reading, children generate regular past tense forms rather than directly accessing phonological representations of regular past tense forms. The inconsistent marking of regular past tense may arise from the same linguistic vulnerability that leads to deficits in oral language regular past tense marking and in grammaticality judgments. These oral reading errors may not extend to irregular past tense because children may directly access phonological representations of the irregular forms from the orthographic representations. If this explanation is valid, we would predict that children with SLI's oral reading of third-person *-s* (e.g., *eats*) parallels their reading of regular past tense, but irregular third person (i.e., *has*, *does*, *says*) does not. Future research could address this hypothesis.

Conclusion

The results of this study suggest that school-age children with SLI struggle with regular past tense marking in oral reading fluency compared to their peers with TL, even though their finiteness marking in spoken language may appear to be largely error free. Furthermore, using a 90% accuracy cutoff for regular past tense marking accuracy produced moderate sensitivity and specificity. We believe that the diagnostic accuracy in this study underestimates the use of regular past tense marking in oral reading because the published standardized assessment used in this study was not designed specifically to measure past tense marking. The results of this study suggest that regular past tense marking accuracy is a promising clinical marker of SLI in school-age children. The creation of an oral reading task specifically designed to assess regular past tense marking has the potential to be able to distinguish children with and without SLI more readily by school personnel than current assessment methods.

Acknowledgments

This work was supported by a Jeanne S. Chall Research Fellowship from the International Reading Association, awarded to Krystal L. Werfel; Preparation of Leadership Personnel Grant H325D080075 and H325D140087 from the U.S. Department of Education, awarded to C. Melanie Schuele; and Vanderbilt Institute for Clinical and Translational Science Award Grant UL1 RR024975 from the National Center for Research Resources/National Institutes of Health, awarded to Gordon Bernard. The content is solely the responsibility of the authors and does not necessarily reflect the views of the International Reading Association, the U.S. Department of Education, or the National Institutes of Health. We appreciate the efforts of Sarah Lorch on an earlier analysis of these data, supported by H325K090304.

References

- Bedore, L., & Leonard, L. (1998). Specific language impairment and grammatical morphology: A discriminant function. *Journal of Speech, Language, and Hearing Research*, 41, 1185–1192. <https://doi.org/10.1044/jslhr.4105.1185>
- Bishop, D. (1994). Grammatical errors in specific language impairment: Competence or performance limitations? *Applied Psycholinguistics*, 15, 507–550. <https://doi.org/10.1017/S0142716400006895>
- Brown, L., Sherbenou, R., & Johnsen, S. (2010). *Test of Nonverbal Intelligence—Fourth Edition*. Austin, TX: Pro-Ed.
- Catts, H., Fey, M., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of Speech, Language, and Hearing Research*, 45, 1142–1157. [https://doi.org/10.1044/1092-4388\(2002/093\)](https://doi.org/10.1044/1092-4388(2002/093))
- Conti-Ramsden, G. (2003). Processing and linguistic markers in young children with specific language impairment (SLI). *Journal of Speech, Language, and Hearing Research*, 46, 1029–1037.
- Conti-Ramsden, G., Botting, N., & Faragher, B. (2001). Psycholinguistic markers for specific language impairment (SLI). *The Journal of Child Psychology and Psychiatry*, 42(6), 741–748.
- Dollaghan, C. (2007). *The handbook for evidence-based practice in communication disorders*. Baltimore, MD: Brookes.
- Eyer, J., & Leonard, L. (1994). Learning past tense morphology with specific language impairment: A case study. *Child Language Teaching and Therapy*, 10, 127–138. <https://doi.org/10.1177/026565909401000201>
- Fletcher, P., & Peters, J. (1984). Characterizing language impairment in children: An exploratory study. *Language Testing*, 1, 33–49. <https://doi.org/10.1177/026553228400100104>
- Gersten, R., Clarke, B., Jordan, N., Newman-Gonchar, R., Haymond, K., & Wilkins, C. (2012). Universal screening in mathematics for the primary grades: Beginnings of a research base. *Exceptional Children*, 78, 423–445. <https://doi.org/10.1177/001440291207800403>
- Gillam, R., & Carlile, R. (1997). Oral reading and story retelling of students with specific language impairments. *Language, Speech, and Hearing Services in Schools*, 28, 30–42.
- Jessup, B., Ward, E., Cahill, L., & Keating, D. (2008). Teacher identification of speech and language impairment in kindergarten students using the kindergarten development check. *International Journal of Speech-Language Pathology*, 10, 449–459. <https://doi.org/10.1080/17549500802056151>
- Laing, S. (2002). Miscue analysis in school-age children. *American Journal of Speech-Language Pathology*, 11, 407–416.
- Leonard, L., Caselli, M. C., Bortolini, U., McGregor, K., & Sabbadini, L. (1992). Morphological deficits in children with specific language impairment: The status of features in the underlying grammar. *Language Acquisition*, 2, 151–179. https://doi.org/10.1207/s15327817la0202_2
- Marchman, V. (1997). Children's productivity in the English past tense: The role of frequency, phonology, and neighborhood structure. *Cognitive Science*, 21(3), 283–304.
- Marchman, V., Wulfeck, B., & Weismer, S. (1999). Morphological productivity in children with normal language and SLI: A study of English past tense. *Journal of Speech, Language, and Hearing Research*, 42, 206–219.
- National Institute on Deafness and Other Communication Disorders. (2017). *NIDCD fact sheet: Specific language impairment in children*. Retrieved from <https://www.nidcd.nih.gov/health/specific-language-impairment>
- Oetting, J., Gregory, K., & Riviere, A. (2016). Changing how speech-language pathologists think and talk about dialect variation. *Perspectives of the ASHA Special Interest Groups*, 1(SIG 16), 28–37. <https://doi.org/10.1044/persp1.SIG16.28>
- Poll, G., Betz, S., & Miller, C. (2010). Identification of clinical markers of specific language impairment in adults. *Journal of Speech, Language, and Hearing Research*, 53, 414–429.
- Rice, M., Hoffman, L., & Wexler, K. (2009). Judgments of omitted BE and DO in questions as extended finiteness clinical

- markers of specific language impairment (SLI) to 15 years: A study of growth and asymptote. *Journal of Speech, Language, and Hearing Research*, 52, 1417–1433.
- Rice, M., Tomblin, J. B., Hoffman, L., Richman, W., & Marquis, J. (2004). Grammatical tense deficits in children with SLI and non specific language impairment: Relationships with nonverbal IQ over time. *Journal of Speech, Language, and Hearing Research*, 47, 816–834.
- Rice, M., & Wexler, K. (1996). Toward tense as a clinical marker of specific language impairment in English-speaking children. *Journal of Speech and Hearing Research*, 39, 1239–1257.
- Rice, M., & Wexler, K. (2001). *Rice/Wexler Test of Early Grammatical Impairment*. San Antonio, TX: The Psychological Corporation.
- Rice, M., Wexler, K., & Cleave, P. (1995). Specific language impairment as a period of extended optional infinitive. *Journal of Speech and Hearing Research*, 38, 850–863.
- Rice, M., Wexler, K., & Hershberger, S. (1998). Tense over time: The longitudinal course of tense acquisition in children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, 41, 1412–1431.
- Semel, E., Wiig, E., & Secord, W. (2003). *Clinical Evaluation of Language Fundamentals—Fourth Edition*. San Antonio, TX: The Psychological Corporation.
- Seymour, H., Roper, T., & de Villiers, J. G. (2003). *Diagnostic Evaluation of Language Variation—Screening Test*. Bloomington, MN: Pearson.
- Snowling, M., Bishop, D., Stothard, S., Chipchase, B., & Kaplan, C. (2006). Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. *The Journal of Child Psychology and Psychiatry*, 47, 759–765. <https://doi.org/10.1111/j.1469-7610.2006.01631.x>
- Tager-Flusberg, H., & Cooper, J. (1999). Present and future possibilities for defining a phenotype for specific language impairment. *Journal of Speech, Language, and Hearing Research*, 42, 1275–1278.
- Tomblin, J. B., & Nippold, M. (2014). *Understanding individual differences in language development across the school years*. New York, NY: Psychology Press.
- Tomblin, J. B., Records, N., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech, Language, and Hearing Research*, 40, 1245–1260.
- Weiler, B. (2016). *Tense marking in the general kindergarten population: Is there evidence of bimodal distribution?* (Unpublished doctoral dissertation). Vanderbilt University, Nashville, TN.
- Werfel, K. (2012). *Contributions of linguistic knowledge to spelling performance in elementary school children with and without language impairment*. (Unpublished doctoral dissertation). Vanderbilt University, Nashville, TN.
- Werfel, K., & Krimm, H. (2017). A preliminary comparison of reading subtypes in a clinical sample of children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, 60, 2680–2686. https://doi.org/10.1044/2017_JSLHR-L-17-0059
- Wiig, E., Secord, W., & Semel, E. (2013). *CELF-5 Screening Test*. San Antonio, TX: Pearson
- Williams, C. (2006). Teacher judgements of the language skills of children in the early years of schooling. *Child Language Teaching and Therapy*, 22, 135–154.
- Windsor, J., Scott, C., & Street, C. (2000). Verb and noun morphology in spoken and written language of children with language learning disabilities. *Journal of Speech, Language, and Hearing Research*, 43, 1322–1336.
- Woodcock, R. (2011). *Woodcock Reading Mastery Tests—Third Edition*. San Antonio, TX: Pearson.
- Zhang, X., & Tomblin, J. B. (2000). The association of intervention receipt with speech-language profiles and social-demographic variables. *American Journal of Speech-Language Pathology*, 9, 345–357. <https://doi.org/10.1044/1058-0360.0904.345>

Appendix A

Verbs in WRMT-III Oral Reading Fluency Subtest by Passage

Passage	Regular verbs	Irregular verbs	Excluded verbs
A	watched wanted watched popped watched looked	saw	was did was
B	wanted played played showed shared cleaned imagined	spent drew had	were liked (to) loved (to) did was
C	reached showed picked started practiced pointed answered	had went made blew had	had was was liked (the) asked (to)

Note. Words are presented in this table in the order they appear in passages. WRMT-III = Woodcock Reading Mastery Tests—Third Edition (Woodcock, 2011). The irregular verb “saw” in Passage A was excluded from analyses of irregular verbs, because it was the only token in the passage.

Appendix B

Illustration of +Finite Variable Calculation for a Hypothetical Child

Past tense target	Child reading	Response type					
		(a) accurate	(b) overmarked	(c) bare stem	(d) other verb inflection	(e) nonverb	(f) no response
watched	watched	x					
wanted	wanted	x					
watched	watcheded		x				
popped	pop			x			
watched	was watching				x		
looked	(omitted)						x
wanted	wild					x	
played	play			x			
played	played						
showed	should					x	
shared	shared	x					
cleaned	clean			x			
TOTAL		3	1	3	1	2	1

+Finite % = (a + b) / (a + b + c); for this child: (3 + 1) / (3 + 1 + 3) = 4/7 = 57%