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Morphological Awareness Performance Profiles of First- Through Sixth-Grade Students

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ABSTRACT

Purpose: We examined whether diverse profiles of strengths and weaknesses would emerge when assessing different aspects of morphological awareness in first- through sixth-grade students using a recently developed standardized test, the Morphological Awareness Test for Reading and Spelling (MATRS; Apel et al., 2021).

Method: Four thousand fifty-nine first- through sixth-grade students completed the eight morphological awareness tasks of the MATRS. The eight tasks represent the multiple ways that morphological awareness impacts both spoken and written language skills for the English language. Exploratory finite mixture models estimated the number of latent subgroups that best reflected heterogeneity in task-level performance by grade level. Specific profiles were chosen that demonstrated strong reliability and included a set of tasks that were consistent between first- and second-grade students and between third- and sixth-grade students.

Results: Different performance profiles emerged when the students completed multiple morphological awareness tasks. At each of the six grades (first through sixth), clusters of students performed differentially on specific tasks.

Conclusions: The findings demonstrate that students can differ in patterns of strength and weaknesses of their morphological awareness given a range of tasks that assess different aspects of morphological awareness. The clinical implications of these findings suggest that by identifying students struggling in specific areas of morphological awareness, clinicians can develop and implement specific prescriptive instructional plans.

In this investigation, we sought to determine whether we could identify a set of performance profiles for the morphological awareness skills of first- through sixth-grade students. To accomplish this task, we administered a recently developed standardized assessment tool, the Morphological Awareness Test for Reading and Spelling (MATRS; Apel et al., 2021). The MATRS contains eight tasks that assess first- through sixth-grade students' spoken and written morphological awareness abilities. MATRS has been empirically validated in terms of its reliability, concurrent validity, and predictive validity of scores (Apel et al., 2021). Given the range in tasks and grade levels, we believed that MATRS was capable of identifying performance profiles in first- through sixth-grade students.

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Morphological Awareness

Broadly defined, morphological awareness is the ability to consciously consider the smallest units of meaning in a language—morphemes (e.g., Apel & Henbest, 2016; Carlisle, 1988; Larsen & Nippold, 2007; Wolter et al., 2009). Over the past few decades, morphological awareness has received increasing attention, with researchers demonstrating the strong and positive impact it has as a crucial and supportive underlying skill for the development and use of reading and spelling (e.g., Bryant et al., 1997; Goodwin et al., 2020; Nagy et al., 2006; Tighe & Schatschneider, 2016). Furthermore, reviews of morphological awareness interventions have demonstrated the positive effect that such an instructional focus can have on improving students' literacy abilities (e.g., Bowers et al., 2010; Goodwin & Ahn, 2013).

Research teams have used different tasks to measure morphological awareness (e.g., Apel & Diehm, 2014; Casalis & Colé, 2009; Goodwin et al., 2020; James et al., 2020). Variations in these tasks have included whether the measures assessed inflectional and/or derivational morphological knowledge, the mode of presentation and response (e.g., spoken and/or written), and the required skill to be used (e.g., judgment, production, blending/segmenting, and analogy). The number of measures used when assessing morphological awareness also have varied, with some investigators using one task to assess the skill and others using two or more (e.g., Apel, Brimo, et al., 2013; Deacon et al., 2013; Katz & Carlisle, 2009; Kirby et al., 2012; Levesque et al., 2017). This variation is particularly troublesome when comparing findings across studies and may hinder researchers' attempts to better understand the developmental trajectory of morphological awareness and educators' ability to determine whether a student is below grade expectancies. The nonuniformity in methods across investigations likely occurs, because morphological awareness has traditionally been broadly defined, with investigations only recently aimed at defining and examining morphological awareness as a multiple component construct (e.g., Apel, 2014; Deacon et al., 2017; Goodwin et al., 2020; Levesque et al., 2017).

Componential Definition of Morphological Awareness

In 2014, Apel provided a specific, four-component definition of morphological awareness that accounted for the ways morphological awareness impacts both spoken and written language skills for the English language. This definition included the conscious ability to think about (a) spoken and written morphemes, (b) the meanings of prefixes and suffixes and how the meaning or grammatical class of a base word may be modified when an affix is attached (e.g., respectively: happy > unhappy or happy > happily), (c) how alterations to the written form of base words may occur when suffixes are attached (bunny > bunn_i_es), and (d) the meaningful connections between base words and inflected and/or derived forms of those words (act: acts, acting, and actor). Subscribing to such a multifaceted definition, researchers and educators interested in documenting students' morphological awareness abilities would, at minimum, need to use at least one task that assessed each of the four components.

Recently, Levesque et al. (2020) also defined morphological awareness as a multidimensional construct. Their Morphological Pathways Framework depicts morphology as impacting literacy skills via morphological decoding and morphological analysis. Morphological decoding, a word-form process, engages morphology with orthography, semantics, and syntax. Specifically, Levesque et al. (2020) argued that individuals use their knowledge of written affixes to decode larger chunks of orthographic elements (e.g., the "–ed" used for past tense) as well as to understand the meaning and grammatical form those morphemes represent (e.g., knowing that the suffixes "–ion" and "–ian," although phonologically identical, denote different meanings and different grammatical classes). Morphological analysis is a word-meaning process. Individuals use their understanding of the component morphemes within multiple morphemic words to comprehend the overall meaning of those complex words.

Levesque et al.'s (2020) framework is similar to some aspects of Apel's (2014) four-component morphological awareness model in that it promotes an awareness of the form of written morphemes and what those affixes mean as essential elements for morphological decoding and analysis. However, it differs from Apel's definition, because it puts a focus on the use of morphological awareness without defining the different components that contribute to the successful use of that linguistic awareness skill. For example, it does not specify the required understanding of how the addition of affixes can alter the spelling and/or meaning of a base word. It also does not draw attention to the need to actively think about base words and their inflected and derived forms of that base word to draw meaning from unknown morphologically complex words. These types of understandings are required for successful morphological decoding and analysis. Thus, while both frameworks provide specificity to the definition of morphological awareness, Apel's viewpoint may provide more guidance to researchers and practitioners. Using the Apel framework, researchers could more fully examine the development of different aspects of morphological awareness and how those different components might relate to literacy skills in varying ways. Furthermore, practitioners may be better prepared to provide prescriptive interventions that target specific components of morphological awareness in need of improvement.

Using Multiple Tasks to Measure Morphological Awareness

In recent years, some research teams have intentionally used multiple morphological awareness tasks to assess the skill; for some, this strategy was based on the notion that morphological awareness is a multidimensional construct (e.g., Apel, Diehm, & Apel, 2013; Deacon et al., 2017; Goodwin et al., 2020; James et al., 2020). For example, Apel, Diehm, and Apel assessed the morphological awareness skills of 156 kindergarten through second-grade students using four different tasks, each representing one of the four components of Apel's (2014) model. The tasks varied in the mode (spoken vs. written) of the stimulus provided and the response required. Specifically, they assessed students' awareness of the following:

1. written morphemes, by having them circle real written affixes attached to written nonsense words (written stimulus/written response);
2. affix meanings, by having them combine two morphemes to create "silly" nonsense compound words and then define those words (spoken stimulus/spoken response);
3. how suffixes can alter the spelling of base words, by having them spell multimorphemic words (spoken stimulus/written response); and
4. meaningful connections among base words and their inflected and derived forms, by having them complete sentences with an inflected or derived form of a given base word (spoken stimulus/spoken response).

Apel, Diehm, and Apel (2013) reported that the four tasks were differentially related to different literacy outcomes. For example, performance on the "cloze" task (completing sentences with inflected or derived forms of base words) most frequently related to and/or predicted all students' reading abilities. Performance on the spelling and definition tasks also uniquely predicted real and pseudoword reading in second-grade students. Thus, the different tasks seemed to measure different aspects of morphological awareness. Without using the tasks that represented all four aspects of morphological awareness (Apel, 2014), an incomplete view of those different skills and their relationship to literacy would have occurred.

James et al. (2020) administered six tasks to students 6–12 years of age that assessed production and judgment of compound, inflected, and derived words using two tasks to measure each morpheme type. For compound word knowledge, the researchers required students to create novel compound words by combining two base words (e.g., *What is the name for a badge that an elk has?* response = *Elk badge*; production) and determine which of two compound words best fit a provided definition (e.g., *Which is a better name for a spot on your nose? Nose spot or spot nose?* judgment). For the assessment of inflected and derived knowledge, the students either completed an analogy task (e.g., *teach: teacher, sit:* ____; production) or determined which form of a base word best fit a given sentence (e.g., *To skip. Jimmy had skipping/skips/skipped to school*; judgment). For students between 6 and 11 years of age, the task stimuli and responses were either spoken or spoken and written. For students between 12 and 13 years of age, all tasks included written stimuli and written responses.

James et al. (2020) found that performance on the tasks across all age levels represented a single morphological awareness factor, suggesting that morphological awareness is a unidimensional construct. However, this finding may have occurred because the types of tasks were limited (mostly analogy and cloze tasks), essentially assessing the same two constituent skills, and did not measure the broad range of abilities involved in morphological awareness. Indeed, the tasks used appeared to align with only two of four of the components of Apel's (2014) comprehensive definition of morphological awareness. Therefore, concluding that morphological awareness is unidimensional may be problematic given that the tasks did not represent a complex definition of morphological awareness.

To date, Goodwin et al. (2020) are the only investigators who assessed students' morphological awareness abilities using a standardized, reliable, and valid measure composed of multiple tasks. Similar to Apel (2014), Goodwin et al. (2020) defined and assessed morphological awareness using a four-component model, assessing each component with one or two tasks. All of their tasks involved written stimuli and responses. Specifically, they assessed their student participants' abilities to perform the following:

1. identify morphemes in words, by determining which of three words did not fit morphologically based on similar affixes or base words and deciding whether words overlapped in their shared base word;
2. use suffixes to shift meanings and/or grammatical class of words, by choosing an affixed word from a choice of four related forms that best fit a missing word in a sentence and using an affixed form of a base word to complete a sentence;
3. use knowledge of morphemes' meanings to determine the meaning of morphologically complex words, by determining the meaning of the word's component morphemes; and
4. read and spell morphologically complex words, by identifying the correct pronunciation of morphologically complex words and spelling morphologically complex words.

Using these seven tasks, Goodwin et al. (2020) assessed the morphological awareness skills of 1,140 students in Grades 5–8 using a computer-adaptive measure: Monster, PI (Goodwin et al., 2020). Monster, PI is an iPad-based measure that administers a representative number of test items to students based on their developmental level. The measurement tool is a problem-solving game focused on saving a city and its inhabitants from a monster intent on destroying parts of the town (see https://worddetectives.com/ for additional information).

The researchers found the four component skills of their model supported reading comprehension differentially. For example, the students' abilities to use suffixes to shift words' meanings and/or grammatical class had the strongest predictive relation to reading comprehension, whereas their ability to use their understanding of morphemes' meanings to comprehend morphologically complex words had the least. Additionally, the relation between the different morphological tasks was moderate. These two findings provide additional support for a multidimensional view of morphological awareness. Notably, the researchers did not examine whether differences in performance occurred based on the tasks administered. By doing so, both theory and practice would be enhanced. Researchers could determine whether morphological awareness develops holistically across all components of the skill or whether differences in acquisition occur based on different aspects of morphological awareness. Furthermore, practitioners could provide more directed interventions.

Goodwin's et al. (2020) results provide initial support for a multidimensional model of morphological awareness using a standardized assessment measure that has the potential to guide instruction. The researchers developed their assessment tool for use with fifth- through eighth-grade students, a time period when students actively use their morphological awareness skills to read and spell morphologically complex words. Importantly, researchers have identified that the greatest growth in morphological awareness occurs during the first- through sixth-grade years (e.g., Berninger et al., 2010; Kuo & Anderson, 2003); morphological awareness intervention also has its greatest impact during those same years (e.g., Bowers et al., 2010; Goodwin & Ahn, 2013). Thus, further study of the morphological awareness skills of younger students, using multiple tasks, is warranted.

Taken as a whole, assessing students' morphological awareness abilities using tasks that fully represent this multidimensional skill may lead to the discovery of varied performance (or skill) profiles based on those tasks. Although an investigation of different performance profiles based on different tasks has yet to be conducted, some recent studies suggest that students may present with different profiles depending on the type of morphological awareness task administered.

Morphological Awareness Performance Profiles

In the past few years, two investigative teams have reported differences in performance across a range of morphological awareness tasks that suggest different skill profiles emerge when multiple tasks are administered (e.g., Goodwin et al., 2020; Levesque et al., 2020). For example, Goodwin et al. (2020) found that a subset of their fifth- through eighth-grade students, who were identified as having limited reading vocabulary, performed differentially on tasks representing the four morphological awareness components assessed. As an example, these students' abilities to use the syntactic, phonological, and orthographic information in morphemes, as measured by some tasks, were considered more advanced than those same students' use of semantic information in morphemes, using a different task. Similarly, Levesque et al. (2017) found that third-grade students' performance on morphological awareness contributed to reading comprehension indirectly via morphological decoding, as measured with certain tasks, and via morphological analysis, as measured by other tasks. These findings suggest that varied performances on different morphological awareness tasks may result in different skill profiles.

The idea that different morphological awareness tasks can lead to different profiles of performance is tentative given that no researchers have sought to determine directly whether specific profiles arise when assessing students' morphological awareness abilities. A more direct investigation of students' morphological awareness performance profiles is needed, because different profiles should lead to more prescribed instruction specific to the individual needs of the student. To best determine potential performance profiles, a set of measures should be administered that collectively represent a comprehensive definition of morphological awareness (e.g., Apel, 2014). By using such a battery of measures, investigators may be able to determine whether consistent and stable performance profiles are evident across all aspects of morphological awareness or whether variations in specific aspects of, or skills within, morphological awareness exist. In doing so, it would be important to examine these potential skills profiles at a number of grade levels, given students typically increase in their morphological awareness skills across the elementary and middle school years (e.g., Berninger et al., 2010).

This Study

Our goal for this study was to determine whether different groups of students perform differentially across multiple tasks using the MATRS assessment tool. Specifically, we were interested in whether diverse profiles of strengths and weaknesses would emerge when assessing different aspects of morphological awareness at each of six grades. If there were heterogeneity in groups of scores on the MATRS, then MATRS would have potential clinical usefulness in identifying students struggling in particular areas of morphological awareness, leading to more prescriptive instructional plans. On the basis of past investigations (e.g., Goodwin et al., 2020; Levesque et al., 2017), we hypothesized that specific skill profiles would emerge based on the tasks administered. We also hypothesized we would find various profiles of performance at each grade level, given it is during first through sixth grade when active morphological awareness development is occurring (e.g., Berninger et al., 2010; Kuo & Anderson, 2003).

Method

Participants

The data for this study were part of a 3-year project to develop a valid and reliable morphological awareness assessment tool. The current data were from Years 1 and 2. A total of 4,059 first- through sixth-grade students (Grade 1 N = 806, Grade 2 N = 726, Grade 3 N = 756, Grade 4 N = 644, Grade 5 N = 626, Grade 6 N = 501) participated in this study. We recruited the students from a variety of school sites, including public and private schools, in a southeastern region of the United States. These schools were situated in high-, middle-, and low-income neighborhoods based on school-reported percentages of students eligible for free and reduced lunches. We distributed consent forms, approved by the local institutional review board, to teachers in the participating schools; the teachers then distributed the consent forms to their students. Only students with returned, signed parental/guardian consent forms participated in the study. Full sample demographics were 53.97% female; race/ethnicity was 43.81% White, 37.70% Black, 9% Multiracial, 5.24% Latinx, 1.50% Asian, < 1% Native American, and 1.75% no response. Over 90% of the sample reported mother and father's education having completed high school or a General Educational Development. Ninety-four percent of the sample spoke English as the primary language, 3% spoke Spanish as the primary language, and 3% of the sample spoke another primary language in the home. Per parent report, the majority of students participating in this study had not received or currently were not receiving special education services (70%) with approximately 7% of the sample receiving speech services only, 9% receiving reading/writing services only, 9% receiving multiple services, and 5% noting other services that were provided.

The only exclusionary criterion for participation was that students were required to spend the majority of their instructional time in a general education classroom. Similar numbers of male and female students across grades participated. The students also represented diverse races and ethnicity. Information on the numbers of participating students in each grade, as well as their demographic information, is provided in Table 1.

MATRS Tasks

The full MATRS assessment tool contains eight tasks. We administered all eight tasks to the third- through sixth-grade students. Because of potentially high-cognitive demands associated with reading and writing, we did not administer two tasks (Tasks 4 and 8) to the first- and second-grade students; thus, these primary-grade students were administered six tasks in total. Each MATRS task has the same number of items across grades. For all task items for all grades, the base words used were at grade level (e.g., SPELL-Links Word List Maker; Learning By Design, Inc., 2010; Zeno et al., 1995). The items had similar word frequency levels (Zeno et al., 1995) with ranges of word frequencies to ensure a range of difficulty, yet no low frequency/rare words (no Standard Frequency Indexes below 30; e.g., Carlisle & Katz, 2006). Furthermore, each task at each grade level contained items that represented inflectional and derivational affixes and multimorphemic words that varied in their orthographic and phonological transparency from the base word (i.e., the base word either was seen and heard in a derived form or its phonological

Table 1. Participant demographic information by grade.

Characteristic	Group	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Sex	% Female	52.79	54.07	53.17	49.84	54.47	55.09
	% Male	47.21	45.93	46.83	50.16	45.53	44.91
Race	% White	41.76	40.5	46.56	46.74	42.81	45.31
	% Black	41.14	39.94	37.17	33.23	38.34	34.73
	% Multiracial	8.05	9.37	7.01	7.61	5.75	5.99
	% Latinx	3.97	4.68	4.37	5.28	5.75	8.78
	% Asian	1.98	1.93	1.45	2.64	3.19	1.2
	% Native American	1.12	0.41	0.26	0.62	0.48	1.2
Parental education	% GED/HS+	95.26	93.15	94.45	95.72	92.81	93.4
Home language	% English	95.17	94.08	94.18	93.32	93.29	90.42
	% Spanish	2.35	2.62	3.04	3.57	3.51	6.99
	% Other	2.48	3.3	2.78	3.11	3.2	2.59
SPED services	% No SPED	72.24	68.32	70.5	70.19	71.25	74.05
	% Speech	7.56	7.85	7.14	7.14	7.35	6.59
	% Language	< 1%	< 1%	< 1%	< 1%	< 1%	1.8
	% Reading/writing	7.56	9.37	9.52	9.63	8.63	6.19
	% Multiple	9.42	10.19	8.86	9.16	9.42	8.18

Note. GED/HS+ indicates the percentage of parent informants who reported to have at minimum passed the General Educational Development (GED) test or received their high school diploma. This percentage also includes parents who earned advanced degrees. SPED = special education.

and/or orthographic forms was changed; Carlisle & Stone, 2005). In addition, all MATRS task items were reviewed by three content experts to determine their suitability for the intended subtest (i.e., coherence with the definition), whether task items represented a range of difficulty suitable for students in first through sixth grades, and fairness to intended population subgroups (e.g., by gender, race/ethnicity, socioeconomic status, and disability). Only items that met those criteria were included in the test. See the work of Apel et al. (2021) for specific information about the composition of the test and its reliability and validity.

Thinking about, or being conscious of, morphemes necessarily involves spoken and written morphology, including understanding rules for what affixes look like orthographically and how they attach to base words. Without this latter awareness or knowledge, the ability to deduce meaning from unknown written words would be diminished. Thus, the eight tasks vary in the manner in which they are presented (i.e., in spoken and/or written mode). They also vary in the mode of response required (manual, spoken, and written). Below, we describe each task. See Table 2 for further descriptions. Table 2 also provides the range of internal reliability coefficients for each task across the grades. To determine concurrent validity, multiple regression analyses were used to test the additive and interactive strength of MATRS to explain individual differences in performance on the following measures at each grade level: Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007), Test of Word Reading Efficiency–Second Edition Sight Word Efficiency and Phonemic Decoding Efficiency subtests (Torgesen et al., 2012), and the Test of Written Spelling–Fifth Edition (Larsen et al., 2013). The R^2 values ranged from .17 to .86 (see technical report for values at each grade level; Apel et al., 2021).

Awareness of Spoken and Written Morphemes

The first two MATRS tasks assessed students' awareness of spoken and written morphemes (see the works of Casalis et al., 2004, and Apel, Diehm, & Apel, 2013, for similar tasks). Task 1 (Segmenting) required students to segment

Table 2. Morphological Awareness Test for Reading and Spelling tasks.

Task number	Description/example	Component of definition assessed	Administration/ student response	Reliability range across grades
1	Students tap out how many meaningful "parts" (i.e., prefixes, base words, and/or suffixes) they heard in the word (e.g., re/cycl/able)	Awareness of morphemes in spoken and written language	Spoken/manual	.67–.78
2	Students circle prefixes and suffixes ("add-ons") in nonsense words (e.g., triflack)		Written/written	.80–.92
3	Students choose the inflected/derived nonsense word that is appropriate for a sentence (e.g., If edam means "sea," then which word means to go in the direction of the sea? edams, edamer, edamable, edamward)	Awareness of the meanings of prefixes and suffixes and how the meaning or grammatical class of a base word may be modified when an affix is attached	Spoken and written/written	.82–.94
4	Students read a sentence with a missing word and then choose one of four inflected or derived words (e.g., Matthew was not known for being overly [friendly, friendship, friendliness, friends] to others		Written/written	.89–.91
5	Students spell multimorphemic words to dictation; spellings scored as correct or incorrect **Grades 3–6 only**	Awareness of alterations to the written form of base words that may occur when suffixes are attached	Spoken/written	.89–.95
6	Provided with the spelling of a base word (e.g., luck) and three phonologically plausible word endings (e.g., –y, –ie, and –ey), students circle the correct ending choice		Spoken and written/written	.84–.9
7	Students complete a sentence with either an inflected or derived form of a base word (e.g., Farm: My uncle is a ________.) or a base word of an inflected or derived form (e.g., bravery: I don't feel very _______.)	Awareness of the meaningful connections between base words and inflected and/or derived forms of those words	Spoken/spoken	.82–.88
8	Same as the Spoken Relatives task, except provided in written form. **Grades 3–6 only**		Written/written	.93–.95

spoken multimorphemic words into their individual morphemes by tapping out the number of "meaningful parts" (i.e., morphemes) they heard (e.g., neighborly contains neighbor + ly). Specifically, participants were given a wooden block and instructed to "tap out how many meaningful parts you hear in the word." Test items were scored as correct if the participant independently and correctly tapped the block the number of times that matched the number of morphemes in the particular word. The second task (Affix Identification), taken from the work of Apel, Diehm, and Apel (2013), used nonsense words containing real affixes. Students viewed the nonsense words and circled any real affixes that they saw attached to those nonsense words (e.g., circling the "–es" in grushes).

Awareness of Affix Meanings

Tasks 3 and 4 measured students' conscious understanding of affixes and how a base word's meaning and word class may change when an affix is attached. On Task 3 (affix meaning), which was similar to that developed by Mitchell and Brady (2014) and used by Apel and Henbest (2016), students heard and saw nonsense words (e.g., "*edam*") and were told what the words meant (e.g., "*edam means sea*"). The students then were provided the definitions of inflected or derived forms of the nonsense words and asked to choose an affixed word that met the definition (e.g., "*If edam means sea, which word means to go in the direction of the sea: edams, edamer, edamable, edamward*"). We administered Task 3 via a prerecorded audio file containing the task items to ensure consistency in pronunciation of the stimuli. On Task 4 (suffix choice), on the basis of the work of Nagy et al. (e.g., Nagy et al., 2006), the students read sentences with missing affixed words and then chose the correct affixed form from a list of four possible choices (e.g., "*Matthew was not known for being overly _____: friendship, friendly, friendliness, friends*"). Students typically encounter larger amounts of multimorphemic words in their school texts starting in Grade 3 (e.g., Anglin, 1993). Thus, because of its emphasis on reading multimorphemic words, we did not administer Task 4 to the first- and second-grade students.

Awareness of Alterations to Base Word Spellings

The fifth and sixth MATRS tasks required active attention to the alterations in base words when certain suffixes are attached. Thus, both of these tasks focused on the spelling of multimorphemic words. On the basis of Apel, Diehm, and Apel (2013), Task 5 (spelling multimorphemic Words) required students to spell words containing two or more morphemes (e.g., *penniless*). Spellings earned a point only if the entire word was spelled correctly. For Task 6 (suffix spelling), a modification of the Sangster and Deacon (2011) task, students read written sentences that contained spellings of base words without their suffixes and then chose correct spellings of the missing suffix from a list of three potential spellings (e.g., *The two girls had a strong friend_____: shep, shyp, ship; the choir sang all of their songs merr___: ily, iley, aly*). Correct answers included the suffix plus any changes that occurred at the juncture of the base word and the suffix (e.g., the change of "y" to an "i" was included in the correct answer, as seen in the example above). Incorrect responses included suffixes spelled the way they are pronounced and suffix spellings that did not contain the needed modifications that occur at the junction of base words and their suffixes.

Awareness of Meaningful Relations

The final two MATRS tasks, Tasks 7 (spoken relatives) and 8 (written relatives), assessed students' active awareness of the meaningful relations between base words and their inflected and derived forms (e.g., Apel, Diehm, & Apel, 2013; Carlisle, 2000; Wilson-Fowler & Apel, 2015). The two tasks were identical in structure, with the exception that we administered Task 7 using spoken language and provided Task 8 in written form. Because of the considerable reading and spelling requirements for Task 8, only third- through sixth-grade students completed this task. On both tasks, for half of the items, students either heard or saw base words and then heard or read a sentence that was missing an inflected or derived form of the base word; the students then filled in the missing word (e.g., *Act. When he grows up, the boy wants to be an ______ [actor]*). For the other half of the items, the students heard or read an inflected or derived word and then filled in a sentence with the base form of the word (e.g., *Feeding. The farmer has many cows to ____[feed]*).

Procedure

Trained research assistants administered all tasks. Prior to participant testing, the research assistants participated in specific training on task administration. During training, we provided feedback regarding task administration and corresponding protocol-scoring procedures. Once we obtained consent forms, the research assistants assessed students during school hours deemed suitable by the students' teacher. All testing occurred in the students' home school in a quiet location (e.g., library and conference room). Assessment began in the mid-Fall of the school year and continued to mid-Spring. We counterbalanced the administration of tasks across students.

We introduced all MATRS tasks using two to four modeled examples of the task, except for Task 5 (spelling multimorphemic words). For Task 5, we told students that they would hear a word, hear the word used in a sentence, and then hear the word again. We administered Tasks 1 and 7 individually with students. The students completed the remaining tasks in small groups of same-grade peers. We scored all task items as correct (1) or incorrect (0). Table 2 provides a summary of the task.

We conducted reliability in scoring and entering data for 15%–20% of all participants in each grade for Years 1 and 2. Average interscorer agreement and fidelity of data entry were 98.5% and 99.1%, respectively.

Data Analysis

Exploratory finite mixture models (E-FMMs; Muthén, 2008) estimated the number of latent subgroups that best reflected heterogeneity in task-level performance by grade level. E-FMMs can be useful as part of both understanding individual differences and as part of a broader psychometric process to the study existence of types across sets of correlated measures (Borsboom et al., 2016). Using the tidyLPA package (Rosenberg et al., 2019) in R software, we estimated two to seven classes (i.e., clusters of individuals) at each grade level according to the included tasks. Six statistical indices were used to evaluate model fit: (a) log-likelihood of the data, (b) consistent Akaike information criterion (CAIC), (c) sample size adjusted Bayes information criterion (SABIC), (d) Kullback information criterion (KIC), (e) entropy, and (f) a bootstrapped log likelihood test. The CAIC, SABIC, and KIC are information criteria rooted in the log likelihood but penalize the estimate according to the number of parameters or sample size. Lower values for each of the information criteria signal better fit for increasing model complexity. Entropy is a measure of model usefulness with values closer to 1.0 representing greater model usefulness. The confluence of these statistics was to look at both the tradeoff in fit with theoretical adequacy of the model and clinical utility in practice. In this manner, model fit was judged according to the minimum and maximum of the average posterior latent class probability of most likely group membership. Higher minimum and maximum values indicate greater orthogonality in the likelihood of classification certainty. The proportion of sample assigned to the smallest and largest class was also reported to give the range of possible normative expectations for classification by grade. When describing the performances of different classes, we used descriptors of average (within 1 *SD* of the mean) and above or below average (beyond ± 1 *SD* of the mean).

To determine which tasks to include in our final E-FMMs, we initially ran a series of exploratory models to determine potential performance profile groupings. Within each grade, there typically were three to eight different latent profile combinations, each represented by four tasks. For this article, we chose profiles that demonstrated strong reliability, included a set of tasks that were consistent between first and second grades and among third and sixth grades, and involved one task from each component of morphological awareness (Apel, 2014). For the first and second grades, the tasks included were the Task 2 (affix identification), Task 3 (affix meaning), Task 6 (suffix spelling), and Task 7 (spoken relatives). For Grades 3 through 6, Tasks 2, 3, and 6 were included along with Task 8 (written relatives). Other latent profile combinations are available upon request.

Results

Descriptive Statistics

Sample descriptive statistics and correlations among tasks by grade are reported in Table 3. Task means are a function of developmental *z* scores that were estimated in a large-scale vertical equating and scaling psychometric study (Apel et al., 2021). The steady increase in means for each task by grade level demonstrates that grade-based means are expected to increase grade by grade (e.g., Task 2 mean increases from −1.90 in Grade 1 to 1.41 in Grade 6). Task means by grade in this sample approximated the normative sample (Apel et al., 2021, p. 118). The developmental *z* scores were restandardized at each grade level with $M = 0$ and $SD = 1$ to facilitate interpretation of results in the latent profile analysis. Using latent profile analysis allowed us to take a person-centered approach to differentiate classes of abilities. No data were missing from this sample. Correlations showed moderate to

Table 3. Sample descriptive statistics and correlations by grade.

Grade	Variable	*M*	*SD*	1	2	3
1	1. Task 2	−1.90	0.82			
	2. Task 3	−1.05	0.64	.34		
	3. Task 6	−0.72	0.74	.36	.53	
	4. Task 7	−0.33	1.12	.25	.25	.23
2	1. Task 2	−0.77	0.97			
	2. Task 3	−0.43	0.84	.43		
	3. Task 6	0.06	1.03	.48	.58	
	4. Task 7	0.23	0.99	.31	.49	.42
3	1. Task 2	−0.15	0.95			
	2. Task 3	0.04	1.01	.46		
	3. Task 6	0.44	1.10	.44	.62	
	4. Task 8	−1.23	1.82	.39	.67	.68
4	1. Task 2	0.61	0.96			
	2. Task 3	0.34	1.15	.49		
	3. Task 6	0.72	1.07	.45	.58	
	4. Task 8	−0.47	1.64	.45	.66	.71
5	1. Task 2	1.09	1.16			
	2. Task 3	0.36	1.15	.50		
	3. Task 6	0.79	0.84	.39	.56	
	4. Task 8	−0.10	1.53	.42	.62	.67
6	1. Task 2	1.41	1.06			
	2. Task 3	0.77	1.16	.40		
	3. Task 6	1.28	0.95	.33	.57	
	4. Task 8	0.54	1.55	.32	.63	.62

Note. All correlations $p < .01$.

strong relations among the tasks by grade: .23 < *r* < .53 in Grade 1, .31 < *r* < .58 in Grade 2, .39 < *r* < .68 in Grade 3, .45 < *r* < .71 in Grade 4, .39 < *r* < .67 in Grade 5, and .32 < *r* < .63 in Grade 6.

E-FMM Results

Grade 1

Grade 1 results are reported in Table 4. The CAIC, SABIC, and KIC demonstrated that the model improved fit as the complexity of the class structure increased from two to seven classes. Entropy was highest in the three-class (.90), seven-class (.88), and both the six-class and four-class (.87) models. A four-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). The four classes showed patterns of differentiation largely on level of differences of ability *within* a task as opposed to differences in ability across tasks. Class 1 (*n* = 615; 76% of the sample) was characterized by average performance across tasks. Class 2 (*n* = 47; 6% of the sample) was below average on Tasks 2, 3, and 6 and average on Task 7. Class 3 (*n* = 128; 16% of the sample), although average on all tasks (approached above average on Task 3), demonstrated performance in the higher range of average compared with Class 1. Class 4 (*n* = 16; 2% of the sample) was above average on all tasks.

Grade 2

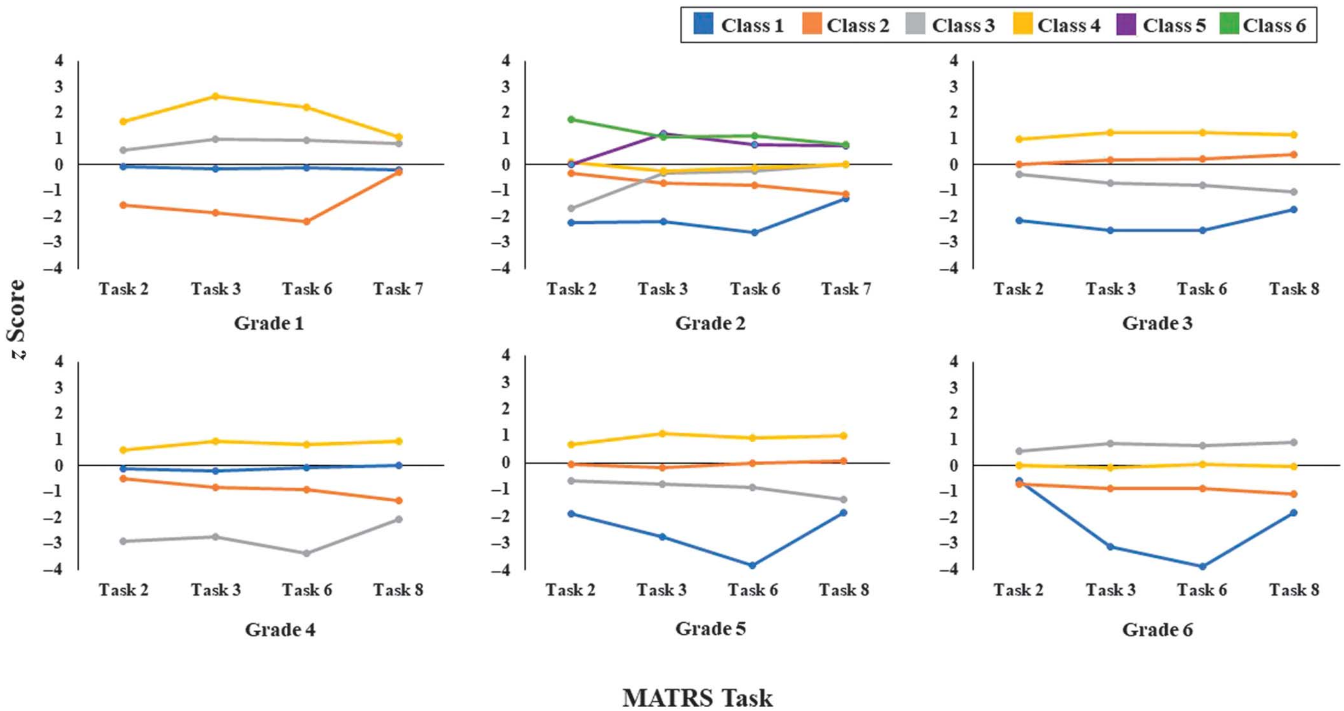
Grade 2 results are reported in Table 4. The CAIC, SABIC, and KIC demonstrated that the model improved fit as the complexity of the class structure increased from two to seven classes. Entropy was highest in the three-class (.88), seven-class (.81), and six-class (.79) models. A six-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). Unlike Grade 1 where profiles were characterized by differences of ability

Table 4. Latent profile analysis model fit by class and grade.

Grade	Class	LogLik	CAIC	SABIC	KIC	Entropy	p_min	p_max	n_min	n_max	BLRT	BLRT_p
1	2	–3756.42	7612.83	7558.55	7554.83	0.77	0.78	0.97	0.16	0.84	294.95	0.00
	3	–3576.70	7291.85	7216.69	7210.40	0.90	0.84	0.98	0.06	0.80	359.89	0.00
	4	–3547.19	7271.30	7175.26	7166.38	0.87	0.77	0.97	0.02	0.76	59.02	0.00
	5	–3536.19	7287.76	7170.85	7159.39	0.75	0.57	0.96	0.02	0.63	21.99	0.00
	6	–3492.90	7239.63	7101.83	7087.79	0.87	0.77	0.97	0.04	0.52	83.85	0.00
	7	–3464.00	7220.29	7061.62	7044.99	0.88	0.80	0.97	0.01	0.47	57.80	0.00
2	2	–3721.28	7541.18	7486.91	7484.56	0.76	0.89	0.95	0.33	0.67	514.03	0.00
	3	–3598.42	7333.38	7258.23	7253.83	0.88	0.90	0.96	0.02	0.68	245.73	0.00
	4	–3561.73	7297.94	7201.91	7195.46	0.73	0.74	0.97	0.02	0.51	73.37	0.00
	5	–3533.96	7280.33	7163.42	7154.92	0.73	0.72	0.97	0.02	0.50	55.54	0.00
	6	–3485.15	7220.64	7082.85	7072.30	0.79	0.67	0.97	0.02	0.48	65.72	0.00
	7	–3462.15	7212.57	7053.91	7041.30	0.81	0.63	0.95	0.02	0.47	46.00	0.00
3	2	–4349.48	8798.11	8743.83	8740.96	0.81	0.93	0.95	0.42	0.58	858.00	0.00
	3	–4222.92	8583.12	8507.96	8502.84	0.80	0.81	0.95	0.17	0.50	253.12	0.00
	4	–4138.14	8451.69	8355.65	8348.27	0.85	0.85	0.94	0.02	0.49	169.57	0.00
	5	–4082.45	8378.44	8261.53	8251.89	0.83	0.85	0.93	0.02	0.38	111.38	0.00
	6	–4060.48	8372.65	8234.86	8222.97	0.83	0.67	0.92	0.02	0.38	43.93	0.00
	7	–4037.27	8364.35	8205.68	8191.53	0.80	0.73	0.96	0.02	0.30	46.44	0.00
4	2	–3733.13	7563.32	7509.04	7508.26	0.78	0.92	0.94	0.41	0.59	677.23	0.00
	3	–3588.44	7311.27	7236.13	7233.88	0.86	0.93	0.95	0.02	0.50	289.37	0.00
	4	–3487.91	7147.55	7051.52	7047.82	0.83	0.89	0.99	0.02	0.45	201.06	0.00
	5	–3463.04	7135.13	7018.24	7013.08	0.77	0.82	0.99	0.02	0.35	49.74	0.00
	6	–3450.63	7147.64	7009.87	7003.26	0.78	0.67	1.00	0.02	0.35	24.83	0.00
	7	–3438.99	7161.70	7003.05	6994.99	0.75	0.59	1.00	0.02	0.32	23.27	0.00
5	2	–3586.80	7270.29	7216.02	7215.60	0.74	0.91	0.94	0.44	0.56	587.10	0.00
	3	–3465.81	7065.49	6990.34	6988.61	0.79	0.87	0.92	0.16	0.55	241.99	0.00
	4	–3390.57	6952.21	6856.19	6853.15	0.83	0.88	1.00	0.01	0.53	150.47	0.00
	5	–3355.80	6919.86	6802.96	6798.60	0.80	0.86	1.00	0.01	0.37	69.55	0.00
	6	–3338.96	6923.36	6785.59	6779.92	0.81	0.71	1.00	0.01	0.35	33.69	0.00
	7	–3317.79	6918.21	6759.56	6752.57	0.83	0.80	1.00	0.00	0.41	36.07	0.00
6	2	–2897.30	5888.39	5834.13	5836.60	0.77	0.91	0.95	0.38	0.62	470.00	0.00
	3	–2815.15	5760.15	5685.02	5687.29	0.86	0.91	0.99	0.01	0.58	164.31	0.00
	4	–2780.12	5726.18	5630.18	5632.24	0.74	0.81	1.00	0.01	0.41	70.05	0.00
	5	–2754.28	5710.58	5593.70	5595.57	0.76	0.78	0.99	0.01	0.44	51.68	0.00
	6	–2728.01	5694.10	5556.35	5558.02	0.81	0.78	1.00	0.01	0.42	52.55	0.00
	7	–2705.83	5685.81	5527.20	5528.66	0.80	0.78	1.00	0.00	0.45	44.36	0.00

Note. LogLik = model log-likelihood; CAIC = consistent Akaike information criterion; SABIC = sample adjusted Bayesian information criterion; KIC = Kull information criterion; p_min = probability minimum; p_max = probability maximum; n_min = sample proportion minimum; n_max = sample proportion maximum; BLRT = bootstrapped likelihood test; BLRT_*p* = *p* value for BLRT.

Figure 1. Line plots depicting *z* scores on Morphological Awareness Test for Reading and Spelling (MATRS) tasks by class for each grade.



within task, profiles in Grade 2 showed patterns of differentiation in ability *across* tasks. Class 1 (n = 19; 2% of the sample) was characterized as below average on all tasks; this class represented the lowest performance across tasks for all classes. Class 2 (n = 100; 14% of the sample) was average on Tasks 2, 3, and 6 but below average on Task 7. Class 3 (n = 66; 9% of the sample) was below average on Task 2 and average on Tasks 3, 6, and 7. Class 4 (n = 346; 48% of the sample) was average on all tasks. Class 5 (n = 105; 15% of the sample) was average on Tasks 2, 6, and 7 and above average on Task 3. Class 6 (n = 90; 12% of the sample) was above average on Tasks 2, 3, and 6 and average on Task 7.

Grade 3

Grade 3 results are reported in Table 4. The CAIC, SABIC, and KIC demonstrated that the model improved fit as the complexity of the class structured increased from two to seven classes. Entropy was highest in the four-class (.85), five-class (.83), and six-class (.83) models. A four-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). Similar to Grade 1, the four classes showed patterns of differentiation largely on level of ability *within* tasks. Class 1 (n = 14; 12% of the sample) was characterized as below average on all tasks; this class represented the lowest performance across tasks for all classes. Class 2 (n = 369; 49% of the sample) was average on all tasks. Class 3 (n = 253; 34% of the sample) was average on Tasks 2, 3, and 6 and below average on Task 8. Class 4 (n = 119; 19% of the sample) was near or above average on all tasks.

Grade 4

Grade 4 results are reported in Table 4. The SABIC and KIC demonstrated that the model improved fit as the complexity of the class structured increased from two to seven classes; however, the CAIC showed a degradation in model fit as the values decreased from two to five classes and then increased from five to seven classes. Entropy was highest in the three-class (.86) and four-class (.83), models. A four-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). Similar to Grade 3, the four classes showed patterns of differentiation largely on level of ability *within* tasks. Class 1 (n = 11; 2% of the sample) was characterized by average performance across tasks. Class 2 (n = 288; 45% of the sample) was average on Tasks 2, 3, and 6 (although near below on Tasks 3 and 6) and below average on Task 8. Class 3 (n = 131; 20% of the sample) was below average on all tasks in a way that demonstrated greater severity compared with Class 2. Class 4 (n = 213; 33% of the sample) was average on all tasks.

Grade 5

Grade 5 results are reported in Table 4. Similar to Grade 4, the SABIC and KIC demonstrated that the model improved fit as the complexity of the class structure increased from two to seven classes; however, the CAIC showed a degradation in model fit as the values decreased from two to five classes and then increased from five to six classes before dropping down in Class 7. Entropy was highest in the four-class (.83), seven-class (.83), and six-class (.81) models. A four-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). The four classes showed patterns of differentiation largely on level of ability *within* tasks. Class 1 (n = 8; 2% of the sample) was characterized by below average performance across tasks. Class 2 (n = 329; 53% of the sample) was average on all tasks. Class 3 (n = 126; 20% of the sample) was average on Tasks 2, 3, and 6 but below average on Task 8. Class 4 (n = 162; 25% of the sample) was above average on Tasks 3 and 8 and average on Tasks 2 and 6.

Grade 6

Grade 6 results are reported in Table 4. The SABIC, CAIC, and KIC demonstrated that the model improved fit as the complexity of the class structured increased from two to seven classes. Entropy was highest in the three-class (.86), six-class (.81), and seven-class (.80) models. A four-class solution was selected based on the balance of fit indices and model usefulness (see Figure 1). The four classes showed patterns of differentiation largely on level of ability *within* tasks. Class 1 (n = 10; 3% of the sample) was characterized by below average performance on Tasks 3, 6, and 8 and average performance on Task 2. Class 2 (n = 122; 24% of the sample) was below average on Task 8 but average on Tasks 2, 3, and 6. Class 3 (n = 164; 32% of the sample) was average on all tasks. Class 4 (n = 207; 41% of the sample) was average on all tasks.

The Appendix contains a table with sample size and percentages for each class by grade level. Caution should be taken against making direct comparisons of numerical classes between grades as mixture models do not necessarily extract similar "types" according to the numerical label. For example, "Class 1" reflects average performance in Grades 1 and 4 but low performance in Grades 2, 3, 5, and 6. For additional information on correlations among tasks, their reliability, and prediction of outcomes, see the work of Apel et al. (2021).

Post hoc Analysis

Recall that approximately 25% of our participants reportedly had received or were receiving special education services in their schools. We were interested in whether the percentage of students reported as receiving special services in certain classes was similar to the percentage of students with reported typical language and learning abilities in those same classes. We examined these percentages at each grade level. Because the number of students per type of special education services category (e.g., speech services and reading/writing services) was not large, we combined all students with reported special needs into one group. For this descriptive analysis, we specifically compared classes in which performance was below average on one or more tasks. Except for first grade, the percentage of students reported to receive special services who were placed into a class that represented some below average performance was higher than for those students reported to have typical skills in the same classes. Indeed, the percentage of students reported to receive special services who performed below average on one or more tasks was 19%–40% greater than the students with typical abilities, depending on the task. In contrast, the percentage of first-grade students receiving special services scoring below average on one or more tasks was lower (3%) than the percentage of their counterparts with typical skills (7%).

Discussion

Morphological awareness is a vital linguistic awareness skill that supports reading and writing (e.g., Apel, 2014; Goodwin et al., 2020; Nagy et al., 2006). As such, researchers measuring students' metalinguistic skills could benefit from knowing whether different tasks lead to different performance profiles, thus impacting their study of its development and its relation to specific literacy skills. Practitioners also could benefit knowing different measures may affect students' performance. With that information in mind, practitioners would assess a range of morphological awareness abilities to determine their students' possible strengths and weaknesses, leading to instruction that can focus on improving identified weaknesses.

Performance Profiles

Our results suggest that different skill profiles emerge when students are administered multiple tasks representing a comprehensive view of morphological awareness. Our findings revealed that, at each of six grades (first through sixth), classes or clusters of students performed differentially on specific tasks. Within each grade, no one task consistently resulted in a stable level of performance across students. That is, all students within a grade did not consistently perform either average, above average, or below average on the same task. Instead, each of the four tasks representing the four components of morphological awareness helped form the different clusters of students by revealing their specific strengths and weaknesses. Thus, our findings demonstrate that students can differ in the patterns of strength of their morphological awareness across a series of tasks. Given these outcomes, researchers and practitioners should not assume that any one task will provide a clear summary of students' morphological awareness abilities. Indeed, students' performances on one or two tasks likely will not represent those students' overall capabilities. Furthermore, our outcomes suggest that findings on separate measures of morphological awareness should not be combined into one composite score as has been done in previous investigations (e.g., Clin et al., 2009; Fracasso et al., 2016); doing so may obscure students' individual abilities in each aspect of morphological awareness.

Some clusters of students within certain grades demonstrated different levels of abilities based on the task (e.g., average performance on some tasks and either above or below average performance on other tasks). For example, in Grade 1, one class of students performed in the average range on Task 7 (spoken relatives) but below the average range on Task 2 (affix identification), Task 3 (affix meaning), and Task 6 (suffix spelling). There were examples of these type of "mixed" or uneven performance profiles in each of the six grades. This finding that some students at each grade level are not performing uniformly at average, below average, or above average levels makes sense given that morphological awareness skills are actively developing in the first six grades of formal education (e.g., Berninger et al., 2010).

By examining performance at the task level, our findings support the idea that development may be uneven as students are in an active phase of acquiring morphological awareness. In other words, it seems that every component of morphological awareness may not develop to the same degree of performance simultaneously. This finding is important, because it provides evidence that morphological awareness is not an all-or-none ability; students may display adequate abilities in some components of the construct and yet below or above average skills in others. Thus, defining and assessing morphological awareness in a more holistic manner (e.g., conscious awareness of morphemes), without attention to the different skills that make up morphological awareness, is not optimal. That is, no task, or a set of tasks, representing one specific component can represent students' overall morphological awareness abilities. Clinically, these findings emphasize strongly the need to assess morphological awareness with a range of tasks so as to best profile young students' morphological awareness skills. By doing so, the resulting information surely will inform subsequent instruction.

For some classes across the six grades, performance on the four tasks was similar (i.e., a performance on all tasks were either average, below average, or above average). That is, there were no mixed or uneven performance profiles across the different tasks. Given this finding, it might seem that assessing students' performance on one of the tasks would capture their overall morphological awareness skills. There are two important caveats to this assumption. First, there would be no way to determine a priori into what class profile a student would fit. Second and most importantly, the class plots and descriptions were based on the mean scores for the students in each specific performance class. As such, there still can be variations in scores for the students within a class. For example, a student may fit best in the class that was below average across the four tasks; however, individually, the student might have performed within the average range on one of those tasks. Thus, researchers and practitioners still would want to administer all tasks to ensure individual students' strengths and weaknesses are identified.

Performance Profiles of Students Receiving Special Services

Although not a specific purpose of our investigation, we descriptively examined the percentage of students receiving special services who fell into the different classes of performance profiles at each grade level. Specifically, we were interested in documenting the percentage of students in each class that demonstrated below-average performance on one or more tasks. We found that the percentage of students receiving special services who fell into classes containing below-average performances on one or more tasks was notably more than that of their peers with typical skills, except for students in first grade. For Grades 2–6, there were higher percentages of students receiving special services in clusters that included below-average performances. This finding is not all together surprising in that students receiving special services, particularly in the area of spoken and written language, often perform poorer on measures of linguistic awareness when compared with their peers with typical skills (e.g., Casalis et al., 2004; Goodwin et al., 2020). Following a different trend, the percentage of first-grade students receiving special services who demonstrated below-average performance was lower than that of students with typical skills. This unusual finding may have occurred because there had been less (school) time for the first-grade students compared with all other grades. That is, it may be some students categorized as having typical skills had not yet been identified as having deficits in spoken and written language. Alternatively, because morphological awareness is early and active in its development in the first grade, it may be that morphological awareness skills are particularly variable at this time even for students who are developing typically, reducing apparent differences in morphological awareness skills between the two groups. In the future, researchers should take a more proactive approach to detailing the performance profiles of students who do and do not receive special services.

Taken as a whole, the performance profiles that emerged at each of the six grades provide evidence that students can differ from their peers in ability level given a range of tasks that assess different aspects of morphological awareness. As such, researchers and practitioners should measure the range of students' morphological awareness using tasks that assess different aspects of the skill. In our study, we chose to use tasks from a standardized test of morphological awareness: MATRS. The characteristics and design of those tasks may have aided in the discovery of the performance profiles that we found.

Task Characteristics and Designs

When assessing morphological awareness abilities, many researchers have only required students to provide spoken responses across one or more tasks (e.g., Deacon et al., 2014, 2017; Desrochers et al., 2018). The performance profiles that emerged from our findings suggests that tasks used to assess morphological awareness should measure students' abilities that require the use of morphological awareness skills for written language items as well. On Tasks 2 and 6, the students were required to identify what written affixes look like and how written suffixes may change the orthographic form of base words to which they are attached. Inclusion of tasks such as these align with one of the main tenets of our comprehensive view of morphological awareness (Apel, 2014); morphological awareness includes a recognition of written morphemes. Indeed, one reason morphological awareness aids reading and spelling is because students must apply their knowledge to written morphology, recognizing the orthographic representations of those morphemes. Identifying written morphemes allows students to apply their knowledge of the meaning of base words and the attached affixes to problem solve the meaning of unknown multimorphemic words (Anglin, 1993). Notably, morphological awareness tasks that focus on the written form of morphemes have not always been used by researchers assessing students' morphological awareness abilities. Given our findings, researchers who do not include tasks involving awareness of written morphological forms will need to apply caution to their descriptions of morphological awareness development and its relation to students' literacy skills.

Each MATRS task contained both inflectional and derivational items. Inflectional and derivational affixes vary in a number of ways. For example, awareness of inflectional affixes tends to emerge sooner than a recognition of derivational affixes (e.g., Kuo & Anderson, 2003). In addition, there are far fewer inflectional affixes than derivational affixes yet inflectional affixes are more frequent in occurrence and generally shorter in letter length. Given these differences, we deemed it important to ensure our task items contained both types of affixes. Inclusion of both types of affixes within a task has not always been the case with measures used by other investigators (e.g., Berko, 1958; Larsen & Nippold, 2007; Singson et al., 2000). Using only one affix type may not lead to well-informed, authentic performance profiles, given the differences in those affixes.

The MATRS tasks were designed to assess morphological awareness for both spoken and written language, with the goal of using tasks that measure how students may apply or need to use their morphological awareness skills when reading and writing. Other morphological awareness tasks, not included in MATRS, also have been used previously to assess this linguistic awareness skill. These measures were not included for this study because they seemed to assess morphological awareness in ways that do not relate to its use when engaged in reading and writing. For example, some investigators have used word or sentence analogy tasks (e.g., drip > dripping, sip > _______ (sipping); James et al., 2020; Nunes et al., 2006). Others have used compound formation tasks (e.g., Which is a better name for a sign that goes on a house? A housesign or a signhouse?; James et al., 2020; Spencer et al., 2015). It remains unclear whether performance on these tasks would contribute to differing skill profiles.

In the past, some researchers have administered multiple tasks to measure students' morphological awareness (e.g., Desrochers et al., 2018; James et al., 2020). Unlike the MATRS tasks, some of those researchers used tasks that appear to differ from one another yet require the same response. For example, Desrochers et al. (2018) required students to complete analogy tasks at the word and sentence levels. Thus, even though the content of the tasks was different, the same type of task requirement (i.e., production) occurred in both measures. The MATRS tasks required a number of different task requirements (e.g., production, judgment, and segmentation) depending on the aspect of morphological awareness being measured. It may be that the need to demonstrate morphological awareness using different response requirements contributed to the differing performance profiles. In the future, researchers may wish to examine whether the type of response requirement influences students' skill profiles.

Previously, researchers have reported differences in the strength of the relation between morphological awareness and literacy skills depending on grade (e.g., Deacon & Kirby, 2004; Nagy et al., 2006). For example, Nagy et al. (2006) administered four morphological awareness tasks and examined the relation between performance on those measures to multiple measures of reading and spelling. They found that the morphological awareness skills of students related to different numbers of literacy skills depending on the grade level. As an example, morphological awareness contributed to reading fluency for eighth- and ninth-grade students but not for fourth- and fifth-grade students. Our outcomes showed that different skill profiles emerged within each grade level. For example, in Grade 3, 12% of the students performed below average on all four tasks. In Grade 4, 20% of the students scored below average on all tasks. Investigators may wish to determine in the future whether the strength of the relation between morphological awareness to reading and writing differs depending on the skill profiles of groups of students in differing grades.

Clinical Implications

Our findings have several potential clinical implications. Given different groups of students demonstrate different performance profiles, practitioners will want to assess all aspects of morphological awareness to best capture their students' abilities. Without doing so, deficient skills within one aspect of morphological awareness may not be revealed. Returning to the example of the first-grade performance profiles mentioned earlier, one class of students performed below average on three tasks (Tasks 2, 3, and 6) and average on the fourth (Task 7). Notably, some version of Task 7 (spoken relatives) is one of the most commonly used tasks to measure morphological awareness (e.g., Apel, Diehm, & Apel, 2013; Carlisle, 1988; Levesque et al., 2017). Had only Task 7 been administered, researchers or practitioners would have had an incomplete picture of a student's overall morphological awareness abilities.

Identifying weaknesses in one or more aspect of morphological awareness aids practitioners in developing and implementing skill-specific instructional strategies to improve those specific weaknesses. For example, for a student whose profile suggested below-average abilities with an awareness of the meaningful relations between base words and their inflected and/or derived forms (i.e., Tasks 7 and 8), instruction focused on how words relate to one another based on a shared base word (e.g., fast, faster, and fastest), such as the "Word Relatives" activity (e.g., Apel, Brimo, et al., 2013; Apel & Werfel, 2014; Wasowicz et al., 2012), might be appropriate. However, if a weakness was noted in an awareness of how suffixes may alter base words when the suffixes are attached (e.g., rule for when to double the final consonant in the base word when suffix is added, "run > running" vs. "sleep > sleeping"; Tasks 5 and 6), a different task, such as a word-sorting activity (e.g., Apel, Brimo, et al., 2013; Apel & Werfel, 2014; Wasowicz et al., 2012), would help improve that aspect of morphological awareness.

Limitations and Future Research Considerations

As with any investigation, there are some limitations to our study. First, we did not use tasks that included compound words, a type of multimorphemic word contained in tasks administered in past investigations (e.g., Apel, Diehm, & Apel, 2013; James et al., 2020). When students are confronted with an unfamiliar written compound word (e.g., "underestimate"), they can use their morphological awareness abilities to decompose the compound word into its two base forms as a strategy to comprehend the word's meaning. This same skill of recognizing two or more morphemes in a word is assessed in MATRS Tasks 1 and 2, which require students to identify all individual morphemes contained in multimorphemic words. The difference is that those MATRS tasks require students to identify not only base words but also any affixes that are part of the words; this makes sense given that a large percentage of multimorphemic words are words containing affixes (e.g., Anglin, 1993). In the future, compound words could be included as items in some tasks meant to assess students' recognition of spoken and written morphemes.

We did not set out to identify the performance of students representing specific categories of special services (e.g., reading and writing, speech). Indeed, our intent was to assess students representing a range of abilities who spend the majority of their time in general education classroom. In that way, we could determine whether different performance profiles existed across a heterogeneous population of students. Although we performed a preliminary descriptive post hoc analysis of the performance of students receiving special services, a more direct investigation of specific subgroups of individuals receiving special services would provide a more detailed picture of these students' performance profiles. Related to this limitation, we also did not have access to students' files to confirm a diagnosis of special needs by a trained professional. Rather, we relied on parental report. Had we had confirmation of a diagnosis by a professional, it may have been that the number of students identified as receiving special services in our study would have differed.

We also did not examine the effect of bilingualism or nonmainstream dialects on students' performances. In the past, research teams have found positive cross-linguistic transfer of morphological awareness skills from one language to another (e.g., Fumero & Tibi, 2020; Lin et al., 2018; Schwartz et al., 2016). That is, strengths in morphological awareness in one language are likely to account for unique contributions of morphological awareness to literacy skills in a second language. Other investigators have examined the role of nonmainstream dialect on morphological awareness performance and found no differences in outcomes between mainstream versus nonmainstream dialect users (e.g., Apel & Thomas-Tate, 2009; Jarmulowicz et al., 2012). In the future, it will be useful for researchers to examine the effects of a second language or nonmainstream dialect on students' performances across a range of tasks that align with a multidimensional view of morphological awareness.

Typically, morphological awareness instruction is not provided in the general education classroom (Henbest et al., 2019). Thus, although our student participants were nested within schools for data analyses, the potential effect of differing curricula on our outcomes is negligible. Furthermore, we took a person-centered latent variable approach to our analyses. In the future, researchers may wish to examine the nature of clustering on the individual differences in task performance.

Finally, we did not examine whether students with different performance profiles demonstrated differences in how their morphological awareness abilities contributed to their scores on measures of reading and writing. It may be that the morphological awareness of students with certain performance profiles show stronger relations to their literacy abilities than for students with other performance profiles. A finding such as this would provide an even greater need to examine how morphological awareness aids reading and writing abilities.

In summary, we found that different performance profiles for students in each of six grades emerged using the tasks we administered. Although additional investigations are needed to better understand the different components of morphological awareness (Apel, 2014), our study provides at least one piece to the puzzle regarding students' component morphological awareness skills and how the strength of those skills may differ depending on the tasks administered. It is important to note that most of those tasks that we administered are not unique; indeed, versions of those tasks have been used in the past by other investigators (e.g., Carlisle, 2000; Nagy et al., 2006; Sangster & Deacon, 2011). However, until this study, an investigation using the combination of these tasks had not occurred, likely because most research teams were not operating under the same model of morphological awareness (Apel, 2014). Additionally, until now, there had been no comprehensive standard measure of morphological awareness for students in Grades 1 through 4, requiring researchers to develop their own experimental tasks. Not only did inclusion of those tasks help form the different skill profiles that emerged but it also provided preliminary insights into the development of morphological awareness across six grades. The knowledge that different tasks can lead to different skill profiles in each grade from first through sixth should encourage both researchers and practitioners to assess students' morphological awareness abilities using a set of tasks that represent a multidimensional view of morphological awareness.

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Appendix

Number of Students (*n*) and Percentages (%) in Each Class by Grade Level

	Class 1		Class 2		Class 3		Class 4		Class 5		Class 6	
Grade	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
1	615	76	47	6	128	16	16	2	—	—	—	—
2	19	2	100	14	66	9	346	48	346	48	105	15
3	14	12	369	49	253	34	119	19	—	—	—	—
4	11	2	288	45	131	20	213	33	—	—	—	—
5	8	2	329	53	126	20	162	25	—	—	—	—
6	10	3	122	24	164	32	207	41	—	—	—	—

Note. Em dashes indicate no students at that grade level for that class.