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Using Multiple Measures of Morphological Awareness to Assess its Relation to Reading

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Purpose: Morphological awareness refers to the ability to consider and manipulate consciously the smallest units of meaning in language. In previous studies investigating students' morphological awareness, no consistent task has been used to measure this skill across grade levels and comparisons among studies have been based on tasks, which measured different aspects of morphological awareness. The overall purpose of our study was to address some of these shortcomings in the literature. **Method:** We investigated whether 156 kindergarten, first, and second grade students from low socioeconomic homes would perform differently by grade on four tasks we created to assess different aspects of morphological awareness. We also sought to determine whether the different tasks uniquely predicted reading abilities above phonological awareness at each of the three grade levels. **Results:** We found that two tasks, one that required students to consider the meaning relations between morphologically related words, and one that required students to identify written affixes within a timed task, differentiated students across grades. Further, although different tasks predicted real word and pseudoword reading and reading comprehension at different grade levels, the former task, with its focus on meaning relations, most frequently related to and predicted the students' reading skills across the three grades. **Conclusion:** Our results provide guidance about tasks that are suitable for young children from high poverty homes when assessing their morphological awareness abilities and provide direction for clinicians and future researchers when deciding how to assess morphological awareness within early elementary students. **Keywords:** *assessment*, *elementary school*, *low socioeconomic status (SES)*, *morphological awareness*, *reading*

MORPHEMES are the smallest units of meaning in a language. Morphemes can be free morphemes, also called base words (i.e., simple, stand-alone words, such as *bat*, *run*, or *ugly*), or they can be bound morphemes or affixes (i.e., prefixes and suffixes that are added onto base words, such as *bats*, *rerun*, and *uglier*). Affixes that modify a base word by changing the number or tense of the base word are called inflectional morphemes (e.g., *cats*, *jumping*, *bits*, *helped*). Affixes that alter a base word by changing its meaning and/or its word class are termed derivational morphemes (e.g., *undo*, *dislike*, *friendly*, *teacher*). In cases where the base word can be heard and seen in print within a derived word (e.g., *grow/growth*), the derivation is said to be phonologically and orthographically transparent (Carlisle & Stone, 2005). However, when the base word is either not heard (e.g., *heal/health*), and/or seen in print (e.g., *agile/agility*; *close/closure*),

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then the derivation is considered to be more opaque in nature (McCutchen, Green, & Abbott, 2008).

Morphological use occurs when speakers and typically more mature writers engage in the process of communicating without consciously thinking about the morphemes they are speaking or writing. Morphological awareness, on the other hand, occurs when individuals consciously think about and/or manipulate morphemes within a word (e.g., Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003). As such, morphological awareness is a meta-linguistic skill, given that an individual consciously considers this aspect of language. Morphological awareness includes awareness of the spoken and printed forms[1] of morphemes, the meaning affixes bring to base words (e.g., how *-ed* causes a verb to refer to the past or how *re-* means something occurred again), the manner in which printed affixes connect to base words (e.g., how some suffixes require a consonant to be doubled or dropped when attached to a base word in written form), and the relation between base words and their inflected or derived forms (e.g., knowing that a variety of words are related because they share the same base word, such as *act*, *action*, *react*, and *activity*). For this study on morphological awareness, we were interested in whether several measures of morphological awareness uniquely predicted reading abilities, above phonological awareness, in kindergarten, first, and second grade students from low-income homes.

[1]It is important to note that our definition of morphological awareness includes the conscious awareness of *printed* morphological forms, which may seem to include a confound between morphological awareness and orthographic knowledge. However, the awareness or knowledge of affixes and the manner to which they are connected to base words is an aspect of written language specific to morphological forms versus more general orthographic knowledge.

Morphological awareness development and its relation to reading

Research has shown that morphological awareness develops across time, beginning as early as the kindergarten years and progressing across the elementary school years (e.g., Anglin, 1993; Carlisle, 1995; Kirby et al., 2012; Mahony, Singson, & Mann, 2000; Nagy, Beringer, & Abbott, 2006). Some researchers have investigated students' morphological awareness abilities using spelling tasks because of the morphophonemic nature of the English language. English orthography preserves the spelling of a bound morpheme to highlight its meaning despite phonemic changes that may occur (e.g., pronouncing the past tense form *-ed* as the /t/ phoneme). For example, Treiman and Cassar (1996) asked students as early as first grade to spell words that ended with consonant clusters, a task that typically is difficult for children of this age. Some of these words represented base words (e.g., *feast*), whereas others represented base words with suffixes (e.g., *laced*). The researchers found that the children represented the clusters in the two-morpheme words significantly more often than chance, suggesting they had at least implicit understanding that the words contained two morphemes. Berninger, Abbott, Nagy, and Carlisle (2010) used growth curve analysis to determine morphological awareness development in first through sixth grade students. The students completed several morphological awareness tasks that contained both inflectional and derivational morphemes. Berninger et al. found that the students made the most growth from first to third grade but that they continued to develop their skills across the remaining three grades. Thus, morphological awareness skills begin developing early and continue throughout several years of childhood.

Importantly, students' performance on measures of morphological awareness significantly predicts their literacy skills. Even when other known predictors of literacy abilities are considered, morphological awareness

continues to be a unique predictor of literacy skills (Apel, Wilson-Fowler, Brimo, & Perrin, 2012; Deacon & Kirby, 2004; Deacon, Kirby, & Casselman-Bell, 2009; Mahony et al., 2000). For example, Apel et al. found that morphological awareness explained unique variance on the word-level reading, spelling, and reading comprehension performance of first through third grade students, above that explained by phonemic awareness or vocabulary. Deacon and colleagues found that morphological awareness uniquely contributed to pseudoword reading, single word reading, and reading comprehension skills above phonological awareness skills, intelligence (e.g., Deacon & Kirby) and short-term memory (Deacon et al.). Based on such findings, experts (e.g., Kirby et al., 2012) have argued that strong morphological awareness skills benefit students by allowing them to interpret or decipher unknown multimorphemic words (e.g., reading the word *cyberloafing* for the first time and comprehending its meaning based on understanding each of its three morphemes). When students successfully apply such a morphological analysis to an unknown word, word-level understanding occurs and, because of reduced demands at the word level, text-level comprehension is facilitated. Further, because application of this analysis process may increase reading speed, reading fluency may improve. Thus, morphological awareness can facilitate word-level reading, reading fluency, and reading comprehension (Kirby et al., 2012).

Measures of morphological awareness

Studies of morphological awareness development and its contributions to literacy development have employed a variety of tasks to assess this important skill. Judgment tasks, production tasks, and analogy tasks are among the major types, each with several subvarieties.

A large number of investigations have included judgment tasks, in which students are asked to make decisions about the semantic relation between two words (e.g., "Does moth come from mother?") (Berninger et al., 2010; Ku & Anderson, 2003; Mahony et al., 2000; Nagy et al., 2006). These tasks typically require a yes/no response. Several other investigators have used tasks that also involved judgments of semantic accuracy; these typically use multiple-choice items (e.g., "*direct*, *directing*, *directions*, *directed*. Did you hear the ____?"; e.g., Berninger et al., 2010; Nagy et al., 2006; Nagy et al., 2003; Nippold & Sun, 2008). For both types of judgment tasks, the presentation and responses have varied in whether they were oral-only or simultaneously oral and written. They also have varied in whether the task included inflectional and/or derivational items and whether the derivational items were transparent or opaque.

Other researchers have used production tasks to assess students' morphological awareness skills, which have varied in their requirements. One commonly used production task includes a cloze procedure (e.g., "*Teach*. Ms. Smith is a _____"; Apel & Lawrence, 2011; Casalis & Cole, 2009; McCutchen et al., 2008; Wolter, Wood, & D'zatko, 2009). Researchers have used cloze tasks that included inflectional and derivational morphemes, both transparent and opaque. The target responses for these cloze tasks have varied; sometimes, the required response has been a multimorphemic word (as in the example above); other times, students have had to decompose a multimorphemic word to yield its base word (e.g., "*Friendly*. I want to be his _____"; Apel & Lawrence, 2011; Berninger et al., 2010). Several other investigators have used production tasks that required students to define (e.g., Jeon, 2011; Tsesmeli & Seymour, 2006), read (e.g., Carlisle, 2000), or spell multimorphemic words (e.g., Apel et al., 2012; Kirk & Gillon, 2007). For example, Wolter et al. used a task similar to the one employed by Treiman and Cassar (1996), requiring students to spell words containing final consonant clusters, some that represented one-morpheme words and others that represented two-morpheme words.

Word analogies also have been used to assess students' morphological awareness skills

(e.g., Bryant, Nunes, & Bindman, 1997; Kirby et al., 2012; Roman, Kirby, Parrila, Wade-Woolley, & Deacon, 2009; Tsesmeli & Seymour, 2006). Typically presented orally, students are asked to complete analogies such as: *anger*: *angry*:: *strength*: _____. Other researchers have used sentence analogies (e.g., *Peter plays at school*: *Peter played at school*:: *Peter works at home*: _____; Bryant et al., 1997; Deacon & Kirby, 2004). Although studies using word analogy tasks have varied in whether the items included inflectional and/or derivational morphemes, the studies using sentence analogy tasks have included only inflectional morphological items.

What is striking about the morphological awareness tasks used in the literature base is the diversity in the types of tasks used. No consistent measure has been administered across investigations, and tasks have measured different aspects of morphological awareness. Thus, it is difficult to compare results across studies. Importantly, no research team has used varied morphological awareness tasks within the same study with a common sample of participants across multiple age levels to identify whether one or more of the measures better explained performance on measures of literacy for children at a given age level. Additionally, no studies have specifically assessed students' identification of affixes within written words, and only two studies that we know of have assessed how the addition of affixes to words creates new word meanings (i.e., defining a new multimorphemic word), both of which were conducted with adolescents (Jeon, 2011; Tsesmeli & Seymour, 2006). Given that morphological awareness includes the conscious knowledge of printed affixes and the modifications that occur when they are added to base word, as well as the knowledge of the meaning of those affixes, tasks that attempt to tap into students' explicit awareness of those aspects of morphological awareness are warranted.

Thus, the overall purpose of this study was to address some of the shortcomings in the literature regarding young students' morphological awareness skills, with an eye toward understanding the relative merits of different tasks used to assess this skill. To do this, we targeted two specific aims. First, using production and judgment tasks, to which we added identification tasks, we sought to determine whether kindergarten, first, and second grade students would perform differently by grade on four tasks we created to assess different aspects of morphological awareness. We reasoned that measures that differentiated students by grade would be useful for practitioners seeking to determine growth in abilities across years. Given the developmental literature that suggests children are acquiring morphological awareness across this age span (e.g., Berninger et al., 2010), we hypothesized that there would be significant differences between grade levels on most if not all our tasks.

Our second aim was to determine whether the different tasks uniquely predicted word- and text-level reading abilities above a known predictor of reading, phonological awareness (e.g., Ehri, 1991; National Early Literacy Panel, 2008), at each of the three grade levels. Again, given past research that suggests morphological awareness is a unique predictor of reading (e.g., Apel et al., 2012), we hypothesized that morphological awareness would uniquely predict scores on measures of word reading and reading comprehension. However, because past investigations have not consistently used the same task(s) to measure morphological awareness, it was unclear whether certain tasks would uniquely predict reading at some grade levels but not others. Thus, what remained unknown was whether the type of task would lead to differences in the relation between morphological awareness and reading by grade.

METHOD

Participants

A total of 156 kindergarten ($n = 58$), first ($n = 44$), and second grade ($n = 54$) students from a public elementary school in a Southeastern state participated in our study. Fifty-one percent of the students within this sample

were female. The majority of students were African-American (75%) and Caucasian (15%), although Hispanic (3%), Asian (2%), and Multiracial (5%) students were also included. Most of these students came from low-income homes; according to the district records, 74% of the students at the school qualified for free and reduced lunch. All participating students returned signed parental consent forms approved by the local institutional review board and provided personal assent before participating in the assessment. The majority of the students were typically developing; however, a total of 12 children in the study had Individualized Education Plans (IEPs) in place to receive special services. Diagnoses of hearing impairment (1 student), language impairment (1 student), speech impairment (6 students), specific learning disability (1 student), Autism Spectrum Disorder (1 student), or other health impairment (2 students) were documented within our sample. English was the primary language for all participants.

Measures

The students were administered four tasks designed to assess morphological awareness, a phonological awareness measure, two word-level reading tasks, and a reading comprehension measure. Raw scores from all tasks were used for all analyses. All tasks were administered to the first and second grade students; however, the kindergarten children were not administered the reading comprehension task and two of the morphological awareness tasks because they involved spelling.

Morphological awareness

We administered four experimenter-designed tasks to assess different levels and aspects of the students' morphological awareness abilities as part of a larger morphological intervention study (Apel, Diehm, & Apel, 2012). The four tasks represented the types of tasks used previously in the literature (i.e., production and judgment tasks) as well as a new task (i.e., identification task). Table 1 provides an overview of the four tasks and the characteristics that best describe them (e.g., production vs. judgment, oral vs. written). Across the four tasks, the base words or the base forms of the inflected or derived words were at or below the third grade level of word frequency (SPELL-Links Word List Maker; Learning By Design, Inc., 2010). All affixed items were phonologically transparent with their base form (e.g., *friend/friendly*). The prefixes and suffixes used on the assessment tasks were chosen from a list of common affixes (Berninger & Abbott, 2003). The four tasks had been used previously to measure gains in morphological awareness ability in a small-scale feasibility study of a morphological awareness intervention (Apel, Brimo, Diehm, & Apel, in press).

Relatives Task

The Relatives Task, a cloze task, was based on production measures used previously by other researchers (e.g., Carlisle, 2000). The students were given a base word and then required to finish a sentence orally using an inflected or derived version of that base word (e.g., "*Run*. Every morning the man _____." Correct answer: runs). A point was awarded for each correct response. Seven of the items required an inflected form of the base word and 19 required a derived form, for a total of 26 possible points. The students were given two practice items before the task was initiated. Internal reliability for the group of students was adequate (Cronbach's alpha = .85).

Rehit Task

The purpose of the Rehit Task was to determine students' ability to explicitly combine two morphemes into a novel word, define that word, and then judge its semantic acceptability within the context of a spoken sentence. As such, it combined production and judgment tasks that tapped into students' understanding of the meaning of affixes. Specifically, the students were first asked to repeat one bound and one free morpheme (e.g., "Say *re*." [student responds] "Now, say *hit*." [student responds]) and then to combine them

Table 1. Morphological awareness assessment overview

Task Analysis	Spelling Multimorphemic Words Task	Affix ID Task	Relatives Task	Rehit Task
Stimulus/response	Oral/written	Written/written	Oral/oral	Oral/oral
Type of task	Production	Identification	Production	Production, judgment
Type of word	Real multimorphemic words; inflectional and derivational	Nonwords with real affixes; inflectional and derivational	Real base words; inflectional and derivational	Real affixes and bases, combined to form pseudo words; inflectional and derivational
Ability in MA demonstrated by:	1. Spelling multimorphemic words	1. Identifying and circling real affixes attached to base words not found in the English language	1. Orally producing a related multimorphemic word when given a base word, in the context of a sentence	1. Orally blending an affix to a base word to create a pseudoword 2. Defining the multimorphemic pseudoword 3. Judging the acceptability of the multimorphemic pseudo word in a sentence
Example	1. Refill. Please *refill* the cookie jar. Refill.	1. Doep**er**, Rinn**ing**, Hett**s**, Friece**ly**, **Un**dut, **Re**mape	1. *Friend*. The substitute teacher was very _____.	1. Say "*re*." Now say "*bit*." Put those together to make a new word (*rehit*). 2. What do you think *rehit* means? 3. The *rehit* is on the bed. Does that make sense? (Y/N) She *rehit* the ball three times. Does that make sense? (Y/N)

to create a "silly" word (i.e., "rehit"). The students were awarded a point for a correct answer. The students next were asked to define the newly formed word. Responses were scored via a list of acceptable definitions that were based on previous use of the measure (Apel et al., in press; see sample list in Appendix). A correct response was given two points. When students provided incorrect definitions, they were asked to judge the acceptability of two definitions (e.g., "Do you think *rehit* means *to hit again* or *a person who hits*?"), making it a judgment task. Students received one point for correctly identifying the word's definition when not able to make up their own definition. Finally, judgment was required when students were asked to determine the acceptability of two sentences containing the silly word (e.g., "The rehit is on the bed. Does that sentence make sense?"). The incorrect definition contained the target word in a grammatically incorrect word position (e.g., noun as a verb). Students earned one point for correctly judging the acceptability of the word within both sentences. Thus, for each item, there were a total of four possible points—two for a correct definition and one each for judging word use in two sentences. The task contained 18 items plus one practice item. Internal reliability as measured by Cronbach's alpha was adequate (.85).

Affix Identification task

The Affix Identification task was developed to assess students' conscious awareness of printed affixes and the modifications that occur when those affixes are added to base words. The task was group administered to the first and second grade students as a whole class, or smaller group of four to five students if students were absent on the day of their class assessment. Students were presented with a paper containing a list of pseudowords with real affixes (e.g., "rinning"). Then they were told to circle all affixes (i.e., "add-ons") they saw. They were given three minutes to complete the task, which included a total of 51 items, preceded by four example items. Each correctly circled affix was given a point. The task had adequate internal reliability as measured by Cronbach's alpha (.83).

Spelling multimorphemic words (SMW) task

The SMW task also assessed students' productive knowledge of printed affixes. This spelling test, consisting of 26 multimorphemic words (e.g., *sweeter*, *brightly*, *reopen*), was group administered to first and second grade students. For each item, an examiner said the word, used the word in a sentence, and then repeated the word. The students then wrote the word. If a student did not hear the word, one repetition (provided to the whole class) was allowed. We only scored the students' spellings for the affixes, not the base forms of the words, because we were interested in their inflectional and derivational morphological knowledge. An affix was considered to be spelled correctly regardless of the accuracy of the base portion of the target word (e.g., the affix on *washs* for *washes* was scored as correct, as was the spelling of *ilness* for *illness*). When words' spellings were unclear due to a student's handwriting, multiple scorers conferred to determine the target spelling and/or the students' productions were compared to other words containing similar letters. No spellings were excluded due to illegible writing. The task had adequate internal reliability (Cronbach's alpha = .88).

Phonological awareness

The Elision subtest from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was administered to assess phonological awareness skills. This task requires students to delete whole words from compound words, syllables from words, onsets from rime units, phonemes within rime units, and phonemes from consonant clusters. According to the test manual, alternate form reliability for the elision subtest is .89.

Reading

Three tasks were administered to measure word-level reading and reading comprehension abilities. Two subtests, Sight Word Efficiency (SWE) and Phonetic Decoding Efficiency (PDE), from the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999) were administered to measure the students' word-level reading ability. The SWE subtest requires students to read single real words; the PDE requires students to read pseudowords. Toward the latter portion of the PDE, some of the pseudowords contain letter combinations that could function as affixes (e.g., *-y*, *-er*, *-ed*); however, without context, it is not clear that students view these letter combinations as affixes. The two *TOWRE* tasks were administered to all students. The students read as many real words and decoded as many nonwords as possible within 45 seconds from Form A. According to the test manual, alternate form reliability for all forms of the TOWRE exceed .95, and test–retest reliability ranges from .83 to .97. The Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2010) was group administered to the first and second grade students to assess their silent sentence reading comprehension. On the TOSREC, the students read sentences silently and marked *Yes* or *No* on an answer

sheet to indicate whether the sentences were true or false. The technical manual for the test reports alternate form reliability as .91.

Reliability

Inter-rater score reliability for all tasks was conducted on 10% of the total number of student responses. Each measure was rescored by a second scorer. Inter-rater agreement ranged from 96% to 100%.

Procedures

The students were assessed in a quiet room within their school (e.g., library). All the tasks were administered individually except as noted previously. When tasks were administered in groups, they typically involved whole classroom assessment and small groups of four to five students. Testing occurred across a span of two weeks. The individuals assessing the students had a background in speech-language pathology, elementary education, or special education and had received three hours of training on task administration, which included practice and specific feedback, prior to participant testing.

RESULTS

Descriptive statistics, which include the means and standard deviations for all measures, are provided in Table 2. Our first aim was to determine whether performance on the four tasks differed by grade. To address this aim, we conducted two, one-way Analyses of Variance (ANOVA) to determine whether the performance on the Rehit and Relatives tasks differed among kindergarten, first, and second grade students. In addition, we conducted two, independent samples *t*-tests to determine whether performance differed between the first and second grade students on the Affix Identification and SMW tasks. To be conservative and guard against Type 1 error, we applied a Bonferroni correction on the alpha level for these four analyses, which was computed at $.05/4 = .0125$.

The results of the one-way ANOVA for the Relatives task revealed significant grade-level differences, $F(2) = 48.37$, $p < .001$. Tukey HSD *post hoc* tests revealed that the second grade students scored significantly higher than the first grade and kindergarten students (p's $< .001$), and the first grade students scored significantly higher than the kindergarten students ($p < .001$). The one-way ANOVA for the Rehit task also was significant, $F(2) = 33.00$, $p < .001$. The *post hoc* tests revealed significant differences between kindergarten students and first and second grade students (p's $< .001$) but no significant difference in performance between the first and second grade students.

Table 2. Means and standard deviations for measures by grade level

	Kindergarten	First Grade	Second Grade
TOWRE: SWE	10.09 (10.31)	34.55 (14.03)	52.78 (11.83)
TOWRE: PDE	3.74 (4.31)	14.45 (7.38)	21.22 (10.55)
TOSREC	NA	14.59 (10.32)	21.80 (8.85)
CTOPP	4.64 (2.82)	7.05 (3.26)	10.72 (4.62)
REHIT (out of 54)	12.14 (5.69)	16.61 (1.37)	17.20 (.96)
RELATIVES (out of 25)	8.88 (5.13)	13.05 (3.65)	16.33 (2.97)
AFFIX (out of 51)	NA	4.86 (3.62)	23.17 (15.87)
SMW (out of 26)	NA	7.43 (2.79)	6.26 (2.94)

Note. TOWRE = Test of Word Reading Efficiency; SWE = Sight Word Efficiency; PDE = Phonetic Decoding Efficiency; TOSREC = Test of Silent Reading Efficiency and Comprehension; CTOPP = Comprehensive Test of Phonological Processing; AFFIX = Affix Identification Task; SMW = Spelling Multi-Morphemic Words Task.

The *t*-test for the Affix Identification task was significant, $t(96) = -7.485$, $p < .001$, with second grade students scoring higher than first grade students. On the SMW task, however, the difference between the two grades was not significant, $t(96) = 2.009$, $p = .047$.

To address our second aim, hierarchical linear regression analyses were used to examine the unique contributions of morphological awareness to word-level reading and reading comprehension beyond that explained by phonological awareness. For word-level reading, we conducted regression analyses at each grade level; for reading comprehension, we conducted regression analyses for first and second grade students only, given that we did not assess the kindergarten students' reading comprehension skills. In each regression model, the students' scores on the phonological awareness measure were entered into the first step, and their performances on all four morphological awareness tasks (two in the case of the kindergarten children) were entered into the second step collectively. We report the findings below by grade level.

For kindergarten students (Table 3), phonological awareness explained 33% of the variance on real word reading, $F(1, 56) = 29.42$, $p < .001$.; morphological awareness as a whole accounted for an additional unique 11% of the variance $F(2, 54) = 5.16$, $p = .009$. Examining the standardized regression coefficients, neither the Rehit nor the Relatives tasks contributed uniquely to predicting real word reading, although the Rehit task neared significance ($B = .237$, $p < .068$). For pseudoword reading, phonological awareness contributed 24% of the variance, $F(1, 56)$, $= 18.87$, $p < .001$, with morphological awareness explaining an additional 9%, $F(2, 54) = 3.70$, $p = .03$. Of the two morphological awareness tasks, the Relatives task was the only unique predictor ($B = .255$, $p < .043$; see Table 3).

For first grade students (Table 4), phonological awareness explained 12% of the variance on real word reading, $F(1, 42) = 6.95$, $p = .012$, and 9% on pseudoword reading, $F(1, 42) = 5.22$, $p = .028$. Morphological awareness as a whole did not explain any additional unique variance for either word-level

Table 3. Summary of hierarchical linear regression analyses for kindergarten students

Variable	B	SE B	*B*
TOWRE: SWE			
1 PA	2.15	.396	.587**
2 Rehit	.374	.211	.207
Relatives	.513	.247	.255*
TOWRE: PDE			
1 PA	.767	.956	.502**
2 Rehit	.179	.096	.237
Relatives	.156	.113	.186

Notes. Values are presented in nonstandardized regression coefficients (B) with standard errors (SE) and standardized regression coefficients (*B*).
*$p < .05$; **$p < .001$.

Table 4. Summary of hierarchical linear regression analyses for first grade students

Variable	B	SE B	*B*
TOWRE: SWE			
1 PA	1.62	.615	.377*
2 Rehit	1.73	1.58	.168
Relatives	.042	.611	.011
Affix ID	-.255	.577	-.066
SMW	.815	.749	.162
TOWRE: PDE			
1 PA	.751	.329	.332*
2 Rehit	1.73	.808	.321
Relatives	-.313	.312	-.155
Affix ID	-.138	.294	-.068
SMW	.059	.382	.022
TOSREC			
1 PA	1.13	.456	.357*
2 Rehit	.814	1.11	.108
Relatives	.508	.427	.180
Affix ID	.208	.403	.073
SMW	1.09	.523	.294*

Notes. Values are presented in nonstandardized regression coefficients (B) with standard errors (SE) and standardized regression coefficients (*B*). SMW = Spelling Multi-Morphemic Words Task.
*$p < .05$; **$p < .001$.

reading measure (p's > .05). Similarly, phonological awareness accounted for approximately 11% of the variance for reading comprehension, $F(1, 42) = 6.13$, $p = .017$; morphological awareness did not explain any additional unique variance ($p > .05$). When examining the simple correlations associated with the regressions, we noted that performance on the Rehit task was significantly related with performance on pseudoword reading ($r = .403$, $p = .003$) and neared significance with performance on word-level reading for real words ($r = .244$, $p = .055$). Similarly, performances on the Relatives ($r = .313$, $p = .019$) and the SMW tasks ($r = .312$, $p = .020$) were significantly related to the students' scores on the reading comprehension task. However, in the regression models, all of the variance for these simple correlations was accounted for by phonemic awareness performance.

For second grade students (Table 5), phonological awareness explained 20% of the variance on real word reading, $F(1, 52) = 13.99$, $p < .001$; morphological awareness contributed an additional 21% unique variance, $F(4, 48)$, $p = .004$. On examination of the standardized regression coefficients, the Relatives ($B = .259$, $p < .048$) and SMW tasks ($B = -.384$, $p < .003$) were the only tasks that uniquely predicted real word reading. For pseudoword reading, phonological awareness accounted for 35% of the variance, $F(1, 52) = 28.62$, $p < .001$, and morphological awareness added an additional 22% unique variance, $F(4, 48) = 6.09$, $p < .001$. The Rehit ($B = .253$, $p < .017$) and SMW tasks ($B = -.370$, $p < .001$) were the only two unique morphological awareness tasks predicting pseudoword reading, although the Relatives task neared significance ($B = .207$, $p < .066$). Finally, morphological awareness accounted for an additional 17% unique variance on reading comprehension, $F(4, 48) = 3.08$, $p < .025$, over the 14% explained by phonological awareness, $F(1, 52) = 9.91$, $p < .003$. Out of the four tasks, only the Relatives task contributed uniquely to predicting reading comprehension ($B = .406$, $p < .005$).

DISCUSSION

For this investigation, we sought to accomplish two aims: to determine whether kindergarten, first, and second grade students performed differently on four tasks designed to measure different aspects of morphological awareness and whether their performance on these tasks predicted their scores on measures of reading. Previous investigators typically have not used several tasks simultaneously to target such aims. Additionally, unlike past investigations, we assessed students' ability to consider consciously printed affixes and the modifications that occur when those affixes are added to base word (e.g., Affix Identification task) as well as the knowledge of the meaning of those affixes (e.g., Rehit task).

For our first aim, two morphological awareness tasks were administered to students at

Table 5. Summary of hierarchical linear regression analyses for second grade students

Variable	B	SE B	*B*
TOWRE: SWE			
1 PA	1.18	.315	.460**
2 Rehit	1.67	1.47	.135
Relatives	1.03	.508	.259*
Affix ID	.013	.093	.017
SMW	-1.55	.503	-.384*
TOWRE: PDE			
1 PA	1.36	.254	.596**
2 Rehit	2.78	1.13	.253*
Relatives	.737	.391	.207
Affix ID	-.112	.071	-.168
SMW	1.33	.387	-.370*
TOSREC			
1 PA	.767	.244	.400*
2 Rehit	-.230	1.18	-.025
Relatives	1.21	.410	.406*
Affix ID	.085	.075	.153
SMW	-.363	.406	-.120

Notes. Values are presented in nonstandardized regression coefficients (B) with standard errors (SE) and standardized regression coefficients (*B*). SMW = Spelling Multi-Morphemic Words Task.
*$p < .05$; **$p < .001$.

all three grade levels: the Relatives and Rehit tasks. Both of these tasks required an oral response. The Relatives task, a production task, required students to finish a sentence using an inflected or derived "relative" of a base word that had been provided. The Rehit task, a combined production and judgment task, required students to combine two morphemes into a novel word, define that word, and then judge its semantic acceptability within the context of a spoken sentence. On the Relatives task, students differed significantly by grade, suggesting that the task may be useful for discerning grade level differences, at least for this population of students. On the Rehit task, kindergarten students scored significantly lower than first and second grade students but there was no significant difference between first and second grade students.

These initial findings suggest that the Rehit task may be less sensitive to grade-level differences in the early elementary years than the Relatives task. There may be several reasons for this finding. First, the Rehit task involved multiple responses and targeted different components of morphological awareness (e.g., production vs. judgment) within the same task. It may be that some aspects of the task were relatively easy (e.g., combining the two morphemes into the novel word, providing a forced yes/no choice response), leading to higher scores with less variability. Second, the base words used were relatively high-frequency words that were at or below the third grade level. It may have been that these words, in the context of the task, did not offer enough of a challenge, leading to a ceiling effect. Our initial findings then suggest that of the two, the Relatives task, which required only oral production, may be more useful for measuring grade-level differences in morphological awareness abilities, at least at the grade levels we assessed.

The other two morphological awareness tasks—Affix Identification and SMW—were administered only to the first and second grade students. Both of these tasks involved written aspects of morphology. On the Affix Identification task, students circled real affixes in a list of printed pseudowords containing real affixes; on the SMW task, students spelled multimorphemic words. The second grade students performed significantly higher on the Affix Identification task than the first grade students, suggesting this task was sensitive to grade level differences. The same was not true for the SMW; there were no significant differences between grades. This latter finding was expected, given the second grade students scored slightly lower on average than the first grade students. Examining the means for both grade levels, it appears the SMW task was a challenging one, contributing to a possible floor effect. On average, both groups of students spelled correctly six to seven affixes out of a possible 26. Even though we only scored the affix portion of the words written, it may be that, even for second grade students, the task of spelling, or producing multimorphemic words, was a demanding undertaking, and the linguistic and possibly motor demands of the task lead to the relatively poor performances overall.

Although the Affix Identification task also assessed students' previous knowledge of printed affixes, it did not have the same productive linguistic and motor demands of the *SMW*. Rather, it drew on the students' previous knowledge of printed morphemes within a timed task. As such, higher performance on the task likely represented a higher level of automaticity in conscious awareness of printed morphology, a knowledge base one would expect to increase with age and experience. Therefore, it seems that when students are still learning how to write and spell, the Affix Identification task, which requires only judgment, is more sensitive to grade level differences at these early grades than the spelling task, which requires the more cognitively demanding act of production.

Our conclusion, based on these preliminary results, is that the Affix Identification task, a written morphological awareness task, in addition to the Relatives task, an oral morphological awareness task, may be best suited to assessing morphological awareness among students across the early primary grades,

kindergarten through second grade. Consistent with our rationale for this study, the two tasks measure different aspects of morphological awareness. The Affix Identification task examines students' knowledge of printed morphology, how affixes attach to base words, and, in some cases, how they modify base words. The Relatives task assesses students' awareness of the relation between base words and their inflected and derived forms (i.e., a focus on meaning relations). Combined, the two tasks measure a range of aspects of morphological awareness, incorporating both production and judgment components.

For our second aim, we were interested in determining whether one or more morphological awareness tasks uniquely predicted reading skills at different grade levels. For kindergarten and second grade children, the Relatives task most frequently predicted reading abilities; it predicted pseudoword reading in kindergarten children and real word reading and reading comprehension in second grade children. It also was significantly correlated with reading comprehension in first grade children although this simple relation was nonsignificant once the variance from phonemic awareness was considered. Thus, although it did not predict all reading skills at each grade level, the Relatives task related to some aspect of reading at each grade level. Perhaps because the task focuses on meaning and words' relations between base and inflected and derived forms, it closely aligns with both word-level reading (reading words and attempting to derive meaning) and reading for understanding (reading comprehension).

The SMW task uniquely predicted word-level reading, both real and pseudoword reading, in second grade students and was significantly correlated with reading comprehension in first grade children although again, not after controlling for phonemic awareness ability. Given the focus of the SMW task was on written morphology, the findings for the second grade students were not surprising. Successful performance on the SMW task required conscious knowledge of the orthographic representation of affixes and any modifications that occur when they are attached to base words. This knowledge undoubtedly aids word-level reading, even for pseudoword reading, given that some pseudowords actually contain real affixes (e.g., on the TOWRE, the affixes *-y*, *-er*, *-or*, and *-ed* are attached to pseudowords) (Torgesen et al., 1999). The Rehit task explained unique variance above phonological awareness on pseudoword reading for the second grade children and was significantly correlated to pseudoword reading for the first grade students, before controlling for phonemic awareness abilities. It may be that the Rehit task related to pseudoword reading because of its focus on novel morphological constructions. That is, in the Rehit task, the students were required to construct, albeit orally, novel words created from base words and bound morphemes, a task that mirrors what one undertakes during pseudoword reading: the construction of a novel word based on the assembly of a novel string of phonemes and/or morphemes.

Notably, morphological awareness did not explain unique variance above phonological awareness across any of the regression analyses conducted with the first grade students. This was a surprising and frankly, puzzling finding. At first, it may appear that our findings reflect a developmental process, such that the unique contributions of morphological awareness occur after a period when phonemic awareness is contributing to word- and text-level reading. However, given our findings that morphological awareness explained unique variance on word-level reading for kindergarten children, this explanation seems less tenable. Additionally, previous researchers have found that morphological awareness uniquely predicts reading skills above other known predictors, including phonemic awareness, in first grade children (e.g., Apel et al., 2012). Although there were a higher number of students with IEPs in first grade, inspection of the data revealed no abnormalities to the data. It is possible that our results for the first grade

children were due to the lower number of participants in that grade. As noted, when we examined the simple correlations conducted as part of the regression analyses, a number of the morphological awareness tasks were significantly correlated with reading skills. With an increased sample size, different outcomes may have occurred.

In answer to our second aim, then, it appears different morphological awareness tasks uniquely predicted different aspects of reading at different grade levels. The Relatives task, however, appeared to hold the greatest utility of the four tasks used in our investigation; it predicted or was associated with reading skills at each grade level. This finding, coupled with the finding that the task also differentiates students by grade level, suggests it may be a useful task for assessing morphological awareness abilities in kindergarten, first, and second grade students. Interestingly, the Affix Identification task, which differentiated between first and second grade students, did not uniquely predict reading abilities in first and second grade students. At first glance, it may seem that its utility should be questioned. However, it may be that the Affix Identification task, given its focus on printed affixes, would better predict spelling abilities, an avenue of research worth pursuing in the future. Investigators should determine whether the Affix Identification task, indeed any of the tasks employed in this study, uniquely predict spelling at different grade levels.

Limitations and future research

As with any investigation, there are limitations to our findings. First, our findings are restricted to student populations similar to our student sample. Our students were from a relatively high poverty school. Although it is important to understand the abilities of this student population and to address their need because of their at-risk nature for literacy difficulties (e.g., Craig & Washington, 2004), we are uncertain whether students from other socioeconomic backgrounds would perform similarly on our tasks as our study participants did. In the future, investigators should conduct similar studies with students from a range of socioeconomic backgrounds. Additionally, because of our small sample size and even smaller sample of children with disabilities, we were not able to determine whether the presence of a disability (e.g., speech sound disorder, language impairment, hearing loss) significantly affected the performance on our measures compared to that of typically developing children. Because many children with speech and/or language impairment are at-risk for literacy disorders (e.g., Catts, Kamhi, & Adlof, 2012), investigators should investigate morphological awareness skills within these different populations as well, but it is important to understand typical development first.

Second, the items on our tasks were chosen carefully to represent transparent items (i.e., the multimorphemic words were both orthographically and phonologically similar to their base words). This added a level of simplicity to the items. It may have been that this caused some tasks (e.g., the Rehit task) to be less discerning across grades. In the future, researchers could contrast tasks that contained both transparent and opaque items to increase complexity. Further, our items contained base words, or multimorphemic words with base forms, that were at or below the third grade level of word frequency. Increasing the range of grade level frequency may have led to different results on whether tasks differentiated students by grades. In the future, investigators could determine whether these factors lead to different outcomes.

Additionally, we used a measure of phonological awareness that included syllable and onset rime level deletion tasks in addition to phoneme deletion tasks. Given that phoneme deletion tasks have been shown to powerfully predict early reading development (e.g., National Reading Panel, 2000), it may be that different results would have been obtained in our regressions had we chosen a different phonological awareness measure that only assessed phoneme awareness.

We controlled for the students' phonological awareness abilities when predicting the

effects of morphological awareness on their reading performance. We also could have included additional tasks to control for other linguistic or cognitive factors, such as orthographic knowledge, vocabulary, syntactic, and working memory skills. We chose not to include tasks representing these factors because previous studies have shown that morphological awareness abilities uniquely predict reading above these other skills (e.g., Apel et al., 2012; Deacon & Kirby, 2004; Deacon et al., 2009). In the future, however, investigators may wish to determine whether these or other linguistic abilities (e.g., syntactic awareness skills) influence the effect of morphological awareness on reading.

Finally, as mentioned above, we examined whether performance on the morphological awareness tasks predicted outcomes on the reading measures. Spelling also is an important literacy skill. Investigators should consider determining whether these or other morphological awareness tasks account for unique variance on varied spelling measures as well.

Previous research investigating morphological awareness and its importance for developing successful literacy skills exposed the critical need for researchers to determine how best to assess the multiple components of morphological awareness. Although our study did not include all types of assessment used by previous researchers, our tasks assessed a broad range of morphological awareness abilities, in both oral and written language. Our results provide direction for clinicians and future researchers when deciding how to assess morphological awareness within early elementary students. Although we continue to have much work to do in the area of morphological awareness, we believe this study helps answer questions about tasks that are suitable for young children when assessing their morphological awareness abilities and understanding their contributions to learning to read.

REFERENCES

Anglin, J. M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development*, *58*, 1–165. doi:10.2307/1166112

Apel, K., Brimo, D., Diehm, E., & Apel, L. (in press). Morphological awareness intervention with kindergarten, first, and second grade students from low SES homes: A feasibility study. *Language, Speech, and Hearing Services in Schools.*

Apel, K., Diehm, E., & Apel, L. (2012). *A morphological awareness intervention with primary grade students*. Paper presented at the annual American Speech-Language-Hearing Association Schools Conference, Atlanta, GA.

Apel, K., & Lawrence, J. (2011). Contributions of morphological awareness skills to word-level reading and spelling in first-grade children with and without speech sound disorder. *Journal of Speech, Language, and Hearing Research*, *54*, 1312–1327. doi:10.1044/1092-4388(2011/10-0115)

Apel, K., Wilson-Fowler, E. B., Brimo, D., & Perrin, N. A. (2012). Metalinguistic contributions to reading and spelling in second and third grade students. *Reading and Writing: An Interdisciplinary Journal*, *25*, 1283–1305. doi:10.1007/s11145-011-9317-8

Berninger, V. W., & Abbott, R. (2003). *PAL research-supported reading and writing lessons*. San Antonio, TX: Harcourt.

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of Psycholinguistic Research*, *39*, 141–163. doi:10.1007/s10936-009-9130-6

Bryant, P., Nunes, T., & Bindman, M. (1997). Backward readers' awareness of language: Strengths and weaknesses. *European Journal of Psychology of Education*, *12*, 357–372. doi:10.1007/BF03172798

Carlisle, J. F. (1995). Morphological awareness and early reading achievement. In L. B. Feldman (Ed.), *Morphological aspects of language processing* (pp. 189–210). Hillsdale, NJ: Lawrence Erlbaum.

Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal*, *12*, 169–190. doi:10.1023/A:1008131926604

Carlisle, J. F., & Stone, C. A. (2005). Exploring the role of morphemes in word reading. *Reading Research Quarterly*, *40*, 428–449. doi:10.1598/RRW.40.4.3

Casalis, S., & Cole, P. (2009). On the relationship between morphological and phonological awareness: Effects of training in kindergarten and in

first-grade reading. *First Language*, *29*, 113–142. doi:10.1177/0142723708097484

Catts, H. W., Kamhi, A. G., & Adlof, S. M. (2012). Causes of reading disabilities. In A. G., Kamhi, & H. W., Catts (Eds.), *Language and reading disabilities* (pp. 77–111). Boston: Pearson.

Craig, H. K., & Washington, J. A. (2004). Language variation and language learning. In A. Stone, E. R. Silliman, B. Ehren, K. Apel (Eds.), *Handbook of language and literacy: Development and disorders* (pp. 228–247). New York: Guilford Press.

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, *25*, 223–238. doi:10.1017.S0124716404001117

Deacon, S. H., Kirby, J. R., & Casselman-Bell, M. (2009). How robust is the contribution of morphological awareness to general spelling outcomes? *Reading Psychology*, *30*, 301–318. doi:10.1080/02702710802412057

Ehri, L. C. (1991). Development of the ability to read words. In R. Barr, M. L. Kamil, P. B. Mosenthal, P. D. Pearson (Eds.), *Handbook of reading research: Volume 2* (pp. 383–417). White Plains, NY: Longman.

Jeon, E. H. (2011). Contribution of morphological awareness to second-language reading comprehension. *The Modern Language Journal*, *95*, 217–235. doi:10.1111/j.1540-4781.2011.01179x

Kirby, J. R., Deacon, S. H., Bowers, P. N., Izenberg, L., & Wade-Woolley, L., & Parrila. R., (2012). Children's morphological awareness and reading ability. *Reading Writing: An Interdisciplinary Journal*, *25*, 389–410. doi:10.1007/s11145-010-9276-5

Kirk, C., & Gillon, G. T. (2007). Longitudinal effects of phonological awareness intervention on morphological awareness in children with speech impairment. *Language, Speech, and Hearing Services in Schools*, *38*, 342–352. doi:10.1044/0161-1461(2007/036)

Ku, Y. M., & Anderson, R. C. (2003). Development of morphological awareness in Chinese and English. *Reading and Writing: An Interdisciplinary Journal*, *16*, 399–422. doi:10.1023/A:1024227231216

Mahony, D., Singson, M., & Mann, V. (2000). Reading ability and sensitivity to morphological relations. *Reading and Writing: An Interdisciplinary Journal*, *12*, 191–218. doi:10.1023/A:1008136012492

McCutchen, D., Green, L., & Abbott, R. D. (2008). Children's morphological knowledge: Links to literacy. *Reading Psychology*, *29*, 289–314. doi:10.1080/02702710801982050

Nagy, W., Berninger, V., & Abbott, R. D. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. *Journal of Educational Psychology*, *98*, 134–147. doi:10.1037/0022-0663.98.1.134

Nagy, W., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth grade writers. *Journal of Educational Psychology*, *95*, 730–742. doi:10.1037/0022-06663.95.4.730

National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute for Literacy.

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC; Government Printing Office.

Nippold, M. A., & Sun, L. (2008). Knowledge of morphologically complex words: A developmental study of older children and young adolescents. *Language, Speech, and Hearing Services in Schools*, *39*, 365–373. doi:10.1044/0161-1461(2008/034)

Roman, A. A., Kirby, J. R., Parrila, R., Wade-Woolley, L., & Deacon, S. H. (2009). Towards a comprehensive view of the skills involved in word reading in Grades 4, 6, and 8. *Journal of Experimental Child Psychology*, *102*, 96–113. doi:10.1016/j.jecp.2008.01.004

SPELL-Links Word List Maker [Computer software]. (2010). Evanston, IL: Learning By Design, Inc.

Treiman, R., & Cassar, M. (1996). Effects of morphology on children's spelling of final consonant clusters. *Journal of Experimental Child Psychology*, *63*, 141–170. doi:10.1006/jecp.1996.0045

Tsesmeli, S. N., & Seymour, P. H. K. (2006). Derivational morphology and spelling in dyslexia. *Reading and Writing: An Interdisciplinary Journal*, *19*, 587–625. doi:10.1007/s11145-006-9011-4

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). *Test of word reading efficiency*. Austin, TX: Pro-Ed.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1999). *Comprehensive test of phonological processing*. Austin, TX: Pro-Ed.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., & Pearson, N. (2010). *Test of silent reading efficiency and comprehension*. Austin, TX: Pro-Ed.

Wolter, J. A., Wood, A., & D'zatko, K. W. (2009). The influence of morphological awareness on the literacy development of first-grade children. *Language, Speech, Hearing Services in Schools*, *40*, 286–298. doi:10.1044/0161-1461(2009/08-0001)