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Morphological Analysis in School-Age Children: Dynamic Assessment of a Word Learning Strategy

Jennifer A. Larsen
Marilyn A. Nippold
University of Oregon, Eugene

Morphology is the study of the structure of words and the elements—or morphemes—that contribute to meaning. Derivational morphemes are suffixes and prefixes (affixes) that can be added to lexical morphemes (root words) to produce new words. Morphological analysis is the ability to use one's knowledge of root words and affixes to determine the meanings of unfamiliar, morphologically complex words. When first encountering the word *volcanology,* for example, the learner must be aware of the meaning of the root word "volcano" and the suffix *-ology* and be able to combine this information to determine the meaning of the derived word *volcanology.*

Knowledge of derivational morphemes and the ability to analyze them to determine the meanings of unfamiliar words is an important aspect of language development in school-age children and adolescents (Larsen & Nippold, 2007). Studies have shown that the ability to use morphological knowledge to determine word meanings has a lengthy developmental course, beginning in the early elementary grades and continuing into adulthood (Anglin, 1993; Berko, 1958; Carlisle, 1995, 2000; Lewis & Windsor, 1996; Mahony, 1994; Nagy, Diakidoy, & Anderson, 1993), with the most rapid growth occurring between fourth and eighth grade (Freyd & Baron, 1982; Templeton & Scarborough-Franks, 1985). Anglin's research was particularly revealing. In the Anglin study, children in first, third, and fifth grade (6–11 years of age; $n = 96$) participated in a word definition task where they were asked to explain the meanings of morphologically complex words (e.g., *explorational, foundationless, workable*). During this process, older children often referred to the meanings of constituent morphemes. For example, when asked to explain the word *semi-liquid,* one fifth-grade student responded, "like *liquid* is a wet substance, like, but *semi-* could mean half, like half liquid or something" (p. 99). Younger children were less inclined to analyze words in this way.

Studies have also demonstrated significant interactions between morphological analysis skills and reading comprehension in school-age children, adolescents, and young adults. For example, Carlisle (2000) administered Anglin's (1993) word definition task to children

ABSTRACT: **Purpose:** Morphological analysis is the ability to use knowledge of root words and affixes to determine the meanings of unfamiliar, morphologically complex words. Beginning in the early elementary grades and continuing into the college years, it is a primary strategy that is used to increase one's knowledge of difficult vocabulary. The purpose of this study was to investigate how well school-age children could use morphological analysis to explain word meanings. The study was also designed to examine individual differences in this domain in relation to children's broader literacy skills.
Method: The ability of 50 typically developing sixth-grade children to explain the meanings of 15 low-frequency morphologically complex words was measured using a dynamic assessment procedure. Children were individually interviewed and were asked to define each word. As needed, varying degrees of adult scaffolding were provided. Children were also assessed for their word knowledge and reading comprehension.
Results: Performance on the dynamic assessment task revealed a wide range of skill levels in these children and was positively related to the children's literacy levels. Although some children readily used morphological analysis to explain the meanings of unfamiliar words, others required greater amounts of adult scaffolding to be successful.
Implications: Suggestions are offered for ways to employ dynamic assessment to examine children's ability to use morphological analysis as a word learning strategy.

KEY WORDS: derivational morphology, word learning, dynamic assessment, school-age children

in third and fifth grade (8–11 years of age; $n = 59$). Each child was also administered a morphological structure task and a reading comprehension task. To assess morphological structure, two activities were performed—derivation and decomposition. With derivation, the child was given a root word (e.g., *warm*) and was asked to complete a sentence ("He chose the jacket for its _____") (p. 187) using the appropriate derived word (*warmth*). With decomposition, a derived word was presented (e.g., *baker*) and the child was asked to complete a sentence ("She put the bread in to _____") (p. 188) using the appropriate root word (*bake*). To assess reading comprehension, children read short passages and answered questions about the content. Carlisle reported that fifth graders outperformed third graders on all tasks. In addition, at both grade levels, word definition and morphological structure were significantly correlated with each other (third grade: $r = .46$; fifth grade: $r = .64$). Although reading comprehension was not significantly correlated with the other tasks at third grade, it was significantly correlated with word definition ($r = .63$) and morphological structure ($r = .69$) at fifth grade.

With respect to older students, Mahony (1994) administered a sentence completion task to groups of ninth-grade adolescents (14 years of age) and young adults (20 years of age) ($n = 52$). A set of 27 sentences was presented, each of which had one missing word (e.g., "They hope to _____the two sides together"). Each sentence was followed by a set of nonsense words (e.g., *uniromosity, uniromify, uniromous, uniromative*) (p. 40), only one of which would complete the sentence correctly. To perform the task successfully, knowledge of derivational morphology was required. Reading comprehension was assessed using scores from a recently administered standardized achievement test. Results indicated that the young adults outperformed the adolescents on the sentence completion task (with mean accuracy scores of 95% and 87%, respectively). Performance on both measures was significantly correlated for the adolescents ($r = .59$) and the young adults ($r = .34$), supporting the link between derivational morphology and reading comprehension.

Reports have indicated that school-age children encounter up to 3,000 unfamiliar words each year when reading, and that as many as 80% of these words are morphologically complex (Nagy & Anderson, 1984; White, Power, & White, 1989). Thus, in order to comprehend what they read, children must know the meanings of thousands of morphologically complex words. This is particularly germane when students are reading technical books in areas such as mathematics, science, and social studies, which frequently contain difficult vocabulary (Henry, 2003). For example, the following words occurred in fourth-grade books: *parallelogram, polyhedrons, quadrilateral* (SRA/McGraw Hill, 2002); *bacteriologist, exoskeleton, germination* (Moyer et al., 2002); and *megalopolis, petrochemical, urbanization* (Boehm, Hoone, McGowan, McKinney-Browning, & Miramontes, 1997); and the following words occurred in eighth-grade books: *astrophysics, cryptography, tessellation* (Charles, Dossey, Leinwand, Seeley, & Vonder Embse, 2002); *bioluminescence, chlorofluorocarbons, metalloid* (Padilla, Miaoulis, & Cyr, 2002); and *antifederalists, circumnavigate, monotheism* (Garraty, 1998; Jacobs, Randolph, & LeVasseur, 1998). Similar examples can be found in mathematics, science, and social studies textbooks written at the high school level.

Given the close associations between derivational morphology, word knowledge, and reading comprehension, school districts are tracking students' performance in these areas. In Oregon, for example, the Department of Education (2005) has established accountability standards in the area of English/language arts. These standards indicate that, beginning in second grade and continuing through high school, students should be acquiring knowledge of difficult words through the use of morphological analysis. The Web site www.ode.state.or.us, for example, states that in fifth grade, students are expected to become familiar with "less common roots (graph = writing, logos = the study of) and word parts (auto = self, bio = life) from Greek and Latin, and to use this knowledge to analyze the meaning of complex words (*autograph, autobiography, biography, biology*)." As students are acquiring this lexical knowledge, their reading comprehension skills are assessed with the Oregon Statewide Assessment (OSA; Oregon Department of Education, 2005), a standardized achievement test that is administered in third, fifth, eighth, and tenth grades.

Technical books read by elementary, middle, and high school students contain large numbers of morphologically complex words, but it is impossible for teachers to directly teach the meanings of all of these words. Even the use of dictionaries and glossaries, although helpful, is a slow and inefficient process (Nippold, 2007). Context clues contained in the paragraphs surrounding the unfamiliar words can promote word learning (Sternberg, 1987), and it is important that students learn to infer meaning by attending to these clues. However, context clues are not always sufficient and may require a fair degree of background knowledge before they can be effective learning tools (Sinatra & Dowd, 1991). Moreover, there is evidence that children use a variety of strategies to learn the meanings of unfamiliar words, and that the choice of strategy may vary from one situation to another. For example, studies have demonstrated that morphological analysis is most helpful when the root word is already familiar to the child (Anglin, 1993; Nagy et al., 1993; White et al., 1989; Wysocki & Jenkins, 1987).

Studies have also shown that school-age children with language disorders frequently evidence delays in acquiring knowledge of derivational morphemes such as the agentive *–er* (*teacher*), the comparative *–er* (*bigger*), the superlative *–est* (*biggest*), the diminutive *–let* (*piglet*), and the adjectival *–y* (*lucky*) (Vogel, 1983; Wiig, Semel, & Crouse, 1973; Windsor & Hwang, 1999). Despite the relevance of derivational morphology to children's academic success, speech-language pathologists (SLPs) seldom examine this aspect of development (Moats & Smith, 1992). One explanation for this omission is that standardized language tests that are commonly used with school-age children and adolescents, such as the Test of Language Development—Intermediate: Third Edition (TOLD–I:3; Hammill & Newcomer, 1997) and the Test of Adolescent and Adult Language—Third Edition (TOAL–3; Hammill, Brown, Larsen, & Wiederholt, 1994), do not contain subtests that target derivational morphemes. Although the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF–4; Semel, Wiig, & Secord, 2003) has a subtest called Word Structure, which examines knowledge of morphology, it is administered only to younger students (5–8 years of age), and most of the test items examine grammatical morphemes (e.g., plural *–s*, possessive *–s*, third person singular *–s*, *–ing*, *–ed*). Only a few items on this subtest examine derivational morphemes (e.g., *–er*, *–est*, *–y*), and there is no subtest on the CELF–4 for older students (9–21 years of age) that would examine knowledge of more advanced derivational morphemes (e.g., *–ness*, *–tion*, *–ism*, *–some*). Similarly, the Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1999) emphasizes grammatical morphemes (e.g., plurals, possessives, negatives) and examines only a few derivational morphemes (e.g., agentive *–er*, comparative *–er*, superlative *–est*) in a subtest for older students (7–21 years of age).

Because derivational morphology is associated with word knowledge and reading comprehension (Anglin, 1993; Carlisle, 2000;

Mahony, 1994), it is important that SLPs have a mechanism for examining this aspect of development. A dynamic assessment task is helpful because it can provide insight into the type and degree of assistance that a student might require in order to be successful in using morphological analysis as a strategy to determine word meanings (Palincsar, Brown, & Campione, 1994). The goal of dynamic assessment is to determine if a child's performance on a task can improve if specific feedback is given (Swanson & Lussier, 2002). Dynamic assessment is based on Vygotsky's (1978) notion of the *zone of proximal development* (ZPD), which is the distance between a child's independent and assisted levels of performance (Santrock, 1996). Working independently, the child may be unable to perform a task, but when an adult provides support or *scaffolding* in the form of questions and other sorts of cuing, the child may perform at a higher level, indicating the potential for imminent growth in that aspect of development (Palincsar et al., 1994).

In recent years, a number of researchers in speech-language pathology have advocated the use of dynamic assessment tasks for school-age children (e.g., Gillam, Peña, & Miller, 1999; Miller, Gillam, & Peña, 2001; Peña & Gillam, 2000), and the American Speech-Language-Hearing Association (ASHA, 2005) has provided an online instructional program in its use. The major advantage of dynamic assessment in clinical contexts is the abundance of information that it can provide. Whereas a traditional static assessment task may suggest that a child knows very little about a skill area, dynamic assessment may reveal that the child has already acquired basic information that can serve as a starting point for focused language instruction.

The current study expands on previous research in two ways. First, we used a dynamic assessment task to probe children's ability to explain the meanings of complex words through morphological analysis. Because static tasks are limited in the information they can provide, the goal was to develop a task that could provide insight into children's use (or nonuse) of this word learning strategy. Second, we examined the association between children's morphological analysis skills, using dynamic assessment, and their literate language abilities more broadly, including their word knowledge and reading comprehension. Ideally, children's performance on a dynamic assessment task of morphological analysis would be associated with these other aspects of literacy, indicating that the assessment task is relevant to school-based language expectations. Previous studies showing a link between morphological analysis and literacy did not employ dynamic assessment (e.g., Carlisle, 2000; Mahony, 1994). However, the series of questions employed by Anglin (1993) to probe children's morphological awareness in relation to their knowledge of word meanings could be adapted for this purpose, which is what we attempted to do in this study. Whereas a static task might show that a child knows or does not know a word, a dynamic task could reveal degrees of knowledge within the child (Palincsar et al., 1994).

In this investigation, we asked children to explain the meanings of morphologically complex words. When the children experienced difficulty, we provided increasingly explicit prompts to the meanings of those words. Sixth-grade students were studied because they are halfway between fourth and eighth grades—a stage in human development that is characterized by rapid growth in morphological analysis (Freyd & Baron, 1982; Templeton & Scarborough-Franks, 1985). Typically developing students were examined because normative studies can provide valuable information about the varying degrees of competency that characterize children at any particular age. When children are in the process of mastering specific linguistic skills, it is expected that individual differences will become apparent because of normal variation in rates of development.

In sum, we asked the following research questions:

- Does a dynamic assessment task of morphological analysis reveal a range of performance levels in sixth-grade children?
- Is performance on a dynamic assessment task of morphological analysis associated with children's word knowledge and reading comprehension?

METHOD

Participants

The participants were 50 sixth-grade children (19 boys, 31 girls) having a mean age of 12;2 (years; months) (range = 10;9–12;10). All study participants were enrolled in a public school located in a middle-income neighborhood in western Oregon. According to the children's teachers, all children were typical achievers who represented a range of ability levels, as is commonly found in today's public schools. No child had been diagnosed with a language, learning, cognitive, behavioral, or hearing disorder, or was receiving special education services. All children were monolingual speakers of American English. On the parent consent form, families were not asked to report their racial/ethnic backgrounds because this question had not been part of the university Institutional Review Board application. Hence, the investigators did not have formal permission to obtain this information. The school's Web site indicated that the racial/ethnic background of the entire school population was as follows: 1% American Indian, 4.3% Black, 8.7% Asian/Pacific Islander, 16.9% Hispanic, and 69% White. Examiner observation suggested that the backgrounds of the study participants approximated this breakdown.

Procedure

Each child completed a series of tasks during an individual testing session at school, requiring approximately 45 min. To confirm the presence of normal hearing, a screening was conducted at 20 dB for the frequencies of 1000, 2000, and 4000 Hz, using a portable audiometer. Each child was also administered the Peabody Picture Vocabulary Test—III (PPVT–III; Dunn & Dunn, 1997), a standardized test of general word knowledge that is known to have adequate validity and reliability (Gray, Plante, Vance, & Henrichsen, 1999; Williams & Wang, 1997). A dynamic assessment task of morphological analysis, an experimental measure designed by the present investigators (described below in detail), was also administered. The tasks were administered in a systematically varied order as each child rotated through a series of stations set up in an empty classroom. Graduate student research assistants who were trained by the first author administered the hearing screening and the PPVT–III. To ensure consistency with the experimental measure, the first author always administered the dynamic assessment task.

In addition, each child's scaled score on the Reading and Literature section of the OSA was obtained from the school district, with written parent consent. The OSA is a standardized achievement test that is widely administered to public school children in Oregon to monitor their progress in meeting state educational standards. The Reading and Literature section of the OSA examines the children's literal and inferential comprehension, word knowledge, and familiarity with literary

devices such as figurative expressions. With scaled scores ranging from 150 to 300 points, the OSA is reported to have adequate validity and reliability (Oregon Department of Education, 2005). All participants had taken the OSA most recently when they were in fifth grade.

Dynamic Assessment Task of Morphological Analysis (DATMA). The investigators designed a dynamic assessment task, the DATMA, for this study. The method of questioning children about word meanings was adapted from Anglin's (1993) research, which was described earlier. As part of this task, the children were presented with a series of 15 derived words and were asked to define each one. A series of prompts were presented until the child defined the word correctly or until all prompts were exhausted. The words were presented to each child in a different random order. Task design consisted of four stages: (a) selecting the target words, (b) generating the assessment prompts, (c) writing an administration script, and (d) devising a scoring system.

Target words. The target words were adapted from Carlisle (2000). Fifteen low-frequency derivatives of high-frequency root words were chosen. Frequencies were determined using *The American Heritage Word Frequency Book* (Carroll, Davies, & Richman, 1971). This resource contains a corpus of more than 5 million words, each of which is rated in terms of its frequency of occurrence in written language. With this system, a logarithmic transformation was used to determine word frequency. For example, a value of 90 represents a word that appears once in 10 words of text, a value of 70 represents a word that appears once in 1,000 words, a value of 50 represents a word that appears once in 100,000 words, and so on. High-frequency words have a value of 50 or higher (e.g., occurring at least once in 100,000 words of text). Low-frequency words have a value of 37 or less (e.g., occurring fewer than once per 1 million words of text). High-frequency words are expected to be familiar to average sixth-grade children, whereas low-frequency words are expected to be unfamiliar to them (Carlisle, 2000; Tyler & Nagy, 1989).

Each target word was a low-frequency derived word that contained a high-frequency root word. For example, the derived word *puzzlement* has a frequency value of 31.80, but the root word *puzzle* has a frequency value of 52.20. For the set of 15 target words, the mean frequency value was 33.25 ($SD = 1.67$) for the derived words and 54.71 ($SD = 3.48$) for the root words. The use of low-frequency derived words containing high-frequency root words was intended to help ensure that children would use morphological analysis to determine the meanings of the target words. It was assumed that most participants would be familiar with the root words but unfamiliar with the derived words. However, children were not prescreened for their knowledge of the words. The use of pseudowords was briefly considered but rejected because of concerns about underestimating the children's morphological knowledge. The complete list of target words with their frequency values and other key features is contained in Appendix A.

Assessment prompts. The task was designed to reveal differing levels of morphological analysis through the use of a series of prompts that were progressively more helpful in defining each target word. The prompting structure was based on previous research suggesting that when an individual encounters an unfamiliar morphologically complex word, a certain process occurs (Anglin, 1993; Beauvillian, 1996; Carlisle & Nomanbhoy, 1993; Chialant & Caramazza, 1995; Rastle, Davis, Marslen-Wilson, & Tyler, 2000). First, the learner identifies the constituent morphemes and acceses the meanings of each. Next, the learner attempts to determine how the affix might impact the root word. Finally, the learner combines these bits of information to reveal the meaning of the target word. Thus, the morphological analysis strategy involves an awareness of the constituent morphemes of a word, knowledge of their meanings, and the ability to integrate that information.

For the present task, a series of prompts was presented for each target word. After each prompt, the examiner paused for up to 10 s. If the child did not respond or answered incorrectly, the examiner proceeded to the next prompt. Once the child correctly defined a target word, the prompting stopped and the next word was presented. Throughout the task, the examiner used a gentle, reassuring tone of voice so that the child would feel supported rather than criticized for not knowing a word. Before the task was administered in the present study, it was piloted informally with several sixth-grade children to ensure that the procedures were clear and easy to follow.

Task administration. The task was administered using a scripted procedure. Diagrammed in Figure 1, the script is presented below, illustrated with the word *beastly*:

> Examiner: "I am going to say some words and your job will be to tell me what you think they mean. I'll also show you a written copy of each word. If some of the words are hard, I'll give you some help. Are you ready?"

Prompt #1:

"Tell me what the word *beastly* means."

A. If the child answers *correctly,* the examiner goes to Prompt #2.

B. If the child does not respond or answers *incorrectly,* the examiner goes to Prompt #3.

Prompt #2:

"How did you know that?"

A. If the child's explanation refers to the individual morphemes, the examiner goes to the next word.

B. If the child's explanation does *not* refer to the individual morphemes, the examiner goes to Prompt #3.

Prompt #3:

"Does the word *beastly* have any smaller parts?"
"What are those parts?"

A. If the child answers *correctly,* the examiner asks, "Now can you tell me what the word means?"

B. If the child does not respond or answers *incorrectly,* the examiner goes to Prompt #4.

Prompt #4:

"The smaller parts in this word are *beast* and *ly.*
Now can you tell me what the word means?"

A. If the child answers *correctly,* the examiner goes to the next word.

B. If the child does not respond or answers *incorrectly,* the examiner goes to Prompt #5.

Prompt #5:

"Listen to this sentence and then tell me what *beastly* means: 'Jan tried to scare her brother by dressing up and acting *beastly.*'"

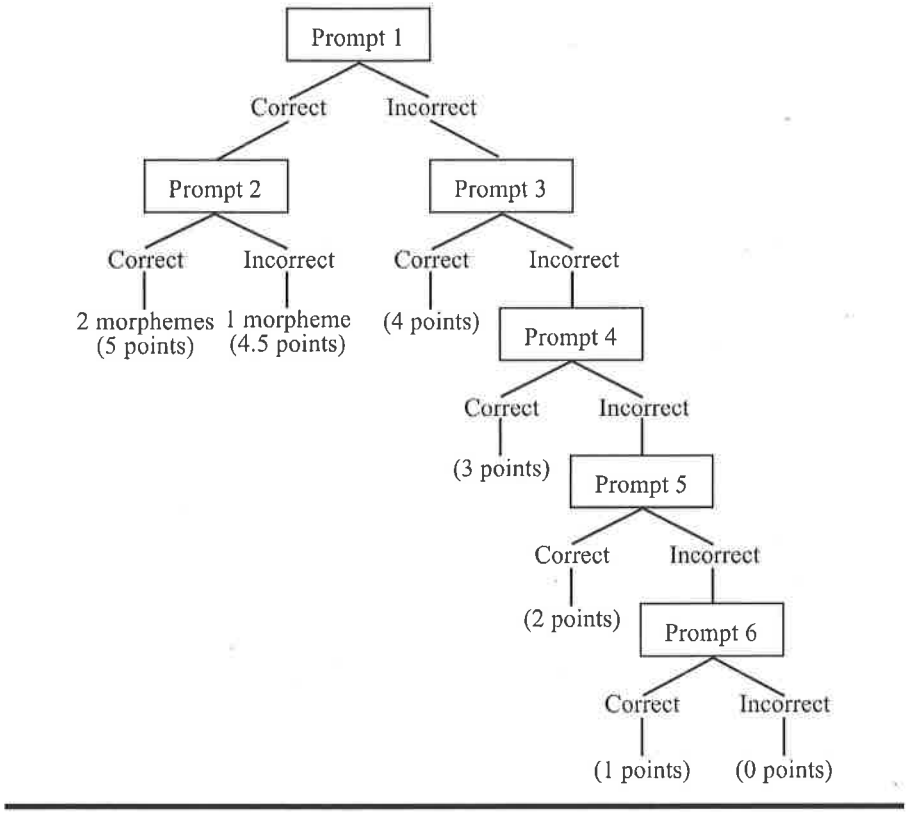
A. If the child answers *correctly,* the examiner goes to the next word.

B. If the child does not respond or answers *incorrectly,* the examiner goes to Prompt #6.

Prompt #6:

"Which of these choices gives the meaning of the word *beastly*? (examiner presents three choices): a) like an animal; b) like a plant; c) like a clown"

Figure 1. Flow chart illustrating the prompting and scoring procedures for the Dynamic Assessment Task of Morphological Analysis.



Purpose of questioning. If the child responded to Prompt #1 correctly (e.g., gave an acceptable explanation of the target word), he or she was questioned further in order to reveal awareness of the constituent morphemes and how they contribute to the target word's meaning (e.g., "How did you know that?"). It was expected that many children who correctly explained the word would refer to the individual morphemes in their response. If they did not, they were questioned further to reveal whether they were aware of the individual morphemes. For children who did not initially provide an adequate explanation of the target word, the remaining questions served a slightly different purpose: to prompt them to use the morphological structure of the target word to determine its meaning. These prompts mirrored the process revealed by the research previously described (Anglin, 1993; Beauvillian, 1996; Carlisle & Nomanbhoy, 1993; Chialant & Caramazza, 1995; Rastle et al., 2000): First, identify the constituent morphemes, think about their meanings, and then use that information to determine the meaning of the derived word. The fifth prompt provided a sentence context to help the child determine the word's meaning. The sixth prompt offered a choice of three meanings, with the expectation that most children would be successful in their response. Appendix A contains the fifth and sixth prompts for each of the 15 target words.

The target words, sentences, and multiple-choice answers were presented in written form as well as orally, with each word displayed on an index card throughout the prompting hierarchy. These visual supports were intended to reduce the effects of memory. In addition, having access to the orthographic representation of derived words can be helpful because it is visually possible to detect the root word in many derived words (Templeton & Scarborough-Franks, 1985). The task always began with two practice words, presented in the same manner as the target words, but not scored.

Scoring system. There were two aspects of scoring the task. The first was to determine if the child provided an acceptable definition of the target word. In general, the conventions established by Anglin (1993) and later adapted by Carlisle (2000) were followed. Definitions of a word could include references to the root word but had to take into account the change in meaning caused by the suffix, making it clear that the child knew the meaning of the root word. For example, an acceptable definition for the target word *beastly* would be "acting/looking like an animal." An unacceptable definition would be "a beast person," because it is not clear if the child understands the root word.

The second aspect of scoring involved the assignment of points based on how far the child progressed through the prompting hierarchy before responding correctly. For each target word, a maximum of five points could be earned (5 × 15 = 75 possible points). Points were deducted as more assistance was required for the child to define the word or recognize its meaning. As shown in Figure 1, points were assigned as follows:

5 points: The child answered Prompts #1 and #2 correctly and completely. A correct and complete answer for Prompt #1 consisted of an adequate definition of the target word (see Appendix A). In addition, the child's response to Prompt #2,

"How did you know that?" had to refer to both morphemes in the word in addition to defining the root morpheme. It was not expected that children of this age would be able to define suffixes because of the high level of abstraction required (Carlisle, 2000). Therefore, the child was only required to mention the suffix. For example, an acceptable response for *beastly* might be: "Because *beast* means an animal and then it has the *–ly*."

4.5 points: The child explained the word correctly after Prompt #1 and referred to one of the constituent morphemes after Prompt #2.

4 points: The child explained the word correctly after Prompt #3.

3 points: The child explained the word correctly after Prompt #4.

2 points: The child explained the word correctly after Prompt #5.

1 point: The child selected the correct meaning after Prompt #6.

0 points: The child did not select the correct meaning after Prompt #6.

While administering the DATMA to each child, the examiner audio-recorded the entire session in order to double check the online scoring at a later time. If there were any doubts about how to score a response, the examiner continued through the prompting hierarchy and was able to make adjustments in scoring as needed. After testing a child, the examiner listened to the entire audiotape to confirm the manner in which the items had been scored online. Very few changes in scoring the responses were needed.

Scoring reliability also was completed on the DATMA. Three SLPs who were carefully trained in the scoring procedures by the first author each scored one third of the handwritten responses, and the first author scored 100% of them. Therefore, all responses were scored twice. Interscorer agreement was 95%. All disagreements were resolved through discussion, yielding 100% agreement.

RESULTS

Table 1 reports the performance of the children on the DATMA, the PPVT–III, and the OSA Reading and Literature test. Independent *t* tests, with Bonferroni corrections for multiple *t* tests and an adjusted alpha of .01, comparing the performance of boys and girls, yielded no statistically significant differences on any of the measures: DATMA, $t(48) = -1.75$, $p = .0860$; PPVT–III, $t(48) = 1.57$, $p = .1223$; OSA, $t(48) = -.014$, $p = .8913$. Therefore, all subsequent analyses were based on the combined performance of boys and girls. It was also important to measure the reliability of the DATMA because it is a new assessment tool. To determine its internal consistency, children's total raw scores for the first five words (FFW) were compared to their total raw scores for the last five words (LFW). Because each child received the 15 target words in a different random order, these totals are based on different sets of words. For all children combined, the scores were very similar (FFW: $M = 16.61$, $SD = 3.42$, range = 7.00–23.50; LFW: $M = 16.87$, $SD = 4.28$, range = 7.00–25.00), and a dependent *t* test indicated that the difference between scores was not statistically significant ($t = -.40$, $p = .6938$). Thus, the DATMA appeared to have strong internal consistency as administered in this study.

Table 1. Performance on the tasks for the 50 sixth-grade children.

Assessment	M	SD	*Range*
DATMA raw score (75 possible points)	51.03	7.99	23–68
PPVT–III standard score	112.72	9.84	91–134
OSA Reading and Literature scaled score	228.12	8.98	210–246

Note. DATMA = Dynamic Assessment Task of Morphological Analysis; PPVT–III = Peabody Picture Vocabulary Test—III (Dunn & Dunn, 1997); OSA = Oregon Statewide Assessment.

The first research question asked if a dynamic assessment task of morphological analysis would reveal a range of performance levels in sixth-grade children. Data reported in Table 1 indicate considerable variability on the DATMA, with raw scores ranging from 23 (31%) to 68 (91%) out of a possible 75 points. This indicates that some children readily used morphological analysis to explain the meanings of low-frequency words whereas others required greater amounts of adult scaffolding to be successful.

The second research question asked if performance on a dynamic assessment task of morphological analysis was associated with children's word knowledge and reading comprehension. To address this question, correlation coefficients were calculated using each child's scores on each of the three measures. The resulting coefficients were statistically significant, positive, and moderate: DATMA and PPVT–III ($r = .36$, $p = .01$); DATMA and OSA ($r = .50$, $p = .0002$); PPVT–III and OSA ($r = .65$, $p < .0001$). This indicates that better performance on the morphological analysis task was associated with stronger word knowledge and reading comprehension skills in children.

In view of these patterns, it was of interest to determine if skill in morphological analysis as measured by the DATMA would differ according to the children's broader literacy levels. Together, the PPVT–III and the OSA Reading and Literature test captured a wide array of literate language skills (e.g., word knowledge, literal and inferential reading comprehension, figurative language knowledge). Given that these tests were strongly correlated ($r = .65$), each child's scores on the PPVT–III and the OSA were combined to yield a single literacy score that reflected the abovementioned skills. The resulting scores, which ranged from 305 to 372 standard score points, represented a spread of 68 points. These scores then were used to form three equal interval subgroups representing different levels of literacy performance: low = 305–327; average = 328–349; and high = 350–372. Each child was assigned to one of these subgroups based on his or her total literacy score, with the 50 children distributed as follows: low ($n = 10$ or 20%; *mean* = 316.30; $SD = 8.77$); average ($n = 22$ or 44%; *mean* = 337.27; $SD = 6.28$); and high ($n = 18$ or 36%; *mean* = 358.83, $SD = 6.15$). To determine if the subgroups were truly distinct in their literacy levels, a one-way analysis of variance (ANOVA) was performed, yielding a statistically significant main effect for subgroup, $F(2, 47) = 131.79$, $p < .0001$, $\eta = .92$. The effect size, computed with the Eta coefficient (η) (Meline & Schmitt, 1997), was very large (Cohen, 1969, p. 276). Post hoc analyses using the Tukey procedure indicated that the high subgroup outperformed the average and low subgroups, and that the average subgroup outperformed the low subgroup. These results confirmed the impression that the three subgroups represented distinct levels of literacy performance.

Next, it was of interest to compare the subgroups on the DATMA. Their performance on this task is shown in Table 2. Using each child's total raw score as the dependent variable, a one-way ANOVA was conducted, yielding a statistically significant main effect for subgroup, $F(2, 47) = 9.30$, $p = .0004$, $\eta = .53$. The effect size was large (Cohen, 1969, p. 276). Post hoc testing using the Tukey procedure indicated that both the high and average subgroups outperformed the low

Table 2. Raw scores on the DATMA (total possible points = 75) for the low (n = 10), average (n = 22), and high (n = 18) literacy subgroups.[a]

	Low	*Average*	*High*
M	43.50	51.00	55.25
SD	10.00	6.09	5.76
Range	23.00–58.00	33.50–60.00	45.50–68.00

[a] high > low; average > low.

subgroup. These findings confirmed the impression that children in the low subgroup required greater amounts of adult scaffolding before they could explain the meanings of morphologically complex words. However, no subgroup had reached a ceiling, indicating that the DATMA was challenging. In terms of the 5-point system that was used to score the children's responses to each of the 15 target words, the following means were obtained, respectively, by the low, average, and high subgroups: 2.90, 3.40, and 3.68.

To further explore the children's performance on the DATMA, the frequency with which each of the seven different scores (5, 4.5, 4, 3, 2, 1, 0) had been assigned to the 15 target words was tabulated for each child. Examples of participants' responses that had earned each score are reported in Appendix B. Table 3 reports the means for each subgroup and for all children combined. For the total group, the most common scores were 4.5 and 4, followed by 2, 5, and 1; scores of 3 and 0 were least common. Similar patterns were observed for the individual subgroups, although some variation was present. Thus, it was of interest to formally compare the subgroups on the frequency with which each of the scores occurred. For each score, the data were analyzed using a one-way ANOVA with Bonferroni corrections for multiple comparisons (adjusted $\alpha = .007$). A statistically significant main effect was obtained only for the score of 1, $F(2, 47) = 6.58$, $p = .003$, $\eta = .47$. The effect size was large (Cohen, 1969, p. 276). Tukey's procedure indicated that the low subgroup obtained the score of 1 more frequently than did the high subgroup. No other differences between subgroups were significant.

DISCUSSION

Dynamic assessment procedures are designed to determine under what conditions a child is able to perform most optimally. Dynamic procedures differ from traditional, static procedures, which provide only a glimpse of a child's knowledge (Palincsar et al., 1994). The purpose of the present study was to determine if a dynamic assessment task of morphological analysis would reveal a range of performance levels in sixth-grade children, and if performance on the task would be associated with word knowledge and reading comprehension. The results indicate that the DATMA did reveal a range of skill levels in these children, and that performance on the task was related to these other aspects of literacy. The study offers a novel contribution to the literature, and the findings suggest that the task could be used to identify the degree of support a child requires to learn the meanings of low-frequency words through morphological analysis.

Examples of children's responses on the DATMA are contained in Appendix B. These responses illustrate how some children used morphological analysis with minimal assistance whereas others required greater amounts of adult scaffolding. In Example #1, which earned 5 points, the child readily identified the constituent morphemes of the derived word *fearsome* and explained how they contributed to its meaning. Example #2 also reflected a high level of competence, but earned 4.5 points because the child mentioned only one of the constituent morphemes, the root word *secret*. Four-point responses occurred when a child defined the derived word correctly but did not mention the constituent morphemes until specifically asked, as in Example #3. Responses that earned 3 points or less reflected a greater need for scaffolding, as in Example #4, where the child appeared to benefit from morphological cuing. An even greater need for scaffolding was apparent in the children's 2-point responses. In Example #5, the child identified the two constituent morphemes and knew the meaning of the lexical morpheme *fear*. However, she seemed unaware of how the suffix *–some* contributed to the meaning of the derived word *fearsome*, and was unable to define it until she heard it used in a sentence. In Example #6, which earned 1 point, the child required the full set of prompts before he could interpret *dramatize*. Although he identified the root word and suffix, he appeared not to know their meanings and was unable to interpret the derived word until he received substantial amounts of additional cuing, which consisted of hearing the word used in a sentence and receiving three alternative interpretations. The score of 1 occurred more frequently in the low literacy subgroup than in the high literacy subgroup.

Although all children in this investigation were typically developing, a substantial portion (20%) experienced difficulty in spontaneously using morphological analysis to determine the meanings of low-frequency derived words. Previous investigations of language development in children of this age range have also found widely varying skill levels, particularly in relation to tasks requiring analytical ability such as interpreting figurative expressions (e.g., Nippold, Allen, & Kirsch, 2001; Nippold, Moran, & Schwarz, 2001a; Nippold, Moran, & Schwarz, 2001b). Consistent with the present study, these other studies also found that children's performance on the tasks was closely associated with their school-based literacy skills in areas such as reading comprehension. These are important findings because metalinguistic competence—the ability to analyze linguistic units and to reflect on their meanings—is a major factor driving the development of language in school-age children, adolescents, and young adults (Nippold, 2007).

Given that morphological analysis is a key word learning strategy that is used by older children, adolescents, and adults, it is critical that low performing students be identified so that they may receive appropriate instruction in this area, particularly in view of the findings from the present study linking performance on the DATMA with

Table 3. Mean frequencies with which each score on the DATMA was assigned to the responses of the low, average, and high subgroups, and to all children combined.

		Low	*Average*	*High*	*All*
Score	5	1.20	1.55	2.33	1.76
	4.5	3.00	4.64	4.50	4.26
	4	3.00	3.27	4.00	3.48
	3	0.10	0.32	0.22	0.24
	2	4.30	3.32	2.94	3.38
	1	3.10	1.73	0.78	1.66
	0	0.30	0.18	0.22	0.22
Total		15.00	15.00	15.00	15.00

the children's broader literacy levels. Activities should be designed for classroom use specifically to boost these children's ability to dissect and analyze morphologically complex words that occur in their reading materials and to infer the meanings of derived words from knowledge of the meanings of the constituent root words and suffixes.

The findings of the present study add to our understanding of derivational morphology, an area that has received little attention in the field of speech-language pathology, evidenced by the dearth of assessment tools available to professionals to examine this aspect of language development in older school-age children. Additionally, the results are consistent with past research in the fields of education and psychology involving static assessment tools, linking derivational morphology to word knowledge and to reading comprehension (e.g., Carlisle, 2000; Mahony, 1994; Nagy et al., 1993; White et al., 1989; Wysocki & Jenkins, 1987). With the current emphasis on the necessity of designing language intervention to promote academic achievement, especially in relation to literacy, it is essential that SLPs have tools to examine knowledge of derivational morphology in their school-age clients.

Future research using the DATMA should be conducted to examine children's morphological analysis skills in relation to their school curriculum. Although children who are typically developing sometimes struggle with morphological analysis, demonstrated by the present study, SLPs must focus most of their attention on students with language disorders given these children's known deficits with derivational morphology (Vogel, 1983; Wiig et al., 1973; Windsor & Hwang, 1999). Some suggestions for applying the DATMA are offered in the following paragraphs.

First, in order to link language assessment to the curriculum, SLPs must consider the expected level of performance in a child's classroom. For example, examination of a state-adopted social studies textbook (Bednarz et al., 1997) indicates that sixth-grade students in Oregon need to understand the following morphologically complex terms, all of which pertain to economics: *capitalism, communism, consumerism, materialism, separatism,* and *tourism.* Additional terms in that same textbook with the suffix *–ism* include *monotheism, mysticism, polytheism,* and *Semitism,* terms pertaining to philosophical beliefs. It is likely that students with language disorders would have difficulty with these terms because of their abstractness and relatively low frequency of occurrence in the language. Because these complex words are part of the state-adopted curriculum, they represent a starting point for examining students' ability to use morphological analysis to determine word meanings.

DATMA, the dynamic assessment task that was developed for the present study, could be used to gain insight into students' ability to break each complex word into its constituent morphemes. If students are unfamiliar with the root words (e.g., *capital, commune, Semite*), their responses on the DATMA might reveal this limitation. For example, the child who earned a score of 1 on the word *dramatize* (Appendix B, Example #6) appeared to be unfamiliar with the root word, *drama.* Because knowledge of root words is essential for morphological analysis to occur (Anglin, 1993; Nagy et al., 1993; White et al., 1989; Wysocki & Jenkins, 1987), this difficulty should be noted. If further assessment indicates that this is a common pattern for the child, it may be important to focus the child's attention on the meanings of root words in addition to the meanings of suffixes that commonly occur in classroom reading materials.

For some children, the DATMA may reveal greater difficulty with suffixes than with root words. For example, the child who scored a 2 on the word *fearsome* (Appendix B, Example #5) appeared to know the meaning of the root word *fear* but not the suffix *–some.* If further assessment confirms this pattern, it might suggest that this child needs to learn the meanings of a variety of suffixes found in school-based reading materials.

LIMITATIONS OF THE STUDY

In this investigation, we examined children at only one level, sixth grade. Given that morphological analysis is important throughout the elementary, middle, and high school years, students in other grade levels also must be studied. In future research, grade-appropriate dynamic assessment tasks of morphological analysis should be designed, beginning with the early elementary years when knowledge of derivational morphology is emerging and continuing through high school when many students have attained a high level of competence in using this strategy (Larsen & Nippold, 2007).

Grade-appropriate dynamic assessment tasks of morphological analysis should reflect the normal developmental sequence for derivational morphology wherever possible, so that easier items are presented before more difficult ones. Derwing (1976) reported that knowledge of the *–er* agentive suffix (e.g., *painter*), the *–y* adjective suffix (e.g., *muddy*), and the *–ly* adverb suffix (e.g., *slowly*) emerges in the early elementary grades, and Anglin (1993) reported that it was easier for school-age children to analyze compound words containing lexical morphemes (e.g., *doghouse, birthday*) than certain derived words. This suggests that tasks for younger students might focus on these early developing derivational and lexical morphemes. However, research is necessary to determine the relative difficulty of other types of derivational and lexical morphemes and to expand our knowledge of the developmental sequence. Such information could then be used to design age-appropriate dynamic assessment tasks of morphological analysis. Because children with language disorders frequently have difficulty with derivational morphology (Vogel, 1983; Wiig et al., 1973; Windsor & Hwang, 1999), they should be included in future studies of morphological analysis using dynamic assessment. Children from diverse cultural, linguistic, ethnic, and socioeconomic backgrounds should also participate in these investigations in order to maximize their relevance to schools today.

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Contact author: Marilyn A. Nippold, Communication Disorders and Sciences, College of Education, University of Oregon, Eugene, OR 97403. E-mail: nippold@uoregon.edu.

APPENDIX A. DEFINITIONS, FREQUENCY VALUES, SENTENCES, AND MULTIPLE-CHOICE OPTIONS FOR TARGET WORDS USED ON THE DYNAMIC ASSESSMENT TASK OF MORPHOLOGICAL ANALYSIS. DICTIONARY DEFINITIONS ARE FROM THE *OXFORD ENGLISH DICTIONARY* (SIMPSON & WEINER, 1989).

Beastly (adj.): of or pertaining to the lower animals; merely animal; bestial
Derived word frequency: 31.4
Root word frequency (beast): 52.3
Jan's brother tried to scare her by dressing up as a bear and acting *beastly.*
Choices: like an animal; like a plant; like a clown
Celebratory (adj.): the quality of celebrating
Derived word frequency: 32.5
Root word frequency (celebrate): 52.4
After winning the prize, Alex was in a *celebratory* mood.
Choices: ready to party; ready to sleep; ready to study
Cookery (n.): the art or practice of cooking; a place or area for cooking
Derived word frequency: 31.9
Root word frequency (cook): 55.8
Grandma's *cookery* was awful so Bob hated eating at her house.
Choices: the art of decorating; the art of preparing food; the art of sewing
Corrective (adj.): having the property or function of correcting or setting right what is erroneous or faulty, or of producing amendment; tending to correct
Derived word frequency: 33.8
Root word frequency (correct): 61.6
Tracy's braces were *corrective* so her teeth would not be crooked.
Choices: tending to clean; tending to damage; tending to fix
Dramatize (v): to convert into a drama; to put into dramatic form; adapt for representation on the stage
Derived word frequency: 36.0
Root word frequency (drama): 50.6
For the school play, the fourth graders decided to *dramatize* the book, *Harry Potter and the Sorcerer's Stone.*
Choices: to make into a performance; to make into a painting; to make into a book report
Equalize (v.): to equal; match
Derived word frequency: 34.8
Root word frequency (equal): 59.0
At the track meet, Josh ran extra fast so he could *equalize* his time with his opponent's.
Choices: to increase; to match; to decrease
Fearsome (adj.): fear inspiring; frightful; dreadful
Derived word frequency: 35.9
Root word frequency (fear): 58.9
The movie was so *fearsome* that John had to cover his eyes most of the time.
Choices: funny; romantic; frightening
Flowery (adj.): abounding in or covered with flowers; producing flowers
Derived word frequency: 34.0
Root word frequency (flower): 57.1
Molly hated the dress with daisies because it was too *flowery.*
Choices: covered with blossoms; covered with dots; covered with colors
Oddity (n.): the quality or character of being odd or peculiar; peculiarity; strangeness; singularity
Derived word frequency: 33.9
Root word frequency (odd): 55.3
The singing horse with a purple tail was an *oddity* they saw at the fair.
Choices: a common thing; an unusual thing; a pretty thing
Odorous (adj.): emitting a smell or scent; scented, odiferous
Derived word frequency: 34.6
Root word frequency (odor): 50.8
Mary hated cleaning the litter box out because it was so *odorous.*
Choices: large; boring; strong smelling
Preventive (adj.): that anticipates in order to ward against; precautionary; that keeps from coming or taking place; that acts as hindrance or obstacle
Derived word frequency: 33.7
Root word frequency (prevent): 55.6
The raincoats were *preventive* and kept the children from getting all wet.
Choices: tending to make something happen; tending to make into a game; tending to keep something from happening
Puzzlement (n.): the fact or condition of being puzzled; perplexity; bewilderment; confusion
Derived word frequency: 31.8
Root word frequency (puzzle): 52.2
Kim tried to figure out how to put the bike together and finally gave up in *puzzlement.*
Choices: confusion; happiness; fright
Secretive (adj.): inclined to or fond of secrecy; very reticent; indicative of secrecy
Derived word frequency: 30.5
Root word frequency (secret): 56.7

Tim had to be very *secretive* so Gail wouldn't find out about the surprise party.
Choices: silly; mysterious; angry
Sparkly (adj.): sparkling; something that sparkles
Derived word frequency: 32.2
Root word frequency (sparkle): 50.8
Elizabeth got to wear a *sparkly* crown on her birthday.
Choices: dull; silky; glittery
Spoilage (n.): the state of spoiling
Derived word frequency: 31.7
Root word frequency (spoil): 51.6
The food was kept cold to prevent spoilage.
Choices: freezing; rotting; stealing

APPENDIX B. EXAMPLES OF CHILDREN'S RESPONSES ON THE DYNAMIC ASSESSMENT TASK OF MORPHOLOGICAL ANALYSIS

1. **Score = 5.0**

   Examiner (E): Now tell me what the word *fearsome* means.
   Child (C): Scary.
   E: How did you know that?
   C: Because *fear* means scary and the *some* kind of gives it away.

2. **Score = 4.5**

   E: Now tell me what the word *secretive* means.
   C: Like hiding something, like a secret.
   E: How did you know that?
   C: Because *secret* means you hide something.

3. **Score = 4.0**

   E: Now tell me what the word *preventive* means.
   C: Preventing or stopping stuff from happening.
   E: How did you know that?
   C: I learned it.
   E: Does the word *preventive* have any smaller parts?
   C: *Prevent* and *ive*.

4. **Score = 3.0**

   E: Now tell me what the word *equalize* means.
   C: To make it separate.
   E: Does the word *equalize* have any smaller parts?
   C: No.
   E: The smaller parts are *equal* and *ize*. Now can you tell what the word means?
   C: To make it the same.

5. **Score = 2.0**

   E: Now tell me what the word *fearsome* means.
   C: Scared.
   E: Does the word *fearsome* have any smaller parts?
   C: *Fear* and *some*.
   E: Now can you tell me what the word means?
   C: I still think scared.
   E: Listen to this sentence and then tell me what *fearsome* means. "The movie was so *fearsome* that John had to cover his eyes most of the time."
   C: OK! It means scary.

6. **Score = 1.0**

   E: Now tell me what the word *dramatize* means.
   C: He's like... it's hard to explain.
   E: Does the word *dramatize* have any smaller parts?
   C: *Drama* and *tize*.
   E: Now can you tell me what the word means?
   C: He's focused.
   E: Listen to this sentence and then tell me what *dramatize* means: "For the school play, the fourth graders decided to dramatize the book, *Harry Potter and the Sorcerer's Stone*."
   C: To copy.
   E: Which of these gives the meaning of the word *dramatize*: to make into a performance, to make into a painting, or to make into a book report.
   C: To make into a performance.

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