Research Article

Morphological Awareness Skills of Second- and Third-Grade Students With and Without Speech Sound Disorders

Kenn Apel[a] and Victoria S. Henbest[b]

Purpose: Morphological awareness is the ability to consciously manipulate the smallest units of meaning in language. Morphological awareness contributes to success with literacy skills for children with typical language and those with language impairment. However, little research has focused on the morphological awareness skills of children with speech sound disorders (SSD), who may be at risk for literacy impairments. No researcher has examined the morphological awareness skills of children with SSD and compared their skills to children with typical speech using tasks representing a comprehensive definition of morphological awareness, which was the main purpose of this study.
Method: Thirty second- and third-grade students with SSD and 30 with typical speech skills, matched on age and receptive vocabulary, completed four morphological awareness tasks and measures of receptive vocabulary, real-word reading, pseudoword reading, and word-level spelling.
Results: Results indicated there was no difference between the morphological awareness skills of students with and without SSD. Although morphological awareness was moderately to strongly related to the students' literacy skills, performance on the morphological awareness tasks contributed little to no additional variance to the children's real-word reading and spelling skills beyond what was accounted for by pseudoword reading.
Conclusions: Findings suggest that early elementary-age students with SSD may not present with concomitant morphological awareness difficulties and that the morphological awareness skills of these students may not play a unique role in their word-level literacy skills. Limitations and suggestions for future research on the morphological awareness skills of children with SSD are discussed.

Morphological awareness often is defined as the ability to consider and manipulate the smallest units of meaning in language (e.g., Apel & Henbest, 2016; Carlisle, 2000; J. A. Larsen & Nippold, 2007). Researchers have demonstrated the powerful influence it has on reading and spelling (e.g., Carlisle, 2000; Deacon et al., 2009; Kirby et al., 2012; Nagy et al., 2006; Roman et al., 2009). In some studies, investigators have demonstrated that morphological awareness is the main or sole predictor of students' literacy abilities (e.g., Apel et al., 2012; Nagy et al., 2003; Siegel, 2008).

Students who present with combined speech and language impairments are at risk for or present with literacy deficits, including morphological awareness (e.g., Hulme & Snowling, 2014; Joye et al., 2019). However, much less is known about the morphological awareness skills of students with speech sound disorders (SSD) only. Students with SSD experience challenges in the production of specific phonemes or clusters of phonemes in the absence of other spoken language development issues (e.g., Farquharson, 2019). Given that almost 90% of all school-based speech-language pathologists (SLPs) serve students with SSD (American Speech-Language-Hearing Association, 2018), it is important to have a clear understanding of the morphological awareness skills demonstrated by these students. The purpose of this study, then, was to examine the morphological awareness skills of a group of second- and third-grade students reported to receive school-based special services for SSD only and compare them to age- and vocabulary-matched students with reported typical speech

[a]Department of Communication Sciences and Disorders, University of South Carolina, Columbia
[b]Department of Speech Pathology and Audiology, University of South Alabama, Mobile
Correspondence to Kenn Apel: kennapel@sc.edu

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and language skills. We also sought to determine how these students' morphological awareness skills related to and predicted their performance on measures of word-level reading and spelling.

Morphological Awareness Defined

In most investigations of students' morphological awareness abilities, researchers have used a general definition of the skill, such as the ability to consciously consider and manipulate the smallest units of meaning in language (e.g., Apel & Henbest, 2016; Carlisle, 2000; J. A. Larsen & Nippold, 2007; Wolter et al., 2009). Perhaps due to this general definition, the tasks used to assess morphological awareness have varied greatly across investigations, with many investigators using one or two tasks to assess morphological awareness (e.g., Katz & Carlisle, 2009; Kirby et al., 2012). When tasks differ across investigations, comparisons across studies are hampered because it may be that the differences in findings are due to the tasks themselves.

To address the issue of variation in measurement tasks, likely due to the use of a general definition of morphological awareness, Apel (2014) suggested that morphological awareness should be considered a multidomain ability that involves the conscious awareness of both spoken and written morphemes. Specifically, he proposed a four-domain model of morphological awareness, including the awareness of the following:

1. spoken and written forms of morphemes;
2. the meaning of affixes and the alterations in meaning and grammatical class they bring to base words/roots (e.g., *–ed* causes a verb to refer to the past, as in *walked*; *–er* can change a verb to a noun, as in *teach* to *teacher*);
3. the manner in which written affixes connect to base words/roots, including changes to the spellings of those base words/roots (e.g., some suffixes require a consonant to be doubled or dropped when attached to a base word/root in written form, such as in *hop* to *hopping* and *hope* to *hoped*); and
4. the relation between base words/roots and their inflected or derived forms (e.g., knowing that a variety of words are related because they share the same base word/root, such as *act, action, react,* and *activity*; Apel, 2014, p. 200).

Since that definition was introduced, Apel et al. (2019) experimentally demonstrated that morphological awareness is best described as a trifactor construct, represented at the levels of task items, domains (i.e., groups of tasks), and general morphological awareness (i.e., overall performance across tasks). At the domain level, there were four domains, each aligned with the domains suggested in Apel's (2014) definition of morphological awareness. This trifactor construct, however, has not guided previous studies of individuals' morphological awareness. In the past, investigations of young students' morphological awareness skills have relied more on a general and limited view of morphological awareness, leading to the use of a task or tasks that represented only one or two of the domains.

Morphological Awareness Development in the Primary Grades

Previous investigations have demonstrated the strong relation of morphological awareness to reading and spelling across a range of grade levels (e.g., Apel, Diehm, et al., 2013; Apel et al., 2012; Berninger et al., 2010; Kim et al., 2013). A subset of these investigations has included students in the primary grades, given the importance of early reading and spelling skills to later academic success (e.g., Hendrix & Griffin, 2017; McCutchen & Stull, 2015; Nagy & Townsend, 2012). Across studies, notable and strong growth in morphological awareness has occurred in the first through third grades (e.g., Apel, Diehm, et al., 2013; Berninger et al., 2010).

Investigators also have reported that early morphological awareness instruction can increase the morphological awareness and literacy skills of young students (e.g., Apel, Brimo, et al., 2013; Bowers et al., 2010; Goodwin & Ahn, 2010). Both a meta-analysis and a systematic review have demonstrated that students in the primary grades are apt to notably benefit from morphological awareness instruction (i.e., Bowers et al., 2010; Goodwin & Ahn, 2010), particularly students who are at risk for literacy deficits. More recent studies focused on morphological awareness instruction have confirmed those findings (e.g., Apel, Brimo, et al., 2013; Kirk & Gillon, 2007; McNeill et al., 2017), demonstrating statistically and clinically significant improvements in primary grade students' morphological awareness abilities and their literacy skills (e.g., reading nonsense words and real words, reading comprehension).

In addition to its relation to reading and spelling, morphological awareness appears to be notably related to vocabulary (e.g., McBride-Chang et al., 2005; Nagy, 2007; Sparks & Deacon, 2015; Spencer et al., 2015; Tong et al., 2011). For example, Spencer et al. (2015) examined whether vocabulary knowledge and morphological awareness represented one or two constructs. The researchers administered a series of morphological awareness tasks and two measures of vocabulary, one a receptive task and the other an expressive measure. Across two studies using fourth- and eighth-grade students, the investigators determined that morphological awareness and vocabulary were best represented as a single factor, suggesting that, at least for fourth- and eighth-grade students and the measures administered, they were representing the same construct. However, Tong et al. (2011) found that the morphological awareness skills of fifth-grade students with poor reading comprehension were different from their peers with typical skills, even after vocabulary skills were controlled statistically, suggesting some differences in students' vocabulary and morphological awareness skills. Such findings suggest

a noteworthy relation between morphological awareness and vocabulary.

Taken as a whole, morphological awareness contributes to and is highly associated with reading, spelling, and vocabulary abilities. Researchers have demonstrated that morphological awareness begins developing early in the school years; furthermore, morphological awareness instruction in those grades can lead to notable improvement in the morphological awareness and literacy abilities of students who are either typically developing or considered at risk for literacy difficulties. Interestingly, there is much less direct information on the morphological awareness skills of students with SSD. Some researchers have reported that children with SSD are at risk for literacy difficulties (e.g., Bishop & Adams, 1990; Peterson et al., 2009); however, only a small number of researchers have directly examined the morphological awareness skills of students with SSD only (e.g., Apel & Lawrence, 2011; Kirk & Gillon, 2007). Given the value of morphological awareness to literacy skills, it is important to understand potential skills that may or may not affect the literacy abilities of students with SSD only.

Morphological Awareness of Students With SSD

There have been a number of investigations of the morphological awareness skills of students who present with SSD and language impairment (e.g., Joye et al., 2019; Marshall & van der Lely, 2007) or language impairment only (e.g., Smith-Lock, 1995; Werfel et al., 2019). In general, results of those studies suggest primary grade students with language impairment, with or without SSD, demonstrate morphological awareness abilities below that expected for similarly aged students with typical language skills (e.g., Joye et al., 2019; Smith-Lock, 1995). Turning to students with SSD only, many research teams have examined their phonemic awareness (e.g., Bird et al., 1995; Mann & Foy, 2007) and reading and spelling skills (e.g., Lewis et al., 2002; Peterson et al., 2009), given phonemic awareness is a known contributor to literacy skills (e.g., Badian, 1995; Scarborough, 1998). Findings have been mixed. Some researchers have reported that students with SSD only perform significantly below their peers with typical speech on measures of phonemic awareness (e.g., Lewis et al., 2002; Mann & Foy, 2007; McNeill et al., 2017; Peterson et al., 2009) and reading and spelling (e.g., Bird et al., 1995; McNeill et al., 2017); others have not found differences in these abilities between students with and without SSD only (e.g., Bishop & Adams, 1990; Catts, 1993; Sices et al., 2007; Skebo et al., 2013).

To date, only a small number of investigators have specifically studied the morphological awareness skills of students with SSD only (i.e., Apel & Lawrence, 2011; Kirk & Gillon, 2007; McNeill et al., 2017). Apel and Lawrence (2011) assessed 44 first-grade students with SSD only on two measures of morphological awareness and compared their performance to 44 age-matched students with typical speech and language skills. The students with SSD only had no reported history of language impairment and scored below the 15th percentile on a norm-referenced measure of articulation. One measure of morphological awareness, similar to the classic task developed by Carlisle (1988), required the students to use an inflected or derived form of a given base word to complete a sentence (e.g., *"teach" Mrs. Smith is a ____* [teacher]) or use a base word of a given inflected form to complete a sentence (e.g., *"trees" I sat underneath the ____* [tree]). The students also were administered literacy (word-level reading and spelling) and literacy-related (phonemic awareness) measures. Apel and Lawrence reported that the students with SSD only performed significantly poorer than the students with typical skills on the morphological awareness tasks and the literacy and literacy-related measures. Furthermore, morphological awareness explained unique variance on the spelling measure for both groups; however, unlike their peers with typical speech and language skills, the morphological awareness abilities of the students with SSD only did not account for unique variance on the word-level reading measure.

McNeill et al. (2017) also sought to investigate directly the morphological awareness skills of twenty-eight 6- to 8-year-old students with SSD only. These students' skills were compared to 28 age-matched students and 28 students matched for reading abilities; all students were matched for vocabulary skills. The students with SSD only had either continuing or resolved SSD. These researchers administered a task similar to that of Apel and Lawrence (2011) that required the students to complete a sentence with its inflected or derived word when given its base word. Additionally, they administered a second task that required the students to determine whether a pair of words were related by morphological meaning (e.g., teach/teacher) or only shared an orthographic form (e.g., corn/corner). Compared to their age-matched peers, the students with SSD only scored significantly lower on the two morphological awareness tasks as well as on literacy (i.e., pseudoword reading and spelling) and literacy-related (i.e., phonemic and orthographic awareness) measures. These findings were true for both students with continuing and resolved SSD, although the former group performed lower than the latter group. The students with SSD only performed similarly to the reading-matched students on all measures but spelling; on that task, the students with SSD only scored lower than their reading-matched peers.

In a longitudinal investigation, Kirk and Gillon (2007) examined whether preschool students who received a speech production intervention with or without a phonological awareness component differed in their morphological awareness skills at 8 years of age. Specifically, one group of eight preschool students with SSD only (Group 1) had received an intervention aimed at reducing their speech errors as well as an instruction in phoneme awareness and letter knowledge. The other group of nine preschool students with SSD only (Group 2) had only received the speech improvement intervention. When the two groups of students reached the age of 8 years, they, along with a third group

of 8-year-old students with a history of typical speech and language development (Group 3), were administered two measures of morphological awareness. The first morphological awareness measure was a spelling dictation task in which the students spelled base words and a derived form (e.g., enjoy/enjoyment). For the second task, the students were required to determine whether the beginning of a derived word contained a smaller word (e.g., fame/famous). If the student agreed there was a smaller word, the student needed to state the small word and then whether the smaller word was related in meaning to the larger word. Overall, Group 1 and Group 3 performed significantly better than Group 2 on the spelling dictation task; there were no group differences on the second morphological awareness task.

Although these three investigations shed some initial light onto the morphological awareness skills of students with SSD only, much more information is needed. First, there is a discrepancy on whether primary grade students with SSD only differ from their peers with typical speech and language abilities in their morphological awareness abilities. Whereas Apel and Lawrence (2011) and McNeill et al. (2017) reported that primary grade students with SSD only performed significantly poorer than their peers with typical speech and language abilities on all morphological awareness tasks administered, Kirk and Gillon (2007) only found this be true for one of their two measures. It may be that the type of morphological awareness measure given leads to different performances. Second, all three research teams administered only two tasks to assess their student participants' morphological awareness skills, and those tasks differed across investigations. This latter fact may be due to the different investigators operating under a more general definition of morphological awareness rather than a more specific, multidomain definition (Apel, 2014; Apel et al., 2019). A group of measures that represent a more comprehensive definition of morphological awareness may provide a clearer view of the morphological awareness abilities of students with SSD only. Finally, not all investigators examined how the morphological awareness skills of students with or without SSD only related to or predicted their performance on reading and spelling tasks. Apel and Lawrence found that the morphological awareness skills of students with and without SSD only predicted spelling performance but not reading performance, unlike their peers with typical skills; the other two research teams did not examine this relation.

This Study

The purpose of this investigation, then, was to examine the morphological awareness skills of a group of second and third-grade students who had received or were continuing to receive special services in the schools because of their speech sound deficits. Our specific research aims were as follows:

1. Do students with SSD only differ from their age- and vocabulary-matched peers with typical speech skills in their morphological awareness abilities on tasks measuring different aspects of morphological awareness?
2. Do the morphological awareness skills of students with and without SSD only predict their performance on measures of word-level reading and spelling beyond that explained by a known contributor to literacy skills: phonemic awareness?

Based on findings from previous investigations (e.g., Apel & Lawrence, 2011; Kirk & Gillon, 2007; McNeill et al., 2017), we believed the students with SSD only would perform significantly poorer than their peers with typical skills on our measures of morphological awareness. However, given the well-documented strong relation between morphological awareness and literacy skills (e.g., Apel et al., 2012; Berninger et al., 2010), we believed that, for both groups, the students' morphological awareness skills would be related to and predict their performance on word-level literacy tasks.

Method

Participants

This study was part of a larger investigation of the morphological awareness skills of students in Grades 1 through 6 (Apel et al., 2019). In the larger study, 224 second-grade and 167 third-grade students, recruited from school districts in a southeastern state in the United States, participated in the study. Signed parental consent forms, approved by the university's institutional review board, were obtained for all participating students. According to parental report, 16 of the second-grade students had or were receiving school-based special services for SSD; none of these students was reported to have any spoken (i.e., oral) or written language difficulties or hearing loss. Nine of those 16 second-grade students were continuing to receive speech intervention; the other seven no longer needed treatment. Fourteen of the third-grade students also had parental report of special services solely for SSD and no hearing deficits. Five of those 14 third-grade students continued to receive speech services; the remaining nine did not. Fifteen second-grade and 15 third-grade students who, according to parental report, had not received any special services for speech, language, or reading/writing difficulties and had no reported hearing loss were chosen as students with typical speech abilities. These latter students were matched to the students with SSD only by age and receptive vocabulary skill. Parental report for all students indicated that no student was in a self-contained classroom and had never repeated a grade. One participant (with SSD only) spoke Spanish as a first language; all other participants spoke English as a first language. Specific demographic information for all second- and third-grade students is contained in Table 1.

The students with SSD only were matched to the students with typical skills by age (within 6 months) and

Table 1. Participant demographics.

Characteristic	Students with speech sound disorders: Second grade	Students with speech sound disorders: Third grade	Student with typical speech: Second grade	Student with typical speech: Third grade	Total sample
Male/female	9/7	7/7	6/9	7/8	29/31
M_{age}	7.91	8.87	8.0	8.93	8.43
Ethnicity					
Caucasian	7	11	7	8	33
African American	7	2	5	4	18
Hispanic	1		1		2
Asian		1		1	2
Native American	1				1
Multiracial			2	1	3
No response/prefer not to answer				1	1

vocabulary skills (within 18 raw score points). For the latter match, the students' performance on the Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007) was used to determine similarity in receptive, vocabulary skills. A Mann–Whitney *U* test confirmed that the two groups did not differ in age (p = .52) or vocabulary skills (p = .93 for raw score and .97 for standard score). We chose to match the students on receptive vocabulary to ensure similar language skills that also were within typical limits. Previous investigations have demonstrated that students with SSD who also present with a language impairment demonstrate lower morphological awareness skills compared to age-matched peers with typical language abilities (e.g., Joye et al., 2019; Marshall & van der Lely, 2007). We matched our two groups on age to ensure potential differences would not be caused by differences due to development.

Measures

The participants were assessed on four different measures of morphological awareness as part of a battery of measures administered in the larger investigation (Apel et al., 2019). The Appendix provides sample items from each measure. Each measure represented one of the four domains of morphological awareness (Apel, 2014; Apel et al., 2019). Table 2 provides information on how each task represented one of the four domains of the definition. In addition, each participant completed tasks measuring their word-level reading (real word and pseudowords), spelling, and vocabulary skills. These tasks are described in detail below. Testing occurred during the fall of the academic year.

Morphological Awareness Measures

Across the two grades, each task had the same number of items containing inflectional versus derivational affixes, the most common affixes (e.g., Baumann et al., 2003; Honig et al., 2000; White et al., 1989), and the same number of multimorphemic words that represented the following relations, when applicable, to their base words:

- transparent: base word was present both phonologically and orthographically in its inflected or derived form (e.g., *friend* and *friendly*);
- phonological shift: inflected or derived form of the base word represented a change in the base word's phonological form (e.g., *magic* and *magician*);
- orthographic shift: inflected or derived forms of the base word represented a change in the base word's orthographic form (e.g., *silly* and *silliness*); and
- opaque: inflected or derived forms of the base word represented a change in the base word's phonological and orthographic form (e.g., *busy* and *business*).

Within the set of measures for each grade, each task used base words that were at grade level (e.g., Learning by Design, 2010; Zeno et al., 1995), had similar word frequency levels (Zeno et al., 1995) with ranges of word frequencies to ensure a range of difficulty, and were not low-frequency/rare words (Standard Frequency Index below 30; e.g., Carlisle & Katz, 2006).

Affix identification task. Based on a task originally developed by Apel, Brimo, et al. (2013), the students were provided a list of 50 written pseudowords with real affixes (e.g., "rinning") and given 3 min to circle all affixes (i.e., "add-ons") they saw. The pseudowords were not read aloud. Two practice items, with corrective feedback, were provided. Cronbach's alpha for this task was .91 (second grade) and .88 (third grade).

Affix meaning task. Using the same format as Mitchell and Brady (2014), the students were asked to determine the correct inflectional or derivational pseudoword when given a definition of the base pseudoword (e.g., "If edam means 'sea,' which word means to go in the direction of the sea?" Choices: *edams, edamer, edamable, edamward*). This task contained 40 items that were presented in writing on a sheet of paper. Instructions and items also were presented via audio recordings. The students were instructed to circle which of the four choices was the best answer. They completed one practice item with corrective feedback. Cronbach's alpha for this task ranged between .81 (second grade) and .84 (third grade).

Derivational spelling task. For this task, based on the work of Sangster and Deacon (2011), the students were

Table 2. Tasks administered.

Task	Component of definition
Affix Identification Task	Awareness of written morphemes
Affix Meaning Task	Awareness of the meaning of affixes and the alterations in meaning and grammatical class they bring to base words
Derivational Spelling Task	Awareness of the manner in which written affixes connect to base words, including changes to those base words
Spoken Relatives Task	Awareness of the relation between base words and their inflected or derived forms

provided a paper sheet and asked to read a base word (e.g., *luck*) and three phonologically plausible word endings (e.g., *–y, –ie, –ey*); they then circled the correct suffix. This task had 25 items and two practice items. The items were read aloud while the students read along on their paper. Corrective feedback was provided for the two practice items. Cronbach's alpha for this task was .65 (second grade) and .71 (third grade).

Spoken relatives task. This task involved a cloze procedure of 15 items (e.g., see Apel, Brimo, et al., 2013) and was similar to a task used in previous investigations involving students with SSD only (e.g., Apel & Lawrence, 2011; Carlisle, 1988; McNeill et al., 2017). For seven of the items, the students were provided a base word (e.g., *farm*) and then a sentence (e.g., "My uncle is a ____.") and asked to complete the sentence with a form of the base word (i.e., *farmer*). For the remaining eight items, the students were provided a derived word (e.g., *bravery*) and were required to complete the sentence with the base form of the derived word (e.g., "I don't feel very _____ [*brave*].). As with the previous tasks, the students were presented with two practice items and corrective feedback. Cronbach's alpha for this task was .66 (second grade) and .75 (third grade).

Language and Literacy Measures

We assessed the students' language and literacy skills using a battery of measures used in previous investigations of the morphological awareness skills of students with SSD (e.g., Apel & Lawrence, 2011; Kirk & Gillon, 2007; McNeill et al., 2017). Furthermore, these measures were reported to have strong reliability.

The Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007) was used to match students with and without SSD only by their receptive vocabulary skills. The students were required to point to one of four pictures that matched a word spoken by the examiner. According to the authors' manual, split-half reliability for second- and third-grade students ranges from .91 to .97.

The Sight Word Efficiency subtest of the Test of Word Reading Efficiency (Torgesen et al., 1999) was used to measure the students' abilities to read single real words. The Phonetic Decoding Efficiency subtest of the Test of Word Reading Efficiency, which requires reading pseudowords, was also administered. Given the Phonetic Decoding Efficiency requires students to blend phonemes to correctly respond to the items, this subtest was used as a proxy for phonemic awareness abilities. On both measures, the students had 45 s to read as many words and pseudowords as they could. Across the two subtests, test–retest reliability, as reported in the authors' manual, is .89–.93 for students between the ages of 6 and 12 years.

The Test of Written Spelling–Fifth Edition (S. Larsen et al., 2013) was used to assess the students' spelling ability. The examiner said a word, used it in a sentence, and then said the word again. The students then were required to spell the word. This task was conducted at the group level to decrease testing time; thus, all students were required to spell all 50 words on the test. However, each student's responses were scored according to the measure's basal and ceiling guidelines. According to the authors' manual, Cronbach's alpha is .90–.94 for students ages 7–9 years.

Procedure

The students were administered three of the four morphological awareness tasks (Affix Identification Task, Affix Meaning Task, and Derivational Spelling Task), the two reading measures, and the spelling task, along with other measures that were part of the larger study (Apel et al., 2019), during large group testing either in their classroom or in another quiet room within their school (e.g., cafeteria). Total group testing time took between 45 and 90 min, depending on the size and ages of the group. At times, the group testing was delivered across two sessions, no more than 1 week apart. The remaining morphological awareness task (Spoken Relatives Task) and the Peabody Picture Vocabulary Test–Fourth Edition, along with other measures from the larger study, were administered individually in a quiet school location (e.g., library, cafeteria, unoccupied foreign language classroom, or science lab). Administration of the tasks included in the individual sessions lasted approximately 25–40 min and, again, was at times split into two sessions within 1 week of another. The tasks were randomized across group administrations and within individual settings. All tasks were administered by trained research assistants who were blind to the purpose of this investigation. The students' teachers received a small monetary remuneration to compensate them for interruptions to their daily schedules.

All tasks were scored by two different research assistants to ensure accuracy. Interscorer agreement for 15% of the total participants from the larger study (Apel et al., 2019) was 99% for second- and third-grade participants for the morphological awareness measures. Interscorer agreement

ranged from 92% to 100% for the standardized language and literacy measures.

Results

The students' overall mean raw and standard scores (when applicable) on all measures are presented in Table 3. As can be seen in the table, standard scores for the vocabulary and literacy measures were within the average range for both the students with and without SSD only. In regard to the morphological awareness measures, performance was low for the Affix Identification task. The average score of 7 (out of a potential 53–62 items) for both groups of children suggests that this task was particularly challenging. Furthermore, they responded correctly to less than half (6/15) of the items on the Spoken Relatives task. In contrast, the average student performance for the Affix Meaning and Derivational Spelling measures, which were in multiple-choice format, were above chance, suggesting some success with these tasks.

Prior to conducting inferential analyses to answer our research questions, the data were explored to determine their suitability for parametric statistics. According to a Shapiro–Wilk test, some of the data for some of the measures (e.g., Affix Identification, Affix Meaning, and Derivational Spelling) were not normally distributed ($ps < .04$). Thus, because our sample sizes for each group were also relatively small and some of the data were not normally distributed, nonparametric alternatives were conducted.

Comparison Between Scores of Children With SSD Only and Children With Typical Skills

To address our first research aim, which was to determine whether students with SSD differ from their peers matched for age and vocabulary in their performance on tasks measuring different aspects of morphological awareness, Mann–Whitney U tests were conducted. Results indicated no significant difference between the performances of each group on any of the morphological awareness measures (all $ps > .24$). Effect sizes were small for the Derivational Spelling and Spoken Relatives tasks (Cohen's $d = .31$ and .32, respectively) with the children with typical speech skills outperforming those with SSD only. Effect sizes were negligible for Affix Identification and Affix Meaning (Cohen's $ds = 0.009$ and 0, respectively). There were also no significant differences between the students' performances on the literacy measures ($ps > .40$).

Contribution of Morphological Awareness to Word-Level Reading and Spelling

Our second research aim was to examine the contribution of the morphological awareness skills of students with and without SSD only to their performance on measures of word-level reading and spelling. As a first step in addressing this aim, performance across the morphological awareness measures was summed to create a composite morphological awareness score. Next, Spearman correlations were conducted for each group. Results of the correlational analyses are presented in Table 4. Correlations among the literacy measures were strong and positive for both groups, ranging from .71 to .86. For the group of children with typical speech, the relation among performance on the morphological awareness tasks and the literacy measures were positive and moderate to strong, ranging from .63 to .69. In contrast, for the group of children with SSD only, the relation among the literacy measures and morphological awareness scores were positive, but weak to moderate, ranging from .41 to .62. Notably, the strength of the relation between performance of the

Table 3. Mean raw and standard scores (when applicable) for measures of language, literacy, and morphological awareness.

	Children with SSD[a]		Children with typical speech[a]	
Measure	**Raw score**	**Standard score**	**Raw score**	**Standard score**
Spoken language				
PPVT-4	137.10 (23.76)	104.40 (16.10)	138.33 (22.73)	104.63 (15.40)
Literacy				
TOWRE-2 SWE	55.10 (14.95)	98.50 (15.34)	55.67 (14.54)	97.13 (15.91)
TOWRE-2 PDE	23.03 (13.65)	91.40 (18.68)	25.10 (13.56)	94.33 (17.33)
TWS-5	17.10 (8.15)	94.97 (21.47)	18.83 (7.34)	97.73 (15.24)
Morphological awareness[b]				
Affix Identification (varied)[c]	7.27 (8.81)		7.20 (6.32)	
Affix Meaning (40)	17.47 (7.68)		17.47 (7.31)	
Derivational Spelling (25)	14.10 (4.05)		15.23 (3.31)	
Spoken Relatives (15)	6.03 (2.47)		6.90 (2.91)	

Note. Standard deviations for raw and standard scores are in parentheses. SSD = speech sound disorders; PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition; TOWRE-2 SWE = Test of Word Reading Efficiency–Second Edition Sight Word Efficiency; TOWRE-2 PDE = Test of Word Reading Efficiency–Second Edition Phonemic Decoding Efficiency; TWS-5 = Test of Written Spelling–Fifth Edition.

[a]Performance on all measures were not significantly different between the two groups. All $ps > .24$. [b]For Morphological Awareness measures, the number in parentheses next to task name represents the total number of items (i.e., possible points) for that task. [c]The Affix Identification task was timed so the total number of items varied across participants.

Table 4. Spearman correlations for measures of word-level reading, spelling, and morphological awareness for students with typical speech skills (above the diagonal) and students with speech sound disorders (below the diagonal).

Measure	TOWRE-2 (SWE)	TOWRE-2 (PDE)	TWS-5	Morphological Awareness
TOWRE-2 (SWE)	—	.84**	.71**	.63**
TOWRE-2 (PDE)	.85**	—	.86**	.66**
TWS-5	.81**	.82**	—	.69**
Morphological Awareness	.56**	.41*	.62**	—

Note. TOWRE-2 (SWE) = Test of Word Reading Efficiency–Second Edition (Sight Word Efficiency); TOWRE-2 (PDE) = Test of Word Reading Efficiency–Second Edition (Phonemic Decoding Efficiency); TWS-5 = Test of Written Spelling–Fifth Edition.

$^*p < .05$. $^{**}p < .01$.

children with SSD only on the phonemic decoding measure and morphological awareness was .25 less than the strength of this relation for the children with typical speech.

To determine the contribution of morphological awareness to word-level reading and spelling for each group of children, a series of hierarchical linear regressions were conducted. To provide some control for the impact of phonological awareness, pseudoword reading performance, which requires application of an individual's phonological awareness, was used as a proxy for phonemic awareness. Students' scores on this task were entered first in the regressions to be consistent with other investigations of the morphological awareness skills of students with SSD only (e.g., Apel & Lawrence, 2011) and because phonemic awareness is a known strong contributor to word-level reading and spelling (e.g., Badian, 1995; Scarborough, 1998). This was followed by the composite morphological awareness score. Table 5 displays the results of the regression models with real-word reading as the outcome, and Table 6 presents the results of the regression analyses when spelling was the outcome of interest.

Results from the regression analyses indicated that morphological awareness did not contribute any additional variance to the students' real-word reading above what was accounted for by pseudoword reading. Morphological awareness also did not account for any additional variance in the spelling performance of the children with typical speech skills. In contrast, morphological awareness accounted for a significant and additional 4.7% of variance in the spelling skills of the children with SSD.

As a post hoc consideration, power analyses were conducted to determine whether our sample sizes were large enough to detect non-null findings. In regard to the correlational analyses, to detect at least a moderate correlation (as with the relation between morphological awareness and decoding, $r = .41$), a sample size of 30 in each group yields a power value of .75. Thus, power was somewhat limited for detecting any weak correlations among the variables. However, given that all other correlations between morphological awareness and the literacy measures were moderate to strong (.56–.69), power was adequate at .97.

For the regression analyses, a power analysis revealed that we did not have enough power with our sample sizes to detect such a small change in R^2. According to a power analysis, to detect such a change, a sample size of 691 would have been required in each group. Given this analysis, such a small effect would not be clinically meaningful even if statistical significance were reached with a substantially larger sample.

Discussion

The purpose of this study was twofold. First, we examined whether students with reported SSD only performed differently on measures of morphological awareness compared to their peers with typical speech abilities. We also

Table 5. Regression analysis for prediction of performance on real-word reading (Test of Word Reading Efficiency–Second Edition, Sight Word Efficiency) for children with typical speech and children with speech sound disorders (SSD).

Variables	R^2	Adjusted R^2	ΔR^2	F	β	p	df
Children with typical speech							
Step 1							
TOWRE-2 PDE	.675	.663	.675	58.087	.821	< .001	(1, 28)
Step 2							
Morphological Awareness	.688	.665	.014	1.173	.145	.288	(1, 27)
Children with SSD							
Step 1							
TOWRE-2 PDE	.696	.685	.696	64.148	.834	< .001	(1, 28)
Step 2							
Morphological Awareness	.722	.702	.026	2.54	.182	.123	(1, 27)

Note. ΔR^2 = change in R^2; TOWRE-2 PDE = Test of Word Reading Efficiency–Second Edition, Phonemic Decoding Efficiency.

Table 6. Regression analysis for prediction of performance on word-level spelling (Test of Written Spelling–Fifth Edition) for children with typical speech and children with speech sound disorders (SSD).

Variables	R^2	Adjusted R^2	ΔR^2	F	β	p	df
Children with typical speech							
Step 1							
TOWRE-2 PDE	.792	.785	.792	106.811	.890	< .001	(1, 28)
Step 2							
Morphological Awareness	.800	.785	.008	1.023	.109	.321	(1, 27)
Children with SSD							
Step 1							
TOWRE-2 PDE	.671	.659	.671	57.103	.819	< .001	(1, 28)
Step 2							
Morphological Awareness	.718	.697	.047	4.488	.244	.043	(1, 27)

Note. ΔR^2 = change in R^2; TOWRE-2 PDE = Test of Word Reading Efficiency–Second Edition, Phonemic Decoding Efficiency.

determined whether the morphological awareness skills of both groups were related to, and explained unique variance on, norm-referenced measures of real-word reading and spelling. We anticipated that we would find differences between the two groups in their morphological awareness skills. We also believed that the morphological awareness skills of all students would relate to and predict their reading and spelling abilities. In both cases, our hypotheses regarding each research question were not supported. There appear to be several reasons for the incongruity between our hypotheses and our actual findings.

On all measures of morphological awareness, there were no significant differences between the performances of the students with and without SSD only. Although these findings were contrary to what we expected and that have been reported by some researchers (e.g., Apel & Lawrence, 2011; McNeill et al., 2017), they were consistent with other reported findings on the morphological awareness abilities of students with SSD only (i.e., Kirk & Gillon, 2007; McNeill et al., 2017) and may highlight the heterogeneous nature of the language skills of students with SSD. For example, Apel and Lawrence (2011) and McNeill et al. (2017) reported that their elementary-age students with SSD only performed significantly poorer than age-matched peers on morphological awareness tasks and norm-referenced measures of reading and spelling. However, students with SSD only performed similarly to their reading-matched peers on morphological awareness measures (McNeill et al., 2017). Although we matched the students with and without SSD only on age and vocabulary, when we examined the word-level reading skills, we found no significant differences between the two groups. Thus, it seems that when students with SSD only have similar reading skills as their peers with typical speech abilities, their morphological awareness skills are commensurate as well. This finding is not all that surprising given the important role morphological awareness plays in reading and spelling development (e.g., Carlisle, 2000; Deacon et al., 2009; Roman et al., 2009). Given this finding, SLPs should ensure that the word-level reading skills of students with SSD are evaluated to determine that word-level reading and morphological awareness skills are with typical limits. SLPs may directly assess students' reading skills or work collaboratively with other professionals who assess students' reading abilities (American Speech-Language-Hearing Association, 2001, 2016).

The similar level of morphological awareness skills found between students with and without SSD only also may have occurred because the two groups were matched for vocabulary. Our decision to match the groups by receptive vocabulary abilities was to ensure that neither group demonstrated below age expectations in an area of spoken language. Given that past reports suggest that students with language impairment, with or without a concomitant SSD, perform lower than their peers with typical speech and language skills on literacy and literacy-related measures (Joye et al., 2019; Werfel et al., 2019), we chose to ensure our students with SSD only presented with speech difficulties. However, researchers have demonstrated the close relation between vocabulary and morphological awareness (e.g., Nagy, 2007; Tong et al., 2011). Thus, it may be that the corresponding level of vocabulary skills between the two groups served as a proxy for their morphological awareness skills. In the future, researchers may wish to include groups of students with and without SSD that are matched by age and language ability using a measure of spoken language ability other than receptive vocabulary.

Our findings about the similarity in morphological awareness skills between students with and without SSD only also reflect the outcomes of some studies of the phonemic awareness, reading, and spelling skills of students with SSD only (e.g., Bishop & Adams, 1990; Catts, 1993; Sices et al., 2007; Skebo et al., 2013). For example, Sices et al. (2007) reported that their 3- to 6-year-old children with moderate-to-severe SSD performed significantly lower than typical limits on norm-referenced measures of reading and writing readiness when a language impairment accompanied the SSD; severity of SSD did not account for lower performance on the literacy tasks when spoken language skills were taken into account. Findings from Skebo et al. (2013) were similar. For students with SSD only, unlike

their counterparts with SSD and language impairment, vocabulary predicted their word-level reading and reading comprehension skills. For the students with SSD and language impairment, "overall language abilities" (i.e., performance on the Clinical Evaluation of Fundamentals–Third Edition; Semel et al., 1995) predicted the students' reading abilities. Thus, across studies of the literacy and linguistic awareness skills of students with SSD only, it may be that these abilities resemble those of their peers with typical speech and language skills when spoken language skills are within the typical range.

The fact that the morphological awareness skills were no different than those of students with typical speech abilities may be due partially to SLPs' growing awareness of the importance of integrating linguistic awareness activities into their speech services. For some time now, research has shown that the integration of phonemic awareness activities into the treatment of speech disorders leads to positive outcomes for both speech and phonemic awareness (e.g., Gillon, 2005; Kirk & Gillon, 2007). More recently, research suggests that SLPs are also aware of the importance of morphological awareness and, indeed, are integrating morphological awareness activities into their speech and language interventions (Good, 2019). In a recent survey of 105 SLPs, Good found that the majority of respondents (83.5%) reported they addressed morphological awareness as part of the services they provided to their clients. With SLPs' increased attention to morphological awareness, it may be that students with SSD only are improving in their morphological awareness skills concomitantly with improvements in their speech abilities. As others have suggested (e.g., Goodwin & Ahn, 2010), researchers could further examine the impact of an integrated speech sound and morphological awareness intervention on morphological awareness abilities.

We also examined whether the morphological awareness skills of students with and without SSD only related to and accounted for unique variance in their performance on real-word reading and spelling measures. We examined the contributions of the students' morphological awareness skills, along with their performance on a pseudoword reading task that served as a proxy measure for phonemic awareness. The pseudoword reading measure was the sole contributor to all students' performance on the real-word reading task. This outcome may be related to the reading task itself. Given the age of the students and the testing starting point on the task, the real-word reading measure contained few words that were multimorphemic. It may be, then, that the lower demands for the use of morphological awareness to recognize words resulted in the lack of contributions of morphological awareness to real-word reading.

Although morphological awareness did not relate to or account for additional variance beyond pseudoword reading for the students with typical skills on the spelling task, it was associated with and explained additional variance, above pseudoword reading, for the students with SSD only. Apel and Lawrence (2011) reported a similar finding for their students with SSD only. The differences we found for how morphological awareness contributes to spelling between our two student groups are interesting. First, as with the reading task, the students encountered few multimorphemic spelling words. Thus, our expectation was that similar findings to the real-word reading regressions would be found. It may be the difference in the contributions of morphological awareness to spelling between the groups was due to their performance on the pseudoword reading tasks and its contributions to spelling performance. For the students with SSD only, the relation between their performance on the pseudoword reading task and the morphological awareness composite score was notably weaker than the relation for students with typical skills. Furthermore, the performance on the pseudoword reading task for the students with SSD only was slightly lower than that of the students with typical skills, contributing approximately 66% to their performance on the spelling task. These students' morphological awareness abilities contributed another 4%. Thus, both variables accounted for 70% of the students' performance in spelling. However, for the students with typical language skills, pseudoword reading explained almost 79% of their spelling performance, a much larger contribution than that of the pseudoword reading skills of the students with SSD only. Thus, there was less variance to explain on their spelling performance. It would be useful in the future to determine whether similar outcomes occur when a standard measure of phonemic awareness is used.

To ensure our morphological awareness tasks represented our definition of morphological awareness, we used four different tasks, representing each of the four domains of the definition. To prepare for the regression analyses completed, we conducted correlational analyses that determined the relation among those four tasks as well as between each morphological awareness task and the reading and spelling measures. As can be seen in Table 4, two of the morphological awareness tasks significantly and moderately correlated with each other (the Affix Meaning and Derivational Spelling tasks; correlation coefficient = .42). The other two morphological awareness tasks did not correlate with any of the other morphological awareness measures. The finding that all the morphological awareness tasks did not significantly correlate with each other was not surprising given that Apel et al. (2019) found that morphological awareness was best described as a trifactor construct (i.e., the task domain and the general morphological awareness levels). The trifactor model supported four domains, commensurate with our definition of morphological awareness. Importantly, in that model, the four domains were not related to each other; instead, they related to the overall or general level of morphological awareness. Because of the model, then, we combined the tasks representing the four domains into a general measure of morphological awareness that was used for the regression analyses. In future studies, researchers could use different morphological awareness tasks representing the four domains to determine whether the different tasks affect the

relation between the measures themselves as well as between the individual measures and reading and spelling tasks.

There are several limitations to this study that are important to note. First, the students with SSD were identified by parent report; a second source of information, such as results on a standardized articulation task, were not implemented. Although other research teams have used parental report as a means of identifying SSD (e.g., Peterson et al., 2009), future investigations may wish to duplicate our procedures using students with SSD who have more than one source confirming the presence of SSD. Second, we did not differentiate whether students were currently receiving speech services or the level of severity of the speech difficulties. Some researchers have suggested that differences in whether an SSD is resolved or unresolved and that the severity of the SSD may lead to differences in literacy and literacy-related outcomes (e.g., McNeill et al., 2017; Peterson et al., 2009); others report no differences based on resolution of the disorder or its severity (e.g., Farquharson, 2019; Skebo et al., 2013). A future investigation that addresses these potential influencing factors on morphological awareness abilities might shed additional light on the morphological awareness skills of students with SSD. Third, the diversity of the sample was somewhat limited (e.g., minimal students of Hispanic heritage). The sample diversity for our study was influenced by the local demographics. In the future, a more robust representation of students from diverse backgrounds should be considered when assessing the morphological awareness skills of students with SSD. Finally, our sample size was relatively small. Different results may have occurred with larger group sizes.

In summary, our findings suggest that the morphological awareness abilities of early elementary-age students with SSD only, who also demonstrate typical word-level reading and vocabulary skills, are commensurate with those of same-age students with typical speech skills. In addition, for both students with and without SSD, morphological awareness appears to contribute little to no variance on reading and spelling skills, above the contribution of pseudoword reading. Our findings may be due to increased awareness of SLPs on the importance of phonemic and morphological awareness and their integration into speech intervention activities. SLPs should continue to address the phonological awareness and morphological awareness skills of the students on their caseloads with SSD and/or concomitant language disorder. With such a focus, SLPs may be able to decrease the at-risk nature of students with SSD for later reading and spelling difficulties.

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Appendix

Sample Items From Morphological Awareness Measures

Affix Identification Task. Students circled affixes ("add-ons") in nonsense words (affixes bolded and underlined below).

1. grett**ing**
2. **bi**counble
3. peclid**less**
4. **dis**cail

Affix Meaning Task. Students circled which of four choices was the correct inflectional or derivational pseudoword when given a definition of the base pseudoword (correct choice bolded below).

If juft means "joy," then which word means full of or having the quality of joy?

1. jufts
2. **juftious**
3. jufted
4. overjuft

If jad means "color," then which word means to change color for the worse?

1. **disjad**
2. jads
3. jadful
4. rejad

Derivational Spelling Task. Students circled the correct suffix when provided a base word and three phonologically plausible word endings (correct choice bolded below).

The machine helped to ______ the cups with the team's logo on them.

1. **plasticize**
2. plastic
3. plasticity
4. plastics

Our family was waiting for my cousin's __________.

1. arriving
2. **arrival**
3. arrive
4. arrived

Spoken Relatives Task. Students provided a base word (or derived word) and asked to choose the correct derived word (or base word) to complete a sentence.

Act When he grows up, he wants to be an ___________________. (actor)
Hardest The students thought the test was really_______________________. (hard)