Published in final edited form as:
Lang Speech Hear Serv Sch. 2013 October ; 44(4): . doi:10.1044/0161-1461(2013/12-0013).

The relation of linguistic awareness and vocabulary to word reading and spelling for first grade students participating in Response to Intervention

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Abstract

Purpose—We examined the relations of phonological, morphological, and orthographic awareness and vocabulary to word reading and spelling for first grade children who were receiving differentiated instruction in a Response to Intervention (RTI) model of instruction (N = 304).

Method—First grade children were assessed on their phonological, morphological, and orthographic awareness, expressive vocabulary, word reading, and spelling. Year-end word reading and spelling were outcome variables while phonological, morphological, and orthographic awareness, expressive vocabulary, and RTI status (Tiers 1, 2, & 3) were predictor variables assessed in the middle of the school year.

Results—The three linguistic awareness skills were unique predictors of word reading and phonological and orthographic awareness were unique predictors of spelling. The contributions these linguistic awareness skills and vocabulary made to word reading and spelling did not differ by children's RTI tier status.

Conclusion—These results, in conjunction with previous studies, suggest that even beginning readers and spellers draw on multiple linguistic awareness skills for their word reading and spelling regardless of their level of literacy skills. Educational implications are discussed.

Keywords

phonological awareness; morphological awareness; orthographic awareness; metalinguistic awareness; vocabulary; word reading; spelling; RTI

Children's ability to think about and manipulate various aspects of language, or their linguistic awareness skills, contributes to their reading and writing development (e.g., Apel & Masterson, 2001; Bear & Templeton, 1998; Ehri & McCormick, 1998; Moats, 2000; Schlagal, 2001; Siegler, 1996). Researchers have documented that children's awareness of sounds (phonological awareness), letter(s) patterns (orthographic awareness), and word meaning and relations among words based on meaning (vocabulary and morphological awareness) influences their acquisition of word reading and spelling skills (e.g., Bird, Bishop, & Freeman, 1995; Burgess & Lonigan, 1998; Castles & Coltheart, 2004; Deacon, Kirby, & Casselman-Bell, 2009; Ouellette & Senechal, 2008; Torgeson, Wagner, &

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Rashotte, 1994; Wolter, Wood, & D'zatko, 2009). Importantly, however, many investigations of the influence of children's linguistic awareness abilities on their development of literacy skills have focused on one of these linguistic awareness skills. Thus, although these studies have informed the field regarding the individual influences each ability makes to literacy development, we still have a limited understanding about the unique contributions these skills make when considered in tandem, particularly for beginning readers and spellers. Such insight could guide early literacy interventions and inform Response to Instruction (RTI) implementation (Individuals with Disabilities Education Improvement Act, 2004). RTI is a new, widely-used approach to provide differentiated instruction and early intervention to children in the United States (e.g., Gersten et al., 2009; Zirkel & Thomas, 2010). However, to date the field lacks guidance about how various linguistic awareness skills might differentially influence word reading and spelling outcomes as a function of both children's language and literacy skills and reading instruction that they receive. The purpose of this study was to examine the combined impact of first grade children's phonological, orthographic, and morphological awareness skills and vocabulary on their lexical level literacy skills (i.e., word reading and spelling) and to examine whether any influence from these linguistic skills on literacy abilities varied by children's RTI status.

According to the connectionist (or triangle) model of reading, word reading in English depends on three critical component processes: phonology, orthography, and semantics (Plaut, McClelland, Seidenberg, & Patterson, 1996; Sidenberg, 2005). This influential model also has been applied to spelling acquisition (Treiman, 1993). The role of phonology (or phonological awareness) in word reading and spelling has been widely recognized (National Institute of Child Health and Human Development [NICHD], 2000) as word reading requires converting letters to sounds and spelling requires representation of sounds using letters. Although necessary, phonological awareness is not sufficient; orthographic awareness also is necessary because both word reading and spelling involve knowing and representing letters and letter patterns. In addition, knowledge of word meanings (vocabulary) is hypothesized to interact with orthography and phonology and contribute to word reading (Duff & Hulme, 2012; Nation & Snowling, 2004; Oullette, 2006; Ricketts, Nation, & Bishop, 2007). Due to inconsistent grapheme-phoneme correspondences in English, children's semantic knowledge might help them read words over and above phonological and orthographic awareness, particularly irregular words in English (Ricketts et al., 2007). It should be noted that although the connectionist model of word reading includes semantics (vocabulary), vocabulary has been primarily examined for its contribution to reading comprehension (e.g., NICHD, 2000); only recently has the direct influence of vocabulary on word reading been examined (Nation & Snowling, 2004; Oullette, 2006; Ricketts, Nation, & Bishop, 2007). On the other hand, vocabulary has received little attention for its potential relation to spelling (Oullette & Sénéchal, 2008). Findings from the few existing studies have shown weak to moderate relations of vocabulary to spelling (Caravolas, Kessler, Hulme, & Snowling, 2001; Sénéchal & LeFevre, 2002). In contrast, many studies have examined the role of morphological awareness in word reading (e.g., Carlisle, 1995; Carlisle & Nomanbhoy, 1993; Casalis & Louis-Alexandre, 2000; Mahony, Singson, & Mann, 2000; Roman, Kirby, Parrila, Wade-Woolley, & Deacon, 2009) and spelling (e.g., Bourassa, Treiman, & Kessler, 2006; Deacon & Bryant, 2005; Kim, 2010; Nagy, Berninger, & Abbott, 2006). In the present study, we investigated the unique contributions of vocabulary and morphological awareness to word reading and spelling in addition to phonological awareness and orthographic awareness.

In recent years, a few research teams have investigated the simultaneous effects of phonological, orthographic, and morphological awareness skills on reading and spelling abilities. However, results are not clear developmentally across grades or by outcomes

(word reading or spelling). Despite the recognized role of phonological awareness in word reading and spelling (NICHD, 2000; National Research Council, 1998; Wagner, Torgesen, & Rashotte, 1994), its unique and independent contribution to either reading or spelling, over and above morphological awareness and orthographic awareness, is not robust. Phonological awareness was found to be uniquely related to word reading for first graders (Ortiz et al., 2012) and struggling second graders (Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003), and to nonword reading for struggling second graders (Nagy et al., 2003) and for more advanced readers (i.e., 4th, 6th, and 8th grade; Roman et al., 2009). In contrast, phonological awareness was not uniquely related to word reading for students in the primary grades (Apel, Wilson-Fowler, Brimo, & Perrin, 2012) and in middle school (Roman et al., 2009), or to spelling for students in the primary grades (Apel et al., 2012; Walker & Hauerwas, 2006).

Similarly, findings about the unique role of morphological awareness to word reading and spelling over and above phonological awareness and orthographic awareness are somewhat mixed. Morphological awareness in kindergarten was uniquely related to reading (word reading and reading comprehension combined) in first grade students (Ortiz et al., 2012), to word reading for second and third grade students (Apel et al., 2012), and to spelling for second (Apel et al., 2012) and third grade students (Apel et al., 2012; Walker & Hauerwas, 2006). In contrast, morphological awareness was not uniquely related to word reading for struggling second and fourth grade students (Nagy et al., 2003) or among typically developing fourth, sixth, and eighth grade students (Roman et al., 2009); or to spelling for first and second grade students (Walker & Hauerwas, 2006) or for struggling second and fourth grade students (Nagy et al., 2003). However, orthographic awareness does appear to be somewhat more consistently related to word reading and spelling, as it has been found to be uniquely related to spelling for primary grade students (Apel et al., 2012; Walker & Hauerwas, 2006), and to word reading for typically developing (Apel et al., 2012) and struggling primary grade students (Nagy et al., 2003), and for typically developing fourth, sixth, and eighth grade students (Roman et al., 2009). To our knowledge, no study has examined a unique role of vocabulary to word reading and spelling in English after accounting for the three linguistic awareness skills.

These mixed findings of the unique roles of phonology, orthography, and morphology might be attributed to multiple factors in previous studies including differences in grades and ages, and differences in the methods (e.g., how word reading, spelling, and linguistic awareness were measured). Furthermore, these studies tended to have small sample sizes (*Ns* ≤ 50 per grade; exceptions were samples in Ortiz et al., [2012] and in Nagy et al. [2003]), which might have influenced statistical significance. Thus, additional information is needed regarding the unique influence of phonology, orthography, morphology, and vocabulary on the early stages of literacy development. Findings from such studies will inform developmental theory. For example, in the past, many researchers advocated for a stage theory of literacy development, such that different linguistic awareness skills are acquired in a step-wise fashion over time, and that different linguistic awareness skills influence literacy skills during different phases (e.g., Bear & Templeton, 1998; Ehri & McCormick, 1998; Moats, 2000). However, the findings reviewed above suggest that even beginning readers and spellers are acquiring the three linguistic awareness skills and vocabulary, and that these skills might be impacting literacy acquisition simultaneously, although the exact nature and patterns are still unclear.

Knowledge of developmental relations of phonology, orthography, morphology, and vocabulary and how they may influence students' response to beginning reading has important educational and practical implications for implementation of RTI. The RTI model is used in all 50 states as an early intervention approach (Jenkins, Hudson, & Johnson, 2007;

Speece, Case, & Molloy, 2003). In RTI, students are typically screened to determine which students have weak literacy skills and to provide them with supplemental literacy intervention. Although RTI models differ in terms of how weak skills are defined, how much intervention students receive, and how responsiveness is defined, most models involve multiple tiers of increasing intervention intensity. The foundation for these models is Tier 1, or evidence-based classroom instruction and screening. Typically, Tier 2 is provided in addition to Tier 1 to students with weak skills; if the students do not respond positively, they receive more intensive help at Tier 3. These extra tiers involve increasingly smaller group sizes, more instructional time, more expert teaching, and often, different intervention materials (see Al Otaiba et al., 2011).

Even at an early phase of literacy acquisition, children vary widely in their phonology, orthography, morphology, and vocabulary knowledge as well as word reading and spelling (Apel & Apel, 2011; Cassar & Treiman, 1997; Ouellette & Sénéchal, 2008). Thus, if the nature of relations differs for children with varying linguistic awareness skills, then supplemental intervention at Tiers 2 and 3 could be differentiated as a function of children's skill level not only for reading, but also for language. If the nature of the relations is similar, then what may need to be varied is the pacing or intensity of instruction rather than content.

In our current investigation, students were screened and were assigned a risk level at the start of first grade, followed by random assignment within classrooms to two types of intervention (see below for details). To date, there has been no investigation about whether phonological, orthographic, and morphological awareness, and vocabulary are differentially related to literacy abilities in children at different tiers of intervention (RTI). Determining whether the impact of these linguistic awareness skills differs by students who vary in literacy ability and receive differential instruction based on a RTI model should provide additional information on which to situate developmental theory and inform practice. Thus, the purpose of this study was to determine the unique contributions of phonological, orthographic, morphological awareness skills, and vocabulary to word reading and spelling in first grade children participating in a year-long evaluation of a three tier RTI implementation. The existing literature suggests no clear patterns for the effects of linguistic awareness skills on reading and spelling across a developmental spectrum, but instead suggests that multiple linguistic awareness skills might be at play (e.g., Apel et al., 2012; Roman et al., 2009; Walker & Hauerwas, 2006). For instance, it has been shown that even novice spellers use morphological and orthographic knowledge in their spelling (Cassar & Treiman, 2009; Ouellette & Sénéchal, 2008). Thus, we hypothesized that there might be no to minimal differences among students in the three tiers regarding the contributions of the three linguistic awareness skills to literacy abilities. In other words, although children's performance level might be different, the extent to which component skills contributes to word reading and spelling might not differ for children in different tiers.

Method

Participants and Schools

A total of 304 first grade students (157 girls; mean age = 6.92 years, *SD* = .38) participated in the study. These represented all consented students from 28 classrooms in five schools serving a variety of socioeconomic (SES) backgrounds, but predominantly lower SES, within a school district in a southeastern US state. The number of participants per class who were consented and who completed the study varied from 5 to 17 with a mean of 10.86 (*SD* = 3.30). All schools and teachers used the Open Court Reading program (Bereiter, et al., 2002) for approximately 90 minutes per day as their Tier 1 core reading program. All schools were in their second year of RTI implementation. Approximately 61% of the children were African American, 27% Caucasian, and 9% multiracial. Three percent were

listed as "other." By design, the majority of the children (72%) qualified for free and reduced lunch status.

These students were participating in a larger study investigating the efficacy of an RTI framework (Al Otaiba et al., 2011). In this larger study, all 304 consented students were screened at the beginning of the academic year (within 6 weeks after school started) on several literacy measures, including a measure of teacher judgment of severity of reading difficulties. These initial screening were used to develop school norms and results discerned who had the weakest initial reading skills from their school peers. To be eligible for supplemental tiers of intervention, students were required to score below the 40th percentile for their school on at least three of four screening measures of real and pseudoword reading, letter-sound knowledge, and letter identification or for their teachers judge them to have severe reading difficulties. Further, they were excluded from intervention if they read above a standard score of 95 on both the Word Identification and Passage Comprehension subtests of the Woodcock Johnson, Third edition (WJ-III; Woodcock, McGrew, & Mather, 2001). Thus, the sample for the present study included all students, whose screening results indicated they had low risk and were initially eligible for Tier 1 only (n = 167; mean age = 6.66 [SD = .49]), those eligible to receive Tier 2 intervention (n = 119; mean age = 6.73 [SD = .58]), and those to receive Tier 3 intervention (n = 18; mean age = 6.56 [SD = .49]). A one-way ANOVA and chi-square tests revealed no significant differences across the three tiers in age, gender, or free and reduced price lunch participation. Based on this initial sorting to tier eligibility, students were then randomly assigned to one of two researcher-administered RTI models. In the Typical RTI model, after screening for eligibility, children received Tier 1 at the beginning of the year and were eligible for Tier 2 if they did not respond to Tier 1 by the second screening 8 weeks later. By contrast, in the Dynamic RTI model, children who were eligible were assigned immediately to receive Tier 2 or 3. Preliminary findings indicated no significant differences in the present sample of students' literacy skills between these two conditions in the middle of the academic year (Al Otaiba et al., 2011). In the present investigation, we used data from middle and end of the school year. To summarize, students were receiving intervention at one of three tiers: Tier 1 (90 minutes per day of classroom literacy instruction), Tier 2 (two, 30-minute supplementary sessions per week in groups of 5-7), or Tier 3 (four, 45-minute supplementary sessions per week in groups of 3). Children's mean performances in the screening measures at the beginning of the year and middle of the year are presented in Appendix A. In the present study, the linguistic awareness and vocabulary predictors were assessed in the middle of the year and the literacy outcomes were assessed at the end of the school year.

Measures

Phonological, orthographic, and morphological awareness skills, vocabulary ability, and children's tier status (i.e., Tiers 1, 2, and 3) served as primary predictor variables. The students' word reading and spelling skills served as the outcome measures.

Phonological awareness—The students were administered two subtests from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999): the Blending subtest (20 items) and the Elision subtest (20 items). Each item was scored as correct or incorrect. The total number of correct items represented the total raw score. Internal consistency estimates were .89 and .92 for the blending and elision tasks, respectively for 6 year old children. Test-retest reliability estimates were .88 for the blending and elision tasks for 5-7 year old children.

Orthographic awareness—An experimenter-designed task (50 test items and 1 practice item) was used to assess the students' awareness of orthographic patterns and rules. Each

item contained two pseudowords, one of which violated English orthography. The English orthographic violations included consonant vowel doubling (e.g., *akke - noop*), vowel/consonant representations of the vocalized/l/and/r/phonemes (e.g., *tibl – tible, kr - ker*), positional constrains on the use of letters for the/k/(e.g., *chacke – chake*), phonological context rules for the use of digraphs for the/ch/phoneme (e.g., *litch – lich*), orthotactic rules for marking the 'rk' versus 'rc' blends (e.g., *sork-sorc*), rules for representing the/a/and/k/phonemes (e.g., *chank – changk*), and the contextual rules for representing the vocalized/l/phoneme after consonant doubles (e.g., *fottle – fottel*). After the examiner modeled the task using the practice item, the students were requested to look at each word pair and to circle the word that "most looked like a real word." Each item was scored as correct or incorrect and the total number of correct items represented the total raw score. Internal consistency (Cronbach's alpha) for this task was .90.

Morphological awareness—The morphological awareness measure also was an experimenter-designed task (40 test items and 1 practice item). For each item, the students heard a word (e.g., *happy*) followed by a sentence with a missing word (e.g., *"When the student did not get an A, he was very _____."*) and were instructed to complete the sentence with a related word. The items to be completed represented inflected words (e.g., *socks, cries*), derivational words with prefixes (e.g., *unusual, disappear*), and derivational words with suffixes (e.g., *driver, helpful*). The first half of the inflected and derived words were phonologically and orthographically transparent with their base forms (e.g., *happy – unhappy*). The latter half of the inflected and derived words involved a phonological and/or orthographic change from their base forms (e.g., *cry – cries*). Each item was scored as correct or incorrect and the total number of correct items represented the total raw score. Internal consistency for this task was .92.

Vocabulary—The students' expressive vocabulary was assessed using the Picture Vocabulary subtest of the WJ-III (Woodcock et al., 2001) which required the students to name pictured objects. Each item was scored as correct or incorrect and the total number of correct items represented the total raw score. Woodcock et al. reported a Cronbach's alpha of .70 for 6-year-old children.

Word Reading—To assess word reading ability, the students were administered the Letter Word Identification subtest of the WJ-III (Woodcock et al., 2001) which required students to identify letters and then to read words. Each item was scored as correct or incorrect and the total number of correct items represented the total raw score. Woodcock et al. reported a Cronbach's alpha of .92 for 6-year-old children.

Spelling—The students' spelling abilities were assessed using the spelling subtest of the WJ-III (Woodcock et al., 2001). This subtest is a dictation task in which students are asked to spell words of increasing difficulty. The research assistant read each word, read the sentence with the word, and then repeated the spelling word (e.g., *"Dog. I took my dog to the park. Dog"*). Each item was scored as correct or incorrect and the total number of correct items represented the total raw score. Woodcock et al. reported a Cronbach's alpha of .92 for 6-year-old children.

Procedures

All predictor measures (i.e., phonological awareness, morphologic awareness, and vocabulary) were individually administered across three sessions within a span of six weeks in the middle of the school year (approximately 5th and 6th months). The only exception was the group-administered (typically 3-5 children) orthographic awareness task which was administered after all individualized tests were completed (e.g., approximately 7th month).

Outcome measures were administered at the end of the academic year (9th month). All measures were administered by undergraduate and graduate assistants trained by the authors. Due to the complexity of the RTI project, all staff members were aware of assignment to condition. Under more ideal circumstances, assessors would be blind to condition. Because of this potential problem, we explained to assessors that experimenter bias could undermine an otherwise very carefully planned study (e.g., Rosenthal & Rosnow, 1984). Task administration occurred in the students' schools.

Results

Descriptive statistics and correlations

Table 1 shows means, standard deviations, and minimum and maximum scores for predictor and outcome variables by students' tier. Where available, standard scores are reported. Notably, by the end of the year, students' word reading and spelling standard scores were in the average range compared to norm samples. Multivariate Analysis of Variance (MANOVA) was used to compare mean performances of the students initially eligible for Tier 1-only, Tier 2, and Tier 3. Significant differences were found (F [2, 294] > 15.06; ps < .001). Post hoc tests (i.e., Bonferroni) showed that Tier 1 students outperformed Tier 2 and 3 students on all the measures (ps < .001) but that Tier 2 students did not differ from Tier 3 students on any measure after the Bonferroni correction (statistical significance at p <. 004 = .05/12). Finally, as shown in Table 2, all the variables were statistically significantly related (ps < .001). Morphological awareness, phonological awareness, vocabulary, and orthographic awareness measures were all moderately related to end of year word reading and spelling (.41 ≤ rs ≤ .63). In addition, morphological awareness, phonological awareness, vocabulary, and orthographic awareness measures were somewhat weakly (r = .27 between orthographic awareness and vocabulary) to moderately (r = .68 between morphological awareness and vocabulary) related with each other. It should be noted that children's performance on the blending and elision tasks were examined separately although both tasks captured phonological awareness, given suggestions from previous studies that various phonological awareness tasks are differentially related to literacy skills (e.g., Katzir et al., 2006).

Contributions of Linguistic Awareness and Vocabulary Skills to Word Reading and Spelling

To address our research question, multilevel models were fitted, using SAS 9.2 Proc Mixed procedures, for the spelling and word reading outcomes to account for nesting of children within classrooms. The unconditional models showed that intra-class correlations were .14 and .08 in the spelling and word reading outcomes, respectively. In other words, 14% and 8% of the total variance in the spelling and word reading tasks were attributable to variation among classrooms. The students' tier status was included as dummy variables with Tier 1 as the referent group.

The final model results are shown in Table 3. When the outcome was spelling, the students' performance on phonological awareness measured by the elision task (p < .001) and orthographic awareness (p < .001) were uniquely and positively related after accounting for all the other variables in the model. The students' performances on phonological awareness measured by the blending task, morphological awareness, and vocabulary were not uniquely related to spelling after accounting for the other variables in the model. When the outcome was word reading, morphological awareness, orthographic awareness, and phonological awareness (both elision and blending) were uniquely and positively related (ps < .02) whereas vocabulary was not (p = .15). The main effects of tiers were statistically significant such that students in Tiers 2 and 3 had lower mean performances than Tier 1 students by

2.93 and 3.74 words in the spelling task, and by 4.57 and 4.82 words in the word reading task after accounting for other predictors in the model (see the main effects of Tier 2 and Tier 3 variables in the model). In other words, by the end of the year following participation in RTI, after accounting for all the other predictors in the model, students eligible for Tier 1 after the second screening (middle of the academic year) outperformed classmates receiving Tiers 2 and 3 in both word reading and spelling. Interaction terms between the linguistic awareness skills and vocabulary, and tier status were systematically included in the models to examine whether the effects of the linguistic awareness skills varied as a function of children's tier status. For both outcomes, no interaction terms were statistically significant (*ps* > .05) and thus not included in the final model, indicating there were no differences in the contributions that three linguistic awareness skills and vocabulary made as a function of students' tier status.

Discussion

The purpose of this study was to determine the unique contributions of phonological, orthographic, and morphological awareness skills, and vocabulary knowledge to the word reading and spelling skills of first grade children. The children were part of an RTI model of assistance and were receiving either Tier 1, 2, or 3 interventions. We found that the three linguistic awareness skills (phonological, orthographic, and morphological awareness) were unique predictors to word reading and phonological and orthographic awareness were unique predictors of spelling. The unique contributions these linguistic awareness skills made to word reading and spelling were similar regardless of student's initial RTI tier status. We discuss our findings and their implications below.

Contributions of Linguistic Awareness Skills and Vocabulary to Word Reading and Spelling

The phonological, orthographic, and morphological awareness skills of the first grade students in our investigation were all uniquely related to their word reading abilities whereas vocabulary was not after accounting for the other three linguistic awareness skills. These findings differed somewhat from those of Ortiz et al. (2012), the only other research team to examine the influence of these three linguistic awareness skills on the word reading skills of first grade children. In their investigation, Ortiz et al. used kindergarten linguistic awareness ability to predict first grade reading (combined word reading and reading comprehension), and found that children's phonological and morphological awareness skills predicted their reading skills whereas orthographic awareness skills did not. The differences between the findings of the two studies (i.e., unique contribution of orthographic awareness) may be explained in several ways. First, Ortiz et al. measured their students' linguistic awareness skills when the children were in kindergarten. Thus, it may be that differences resulted from age of testing: kindergarten children may have different profiles and abilities than first grade children. In addition, the reading outcome in Ortiz et al was a combined measure of word reading and reading comprehension, and word reading ability in kindergarten was included as a control variable. Finally, we used different measures of orthographic awareness than did Ortiz et al.; we used a task that required the students to consider allowable orthographic patterns whereas Ortiz et al. required the students to name letters, which is typically considered as alphabet letter knowledge. While both tasks may tap into orthographic knowledge (Apel, 2011), they require different levels of linguistic awareness. It may be that the orthographic task used in our investigation required a higher level of linguistic awareness and thus better represented the orthographic awareness demands associated with recognizing words when reading. In the future, investigators may wish to examine whether the type of orthographic awareness task affects the impact the skill has on word reading.

When spelling was the outcome variable, a slightly different result was obtained. Phonological awareness and orthographic awareness, but neither morphological awareness nor vocabulary, uniquely influenced spelling ability. These results are divergent from Walker and Hauerwas (2006), who examined the influence of first grade students' three linguistic awareness skills on spelling and found that orthographic awareness alone predicted spelling. However, there are two caveats to the findings of Walker and Hauerwas. First, their outcome variable was the spelling of inflected verbs, which is a much more narrow outcome variable than was used in the present study. Second, they combined the results of their first grade students with those of second grade students. Thus, any developmental differences due to age or grade could not be determined. It may be that phonological awareness ability could have impacted spelling skills had it been examined for the first grade students alone. However, Nagy et al. (2003) also found that orthographic awareness alone accounted for variance on spelling in a group of second grade students at risk for literacy development, presumably a group of students with skills similar to younger (e.g., first grade or lower) students. Although these researchers (Nagy et al.; Walker & Hauerwas) did not find that phonological awareness skills, when examined in tandem with other linguistic awareness skills, influenced spelling ability in students in the early stages of spelling development, our findings suggest that phonological awareness skills do impact spelling ability after accounting for other linguistic awareness skills and vocabulary. Given the theoretical importance of phonological awareness, and converging findings supporting the importance of phonological awareness in word reading and spelling (National Research Council, 1998; NICHD, 2000; Lonigan, Schatschneider, & Westberg, 2009), additional research is required to better understand the unique role of phonological awareness skill, in combination with other linguistic awareness abilities, for literacy development.

In our study, morphological awareness did not uniquely contribute to spelling, a finding contrary to those of other investigations with second through fourth grade students (e.g., Apel et al., 2012; Nagy et al., 2003; Walker & Hauerwas, 2006). The finding may be due to several reasons. First, it is possible that first grade students who, on average, are still in the beginning stage of spelling, might depend on phonological and orthographic awareness to a larger extent than on morphological awareness. Although children are likely to draw on multiple linguistic awareness skills for spelling, the weight of contributions of multiple linguistic skills to spelling might differ across developmental span in literacy acquisition. Second, discrepant results might be attributed to different types of tasks used across the studies. Walker and Hauerwas (2006) required their participants to spell inflected words. Thus, it seems logical that a relation would exist, given that their morphological awareness was a cloze task focused on inflectional morphology. Apel et al. required their participants to spell between 30 and 50 words from the Test of Written Spelling-4 (TWS-4; Larsen, Hammill, & Moats, 1999), a list of words that contained inflected and derived words. In the present study, the children also were required to spell words from a norm-referenced measure that contains inflected and derived words (i.e., WJ-III). However, unlike Apel et al., testing was terminated when children reached the ceiling as defined by the test manual. It may be that our participants spelled less multi-morphemic words, which may have limited the influence of morphological awareness on spelling. The relation between spelling and morphological awareness, then, may depend on the degree to which students are required to spell inflected and derived words. Future investigators should examine how different measures of morphological awareness and spelling influence the unique role morphological awareness in spelling.

Vocabulary also was not uniquely related to word reading or spelling over and above phonological awareness, orthographic awareness, and morphological awareness. Although previous studies suggest a unique role of vocabulary to word reading (Oullette, 2006) and irregular word reading (Ricketts et al., 2007), these studies did not include any of the three

linguistic awareness skills included in the present study. An exception from another orthography, however, is relevant; one study with young Korean-speaking children (Kim, 2010) also found vocabulary was not uniquely related to word reading or spelling after accounting for phonological awareness, orthographic awareness, morphological awareness, and rapid automatized naming. However, these findings are not directly comparable due to differences in orthographic depth (Share, 2008) between English and Korean. The Korean language has a relatively transparent orthography where phoneme-grapheme correspondences are largely consistent and truly irregular words do not exist (Kim, 2011). Therefore, sublexical strategies (phonology, orthography, and morphology) might largely explain variation in word reading (Katz & Frost, 1992) and spelling without additional facilitation of semantic information. According to the present study, vocabulary does not appear to be uniquely related to word reading and spelling for English-speaking first graders as well after accounting for linguistic awareness skills. However, it is not clear whether this is true for children who are more advanced in their literacy skills (e.g., grade two and three), or whether results differ as a function of type of words (irregular words vs. regular words). Future efforts are needed to replicate and expand our understanding about the relation of vocabulary to lexical level literacy skills.

We did not find any statistically significant differences among the three RTI tier groups in the effects of the three linguistic awareness skills on year-end reading or spelling once students were given intervention. Taken together with previous studies with struggling readers in second and fourth grade (Nagy et al., 2003) and typically developing readers (e.g., Apel et al., 2012; Ortiz et al., 2012; Walker & Hauerwas, 2006), it appears that linguistic awareness at mid-year did not differentially contribute to reading and spelling outcomes of children, based on their initial eligibility to different Tiers. However, caution needs to be exercised with this interpretation for two reasons. First, the sample size for Tier 3 was small, which might have influenced the results. Second, the participating children tended to have relatively high performance in their word reading and spelling measured by the WJ-III compared to the norm sample (*mean standard scores* = 91.28 and 99.78 in spelling and word reading for those in Tiers 2 and 3, respectively). However, interesting to note is large differences in standard scores between the WJ-III measures and scores on the TOWRE Sight Word Efficiency (one of the initial screeners). According to the latter, children in Tiers 2 and 3 were poor readers at the beginning of the year with mean standard scores below 80. Future studies are needed to investigate these discrepancies in standard scores.

It should be noted that although the nature of relations between linguistic awareness and lexical level literacy skills (word reading and spelling) did not differ as a function of children's tier grouping, there remained performance differences between children in Tier 1 vs. those in Tier 2 and Tier 3 in the word reading and spelling tasks even after accounting for all the predictors in the model. That is, after accounting for individual differences in phonological awareness, morphological awareness, orthographic awareness, and vocabulary, children in Tiers 2 and 3 had lower average scores in word reading and spelling. These results suggest a need to explore additional factors influencing these children's performance on word reading and spelling. Given the classroom level variation in the outcomes (8% and 14%, respectively, for word reading and spelling), classroom level predictors such as instructional quality and the extent of differentiated instruction could be explored as potential explanatory factors. Furthermore, additional child level factors such as executive functions (e.g., working memory, self-regulation) might be potential predictors to examine in future studies.

Our finding that students' phonological, orthographic, and morphological awareness skills related to their word reading and spelling skills supports more current theories of literacy development that characterize literacy development as relying on multiple linguistic

awareness skills simultaneously across development (e.g., Apel & Masterson, 2001; Bourasssa & Treiman, 2009; Rittle-Johnson & Siegler, 1999; Siegler, 1996). Unlike stage theories (e.g., Bear & Templeton, 1998; Ehri & McCormick, 1998; Moats, 2000), these repertoire or "overlapping waves" theories suggest that children have access to and utilize their phonological, orthographic, and morphological awareness skills when engaged in word reading and spelling, with the use of those linguistic awareness skills varying based on the requirements of the literacy task. The present findings support this notion. Their phonological and orthographic awareness contributed to spelling; all three linguistic awareness skills uniquely influenced word reading. These findings suggest that the children had access to all three linguistic awareness abilities and utilized them differently depending on the literacy task.

There are several limitations to our findings that should be addressed. First, results are based on correlational data and thus causal inferences cannot be made. Although theoretical accounts of word reading and spelling specify causal roles of the linguistic awareness skills, bidirectional relation has been suggested as well (e.g., spelling influencing phonological awareness – Hecht & Close, 2002). In addition, the results in the present study show a snapshot across an important, but brief developmental spectrum. Thus, longitudinal studies are needed to investigate the relations of the linguistic awareness skills to word reading and spelling. Second, our findings are based on the specific linguistic awareness and literacy tasks that were used in the present study. Thus, it is possible that different outcomes would have resulted had other measures been used. In the future, investigators should determine the role that specific tasks play in studies of the impact of linguistic awareness skills on reading and spelling ability. Third, there was a brief lag between administration of the orthographic awareness task and the phonological and morphological awareness tasks due to practical reasons of administering a large battery of assessments. Although we obtained similar results as other researchers for the impact of orthographic awareness on reading and spelling (e.g., Apel et al., 2012; Walker & Hauerwas, 2006), it would have been optimal to have administered the orthographic awareness task at the same time as the other two linguistic awareness measures. Fourth, the number of students in each tier differed. In particular, the number of children in Tier 3 was small (n = 18 compared to n = 167 and n = 119 for students in Tiers 1 and 2, respectively). Although this imbalance reflects a natural phenomenon in the schools and reliable achievement differences were observed in the models (Table 3), we acknowledge that, statistically, it would informative to have similar sample sizes in each group. For instance, lack of statistically significant differences in mean performances between Tier 2 and Tier 3 students and interaction effects might be attributed to the small sample size for the Tier 3 group. Fifth, causal experiments could inform intervention efforts by manipulating training in the three skills of phonological, orthographic, and morphological awareness to examine child by treatment interactions with larger samples of students with language and reading impairments. Finally, by design, the majority of our participants was African American and came from low-income homes. It is unclear whether similar results would be obtained from different populations. However, given that children from low-income homes are considered to be at risk for literacy difficulties (e.g., National Research Council, 1998), this population was important to study for practical purposes. Studies have shown that poverty and its common correlates (e.g., lower parental education) strongly influence children's developmental trajectories in oral language and emergent literacy skills and conventional literacy skills (Arnold & Doctoroff, 2003; Bradley & Corwyn, 2002; Kaplan & Walpole, 2005). For instance, children from lower SES backgrounds often demonstrate lower phonological awareness than children from middle income homes (Lonigan, Burgess, Anthony, and Barker, 1998) as well as smaller expressive and receptive vocabulary (Arriaga, Fenson, Cronan, & Pethick, 1998).

Future Educational Implications

Although the findings of the present study are correlational and have limited causal implications, we cautiously suggest the following educational implications. First, as mentioned above, our results suggest that first grade students, varying in their literacy abilities, show a similar pattern of relations between linguistic awareness skills and lexical level literacy skills. As such, educators and other specialists (e.g., speech-language pathologists) may apply similar assessment and instructional practices to all students in the process of acquiring their literacy skills. Specifically, it appears that educational professionals might benefit from assessing students' abilities in all three linguistic awareness skill areas to determine the need for instruction or remediation (e.g., Apel, Masterson, & Brimo, 2011). Using this prescriptive assessment approach, educational or clinical goals can be tailored for students' specific needs. Likewise, the present findings suggest a multi-linguistic approach to literacy instruction which emphasizes the different linguistic awareness skills as foundational skills for reading and spelling (Apel et al., 2012).

In conclusion, our results suggest that first-grade children who were enrolled in three different tiers of an RTI model utilized their phonological, orthographic, and morphological awareness skills when reading and spelling words. That is, it appears that literacy development is best characterized as a “conjoined” acquisition process (Berninger, Abbott, Nagy, & Carlisle, 2010) in which children use a repertoire of linguistic awareness skills to read and write (Apel & Masterson, 2001). These findings add to the literature base because, to date, no research has studied the impact of these three linguistic awareness skills on reading and spelling ability in a cohort of first grade students who receive differential instruction based on an RTI framework. With additional investigations of the linguistic awareness skills of young students with different literacy abilities, developmental theory and educational practices may be better informed.

Acknowledgments

This work was partially supported by the grant P50 HD052120 from the National Institute for Child Health and Human Development. The opinions expressed are ours and do not represent views of the funding agencies. The authors wish to thank all the participating schools, students, and their parents.

Appendix A

Mean standard score (standard deviation) of students in Tiers 1, 2, and 3 in the Woodcock Johnson – III (WJ) word reading and sight word efficiency at the beginning and middle of the academic year.

		Beginning of the year	Middle of the year
WJ Letter Word Identification	Tier 1	110.62 (10.73)	114.86 (9.97)
	Tier 2	93.10 (10.17)	99.48 (11.00)
	Tier 3	88.39 (8.29)	99.17 (7.25)
TOWRE Sight Word Efficiency	Tier 1	94.36 (11.39)	102.25 (13.22)
	Tier 2	77.33 (9.16)	84.08 (12.63)
	Tier 3	70.61 (7.42)	83.50 (9.59)

Note: Spelling was not used as a screening measure at the beginning and middle of the academic year, and thus not reported here.

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Table 1

Descriptive statistics of measures included in the study (spelling, word reading, morphological awareness phonological awareness, vocabulary and orthographic awareness) for the entire sample and students by tiers.

	Entire Sample (N = 304)		Tier 1 (n = 167)		Tier 2 (n = 119)		Tier 3 (n = 18)	
	Mean (SD)	**Min – Max**	**Mean (SD)**	**Min – Max**	**Mean (SD)**	**Min – Max**	**Mean (SD)**	**Min – Max**
Spelling – raw	24.14 (5.50)	9 – 39	27.24 (4.29)	18-39	20.69 (4.41)	9-29	18.28 (3.14)	14-25
Spelling – SS	105.32 (15.60)	61 – 145	113.86 (11.84)	80-145	95.51 (13.60)	61-124	91.28 (9.18)	71-106
Word reading – raw	37.38 (7.71)	16 – 62	41.82 (5.80)	30-62	32.37 (6.17)	16-43	29.78 (5.85)	18-40
Word reading – SS	109.30 (12.66)	64 – 141	116.06 (8.98)	90-141	101.37 (11.91)	64-123	99.78 (9.70)	78-113
Morphological awareness – raw	16.73 (7.48)	0 – 36	19.83 (6.89)	5-36	13.38 (6.39)	0-28	10.33 (5.95)	3-22
PA Elision task – raw	8.38 (4.27)	0 – 20	10.16 (4.15)	4-20	6.55 (3.28)	0-16	3.94 (2.64)	0-9
PA Elision task – SS*	9.02 (4.40)	0 – 19	10.08 (4.63)	0 – 19	7.94 (3.74)	0 – 15	6.17 (3.20)	0 – 11
PA Blending task – raw	14.72 (3.25)	1 – 20	15.58 (2.84)	8-20	13.86 (3.38)	4-19	12.44 (4.89)	1-19
PA Blending tsk – SS*	13.50 (2.68)	5 – 19	14.20 (2.41)	9 – 19	12.72 (2.66)	6 – 18	12.11 (3.38)	5 – 17
Expressive vocabulary – raw	19.05 (3.14)	10 – 28	20.13 (2.87)	12-28	18.01 (2.95)	10-25	16.00 (2.35)	11-19
Expressive vocabulary – SS	98.27 (11.06)	60 – 127	102.31 (9.62)	75-127	94.13 (10.79)	60-116	88.39 (9.31)	67-100
Orthographic awareness – raw	37.14 (8.51)	16 – 53	41.01 (7.43)	16-53	32.62 (7.30)	18-51	31.11 (7.23)	21-50

Note: PA = Phonological awareness; raw = raw score; SS = Standard score; SD = Standard deviation; Min = minimum score; Max = maximum score;

* Standard scores for these are in the scale of mean = 10 and SD = 3 whereas the others are in the scale of mean = 100 and SD = 15.

Table 2

Pearson bivariate correlations (two tailed) among variables (N = 304).

	1	2	3	4	5	6
1. Spelling	---					
2. Word Identification	.87	---				
3. Morphological awareness	.53	.59	---			
4. PA Elision task	.62	.62	.57	---		
5. PA Blending task	.42	.45	.53	.44	---	
6. Expressive vocabulary	.41	.47	.68	.47	.36	---
7. Orthographic awareness	.63	.58	.40	.42	.32	.27

Note: All coefficients are statistically significant at .001 level.
PA = Phonological awareness

Table 3

Fixed effects and variance components from multilevel models for the spelling and word reading outcomes.

	Spelling		Word reading	
	β (s.e.)	**p**	**β (s.e.)**	**p**
Fixed effects				
Intercept	11.38 (1.93)	<.001	19.38 (2.72)	<.001
Morphological awareness	.04 (.04)	.26	.14 (.06)	.01
PA Elision task	.35 (.06)	<.001	.41 (.09)	<.001
PA Blending task	.14 (.07)	.06	.23 (.10)	.02
Expressive vocabulary	.04 (.09)	.61	.17 (.12)	.18
Orthographic awareness	.21 (.03)	<.001	.21 (.04)	<.001
Tier 2	-2.93 (.52)	<.001	-4.57 (.78)	<.001
Tier 3	-3.74 (.95)	<.001	-4.82 (1.36)	<.001
Variance components				
Level 1 – individuals	11.07		20.51	
Level 2 – classrooms	.35		2.00	

PA = Phonological awareness