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The contribution of morphological awareness to reading comprehension in Arabic-speaking second graders

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Abstract
We examined the longitudinal contribution of awareness of inflections and derivations to reading comprehension in Arabic, a morphologically rich language, among 734 second graders. Morphological awareness, phonological awareness, word decoding and reading comprehension tasks were delivered at the beginning and at the end of the school year. Results indicated that readers improved in morphological awareness and reading comprehension over the course of the year. More importantly, in general, morphological awareness at the beginning of the year predicted reading comprehension at the end of the year. Moreover, inflectional awareness at the beginning of the year predicted reading comprehension at the end of the year among readers with low levels of morphological awareness, whereas both inflectional and derivational awareness predicted reading comprehension in high morphological awareness readers, beyond the contribution of word decoding. The results highlight the importance of testing awareness of inflections and derivations separately, and the differential role of inflectional and derivational awareness to Arabic reading comprehension in young readers with different levels of morphological awareness.

Keywords Arabic · Derivational awareness · Inflectional awareness · Morphological awareness · Reading comprehension

Introduction

Writing systems reflect the cognitive processes that enable readers to extract meaning from written text. The cognitive system is a "correlation-seeking device", i.e., a system that uses all available properties of language to support the reading process.

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Morphological structure, for example, is mirrored in the orthographic structure of the Semitic word, allowing readers to use morphology to decode and comprehend text (Frost, 2012). Awareness of morphemes and the ability to manipulate them to build up or decompose words (morphological awareness) may be used in decoding new forms that appear in text and in arriving at their meaning. This process is more readily used when words are morphologically transparent (Carlisle & Fleming, 2003; Taha & Saiegh-Haddad, 2016), and is observed as early as the first and the second grades (Saiegh-Haddad, 2013; Saiegh-Haddad & Taha, 2017; Taha & Saiegh-Haddad, 2017; Vaknin-Nusbaum, Sarid, Raveh & Nevo, 2016; Vaknin-Nusbaum, 2018). Therefore, while investigating the reading process, one should consider the unique features of the language and the orthography (Frost, 2012; Share, 2008), as these may inform the way the reading system reacts and adjusts to the language and orthography under question (Saiegh-Haddad, 2018). Arabic, the language examined in this research, provides a unique opportunity for addressing this question because it is a language that differs greatly from European languages both in its morphological structure and in the way morphology is represented in its orthography.

Arabic has both linear and non-linear morphological procedures, and a rich system of inflectional and deviational morphemes that are largely represented in a transparent manner in writing (Saiegh-Haddad, 2017; Saiegh-Haddad & Henkin-Roitfarb, 2014). Both features might encourage morphological processing in Arabic reading. Indeed, it is argued that both the morphological richness of Arabic and its morphological transparency encourage readers of Arabic to rely on morphological processes early in reading and spelling Arabic words (Saiegh-Haddad, 2013, 2018; Saiegh-Haddad & Taha, 2017). By the same token, these features are also expected to encourage readers to use morphological processing to comprehend texts, either directly or indirectly via word decoding. In the Arabic shallow orthography, word decoding accuracy is expected to be mastered by the middle to the end of the second grade. Hence, the second grade is a critical milestone in the transition from word-level decoding to reading comprehension development. The current study investigates reading comprehension at the end of the second grade and compares the contribution of morphological awareness in Arabic-speaking students at the beginning of the second grade to their reading comprehension skills at the end of the school year.

Literature review

Inflectional and derivational awareness and their role in reading

Most research into morphological awareness in young children and its relationship with reading has focused on inflectional awareness. This is because of the abundance of inflections in the input that children receive and because of their early emergence in their oral language. Yet morphological structures in different languages are different both in their predominance and their acquisition, with derivational morphological processes in reading and spelling emerging rather early

in some languages that are rich in morphology, such as Semitic languages (Asadi, Ibrahim, & Khateb, 2017; Saiegh-Haddad, 2013; Saiegh-Haddad & Taha, 2017; Taha & Saiegh-Haddad, 2017; Vaknin-Nusbaum, 2018).

While the bulk of inflectional morphology is often mastered before entry into school and in the first 2 years of elementary school (Carlisle, 1995), derivational morphology—in particular, complex derivational forms (e.g., less semantically and phonologically transparent forms)—continues to develop into the late elementary grades (Anglin, 1993; Carlisle, 1998; Tyler & Nagy, 1989; Verhoeven & Perfetti, 2011). While developing rather late, derivational morphological awareness has been found to be a significant predictor of reading comprehension in elementary school students given its role in understanding phonological relations, syntactic roles and semantic relations (Carlisle, 1995; Kirby et al., 2012). Thus, when assessing morphological awareness in young school children and its relationship with reading development, one should consider including not only inflections but also derivations, despite children's incomplete knowledge of these forms (Carlisle, 1995; Nagy, Carlisle, & Goodwin, 2014). Moreover, these relations should be addressed while taking into consideration the unique features of the language under question and the way morphology is represented in the orthography (Frost, 2012). Because languages differ in their morphological procedures, richness and transparency, the contribution of morphological awareness to reading comprehension may also be different.

Previous research addressing the relationship between morphological awareness and reading in morphologically rich Semitic languages, Arabic and Hebrew, mostly used an analogy task in which the participants were asked to derive a word based on a given example (drive-driver). In these studies, awareness of derivations, which involved root extraction, was a strong predictor of Arabic word reading (Schiff & Saiegh-Haddad, 2018) and of Hebrew reading comprehension (Vaknin-Nusbaum, Sarid, & Shimron, 2016). As argued by Velan, Frost, Deutsch, and Plaut (2005), roots are represented as sub-word units in the mental lexicon and can be used to access a word's meaning following a process of morphologically decomposing the orthographic structure. Therefore, it may not come as a surprise that awareness of derivations was also found to distinguish typical readers from poor readers (Abu-Rabia, Share, & Mansour, 2003; Saiegh-Haddad & Taha, 2017; Vaknin-Nusbaum et al., 2016b; Vaknin-Nusbaum, 2018).

Cross-linguistic differences in morphological structure and in the acquisition of different facets of morphological awareness such as inflections and derivations, might have consequences for their relative role in word reading and reading comprehension. This underscores the importance of examining the contribution of each of these facets to reading separately (Saiegh-Haddad & Elouty, 2019). Also, the distinction between the two facets of morphological awareness might be informative in better understanding differences between poor and good readers. As such, poor readers may rely more in their reading on some aspects of their inflectional awareness than on more complex aspects, such as derivation. At the same time, they might rely to a greater extent on morphological processes than good readers in order to compensate for their poor phonological processing skills (Elbro & Arnbak, 1996; Saiegh-Haddad & Taha, 2017).

Recent research conducted in Semitic languages shed light on the role of morphological awareness in morphologically rich languages in the early development of reading comprehension. For example, in a study conducted among Hebrew-speaking second graders, it was found that inflectional awareness explained 4% of the variance in reading comprehension (Vaknin-Nusbaum et al., 2016), after controlling for phonological decoding and word recognition. In another study conducted at the same grade level, derivational awareness and construct-state formation (akin to compounding) together showed a unique contribution of 13% to reading comprehension beyond the contribution of vocabulary, word recognition, and phonological decoding (Vaknin-Nusbaum, 2018). The particular role of derivational awareness in reading comprehension can be explained by the abundance of and the early exposure of young readers to the words' derivational root and word-pattern morphemes in Semitic languages, together with the role of derivational morphology in meaning-related reading processes.

To better understand the contribution of morphological awareness to reading comprehension more research is needed in languages with different degrees of morphological complexity (Angelelli, Marinelli, & Burani, 2014; Share, 2008; Verhoeven & Perfetti, 2011), and in a variety of writing systems (Frost, 2012; Ruan, Georgiou, Song, Li, & Shu, 2018). Arabic, the language investigated in this study, is characterized by a rich morphology as well as by an abjad orthography that represents morphology in a largely transparent manner (Saiegh-Haddad & Henkin-Roitfarb, 2014; Saiegh-Haddad, 2017, 2018).

Arabic morphology and reading comprehension

Despite the fact that Arabic is characterized by linguistic distance between the spoken and the written varieties of the language, the derivational morphological structure of the two varieties is remarkably similar. Arabic is a typical case of diglossia (Ferguson, 1959), which is a sociolinguistic context in which two language varieties are used within the same speech community for two sets of complementary functions: (Modern) Standard Arabic (MSA or StA) for writing and formal speech and Spoken Arabic for everyday speech (Saiegh-Haddad et al., 2012; Saiegh-Haddad 2017, 2018). The two varieties of Arabic are remarkably different in phonology, morpho-syntax and lexicon. Yet, in derivational morphology, the two varieties are much less distant. As such, both varieties employ primarily non-concatenated procedures for word derivation using consonantal roots and word patterns (nominal and verbal). Moreover, whereas many roots are different in the two varieties, the word patterns (verbal and nominal patterns) that are used to derive words from roots are mostly shared, even though they might sound phonetically slightly different (Laks, Hamad, & Saiegh-Haddad, 2019; Saiegh-Haddad & Henkin-Roitfarb, 2014; Saiegh-Haddad & Spolsky, 2014).

Children learning to read in Arabic are faced with a remarkable challenge: they learn to read in StA, the only language of conventional writing, including in children's textbooks and storybooks, while their linguistic knowledge at this age is mainly restricted to Spoken Arabic, the language they acquire naturally and use

for almost all mundane functions until they start formal schooling. Given the shallow orthography of the vowelized orthography that children learn to read in, reading in Arabic has been shown to depend on phonological decoding using letter-sound knowledge, as well as on phonological awareness (e.g., Mahfoudhi, Elbeheri, Rashidi, & Everatt, 2010; Taibah & Haynes, 2011; Saiegh-Haddad, 2005). At the same time, given the rich derivational morphology of Arabic, with almost all content words being at least bimorphemic (consisting of a root and word pattern), word reading in Arabic was shown to be predicted by morphological awareness as well, even after phonological awareness was accounted for (Saiegh-Haddad & Taha, 2017). Research has also shown that the impact of linguistic distance between spoken and standard Arabic in the phonological, lexical and morphological domains challenges the acquisition of several language, metalinguistic and reading processes in young children (Asaad & Eviatar, 2013; Eviatar & Ibrahim, 2014; Saiegh-Haddad, 2003, 2004, 2007, Saiegh-Haddad et al., 2011; Saiegh-Haddad & Schiff, 2016; Saiegh-Haddad & Haj, 2018; Schiff & Saiegh-Haddad, 2017, 2018; Saiegh-Haddad, Shahbari-Kassem & Schiff, 2020). It has also been argued that this linguistic distance might delay the development of students' reading fluency in Arabic (Ibrahim, Eviatar, & Aharon Peretz, 2007; Eviatar & Ibrahim, 2004, 2014).

One prominent manifestation of diglossia in Arabic is a remarkable phonological distance between Spoken and Standard Arabic. This phonological distance results in a large number of cognate words, which are words that are shared by the two language varieties yet have different phonological forms. Saiegh-Haddad & Spolsky (2014) found that these cognate words make up 40.6% of the lexicon of 5-year-olds. Given the relative similarity between spoken and standard Arabic in derivational morphological structure, a possible way to bridge this gap and facilitate word recognition in Arabic might be to develop advanced awareness of the words' morphological structure, an awareness that will support young readers in the phonological decoding of lexically familiar cognate words as well as unfamiliar words. According to this hypothesis, morphological processing does not replace but consolidates and augments phonological decoding, especially given diglossia and the resultant 'functional opacity' of the Arabic orthography. 'Functional opacity' is a unique feature of orthographic depth (Daniels & Share, 2018; Saiegh-Haddad & Henkin-Roitfarb, 2014) which captures the idea that even when the relationship between the spelling and the sound of the word is transparent, as in voweled Arabic, differences in the phonological form that the spelling of the word encodes, namely its Standard Arabic phonological form, and its form the spoken lexicons of speakers results in 'functional opacity'. This functional opacity might force readers to continue to use phonological decoding in reading (Saiegh-Haddad, 2018), especially when the word is voweled because the voweled script encourages use of bottom-up phonological recoding strategies in word decoding (Saiegh-Haddad & Schiff, 2016). Because all textbooks, even those written for childrenare written exclusively in Standard Arabic, becoming aware of morphological relations on top of phonological awareness can be critical for students' literacy and academic development in general (Saiegh-Haddad & Everatt, 2017).

The morphological structure of Arabic is very rich and comprises three morphological sub-systems (Saiegh-Haddad & Henkin-Roitfarb, 2014). These are: (1)

a primarily non-concatenative or non-linear root and pattern derivational morphological system; (2) a primarily concatenated linear inflectional system; some inflectional procedures follow non-concatenated procedures too, such as broken noun plurals and elative adjectives; (3) a system of clitics which can attach to the word stem as prefixes or suffixes, and can co-occur within the same word resulting in single-word phrases/clauses, such as/*wa-sa-nastaqbilu-hum*/'and (we) will welcome them' (Saiegh-Haddad, 2017). This rich morphological structure predicts that morphological awareness resulting from the continuous decomposition of words in lexical access (Boudelaa, 2014) should develop early on in Arabic-speaking children (Taha & Saiegh-Haddad, 2017), and it should be particularly useful in Arabic word spelling, reading and reading comprehension (Saiegh-Haddad, 2013; Saiegh-Haddad & Geva, 2008; Saiegh-Haddad & Taha, 2017).

Arabic allows inflection through both linear and nonlinear morphological procedures. Linear word formation is usually used to create inflected forms indicating, for example, number (singular, dual, plural), in which distinctions are marked by adding suffixes to word stems resulting in regular (so-called *sound*) plurals. However, pluralization is also marked in Arabic using non-linear procedures, which involve irregular stem-internal vocalic changes as well, as in broken plurals. For example, *kura* 'ball' +the plural feminine suffix—*at* < ات > results in *krat:t*, but *daftar 'notebook'* gets the broken plural form *dafa:ter,* not *daftarat,* in which the consonants of the stem noun are inserted within a broken plural vocalic pattern *CaCCaC* (Saiegh-Haddad, Hadieh, & Ravid, 2012*)*. Inflectional categories in Arabic also include possessive forms. These are only linear but they also include regular and less regular forms. The default possessive forms which are added to the ends of nouns (e.g., *i* 'my', *na* 'our') receive an allomorph with the sound t preceding the possessive pronoun when the stem noun ends in so-called *ta? marbuta*, a grammatical gender marking letter-morpheme. For example, the possessive form that would parallel the English phrase 'my notebook' is *daftari* = *daftar-i*. However, the same possessive form of the phrase 'my ball' is *kurati* = *kura -ti*. This affixational procedure is less regular because in writing it would involve deleting the last letter from the noun, *ta? marbuta* < ة >, and replacing it by the letter < ت >, also called *ta? maftuha*, and then adding the possessive suffix. Similarly, in speech, speakers must note the final sound in the noun and identify it as a feminine gender marker, in which case possession should involve the use of the allomorph *ti*. In addition to gender and number, many person distinctions, as well as case and mood inflections, which are absent from all Spoken Arabic dialects, are marked in Standard Arabic mainly as diacritical marks. These are not encoded in the unvoweled default Arabic orthography, to which children are exposed only until around the fourth grade, and they must be restored using morphological processes (Saiegh-Haddad & Henkin-Roitfarb, 2014).

Arabic's non-linear formation, which is mainly characterized by derivation formations, is created by the combination of a consonantal root, indicating the semantic family, with a vocalic verbal or nominal pattern, composed of vowels and affixal consonants, indicating the word's prosodic structure as well as its syntactic category and related grammatical properties. For example, the word *katab* 'write' is created by a derivation in which the root KTB is interdigitated into the pattern CVCVC (where the C indicates a slot for the root consonant). The same root consonants may

be mounted onto the pattern maCCu:C to create the word/*maktu:b*/'is written' and onto the pattern Ca:CeC to create the word/*ka:teb*/'writer', etc. This derivational procedure is non-linear because the root morpheme is inserted into slots within a fixed prosodic pattern instead of being linearly attached, as is common in European languages like English.

The morphological features discussed above show that the Arabic word is morphologically dense and suggest that processing words in Arabic requires sensitivity to both linear and non-linear morphological structures (Asli-Badarneh & Leikin, 2018). It may require the reader to decompose words into their morphological components even in the early stages of reading acquisition (Mahfoudhi, et al., 2010). In fact, morphological processing has been recently presented as an essential component in the acquisition of word reading in Arabic (Shalhoub-Awwad & Leikin, 2016; Tibi & Kirby, 2017) and spelling (Abu-Rabia, 2007; Elbeheri & Everatt, 2007; Saiegh-Haddad, 2013; Saiegh-Haddad & Geva, 2008) and as a natural response to the centrality of morphology in the Arabic spoken word and its transparent representation in the Arabic written word (Saiegh-Haddad, 2018).

Research has shown that morphological awareness also contributes to reading comprehension in elementary school students (Abu-Rabia, 2007; Mahfoudhi et al., 2010). Identification and production of the root morpheme predicted reading comprehension in typical and dyslexic readers in the third grade (and up) (Abu-Rabia, 2007). Asadi, Khateb, and Shany (2017) found that orthographic skills a well as inflectional and derivational morphological awareness in the first 6 years of elementary school explained an additional 10–22% of the variance in reading comprehension beyond the basic components of the simple view of reading. Additionally, in another study, derivational awareness was found to explain unique variance in reading comprehension in dyslexic sixth graders, in typically developing age-matched controls, and in younger fourth graders (Layes, Lalonde, & Rebaï, 2017).

The present study

The primary goal of the current study is to examine the contribution of inflectional and derivational awareness to reading comprehension in Arabic in a short-term longitudinal study over the course of the second grade. Children are expected to show a rapid development in morphological awareness given (1) the morphological richness of the language; (2) the fact that the orthography represents morphology in a transparent way; and (3) research demonstrating an early emergence of morphological awareness and morphological processing in Arabic word reading and spelling (Saiegh-Haddad, 2013, 2018; Saiegh-Haddad & Schiff, 2016; Taha & Saiegh-Haddad, 2016). More specifically, the study aimed to probe whether morphological awareness at the beginning of the second grade would predict reading comprehension at the end of the year. The study examined a younger age group than targeted in most previous studies, in a language with unique morphological and orthographical features. The goal was to expand our understanding of the development of the

reading process and the way it is related to differences in language and in writing system characteristics.

According to the MAWRID Model (Saiegh-Haddad, 2018), the second grade is a critical milestone in the development of word reading in Arabic because readers begin to use morphological cues in their word reading at this age, and they transition from a grapheme-based (letter and diacritic) phonological recoding mechanism to a letter-based morpho-orthographic mechanism as a natural response to the transparent representation of morphology in the written word (Abu Ahmad, Ibrahim, & Share, 2014; Saiegh-Haddad, 2018; Saiegh-Haddad & Schiff, 2016; Schiff & Saiegh-Haddad, 2018). Therefore, the question of the role of morphological processing in reading comprehension in Arabic becomes particularly important at this transitional stage. Another unique aspect of this study is the examination of a relatively large sample (734)—larger than any sample tested so far in Arabic—which allows a broader perspective on the relationship between morphological awareness and reading comprehension in young Arabic-speaking readers.

In view of the richness of Arabic morphology and the unique features that are involved in word decoding in Arabic, we postulated that both inflectional and derivational awareness would contribute to reading comprehension. Although research examining morphological awareness-reading comprehension relations among second graders in Arabic is relatively sparse, the existing studies do point in this direction (Asadi et al., 2017a, 2017b). Moreover, research on word decoding and spelling development demonstrates a central role for morphological awareness in predicting these skills (Saiegh-Haddad & Taha, 2017). This suggests a similar effect on reading comprehension. Finally, research from Hebrew—also a Semitic language—supports this claim and suggests that young readers who learn to read in a language with a rich morphology and a morphologically transparent orthography might rely on morphological awareness for reading comprehension (Vaknin-Nusbaum et al. 2016a, 2016b; Vaknin-Nusbaum, 2018).

Our second hypothesis focuses on morphological awareness-reading comprehension relations in different types of readers. Because morphological awareness was found to explain variance in reading comprehension between disabled and typical readers of Arabic (Layes et al., 2017; Vaknin-Nusbaum et al., 2016a, 2016b), our second hypothesis predicts differences in reading comprehension between readers with high morphological awareness (HMA) and readers with low morphological awareness (LMA). Also, the contribution of morphological awareness at the beginning of the second grade to reading comprehension at the end of the school year is expected to differ for these two groups of readers.

Method

Participants

The participants were 734 second grade students, 7–8 years old, from 24 classes, native Arabic speakers (N = 332 females; 45.2%). Data were collected over a period of 4 years, six classes each year from two schools (46.9% and 53.1% in

each school). Each class was comprised of between 27 and 36 students. Children are usually assigned to a specific school in Israel according to home address. The schools in this study are located in low socioeconomic neighborhoods in northern Israel (Central Bureau of Statistics of Israel, 2014). Data were collected between 2012 and 2015, with a total of between 178 and 190 students tested per year. The distribution of students per school did not differ by year ($\chi^2(3) = 0.70$, $p = .874$), the distribution of gender did not differ by year ($\chi^2(3) = 4.96$, $p = .174$), and the distribution of gender did not differ by school ($\chi^2(1) = 1.27$, $p = .259$). Students who were suspected to have language, attentional or developmental difficulties (based on their teacher's report) were excluded from the study. Ministry of Education authorization and written parental consent was obtained from all children participating in the study.

Research tools

Morphological awareness tests

Morphological awareness (MA) was examined using a two-part test (inflections and derivations) which was developed based on a previous test conducted with Hebrew readers (Vaknin-Nusbaum et al., 2016a; Vaknin-Nusbaum, 2018). The testing items were all based on common and familiar standard Arabic words used frequently in young children's textbooks. In all MA tests, students were presented with the instructions, then completed practice examples and only then they were asked to complete the task. Each item was presented to the children using a smart board and was read out loud by the experimenter to the students to make sure that reading ability would not confound performance among the low achievers in examining MA. Each item and the three options that followed it were presented and read to the students in standard Arabic, and only then were students asked to choose the right answer by circling it on their own personal sheet. Performance was not limited by time.

All the items that were chosen for the MA tests depicted forms that share morphological features with spoken Arabic forms. Although spoken and standard Arabic vary in morphological structure, the difference between the two forms, especially in derivational morphology, is often in the phonetic representations of shared morphological units. Earlier research has shown that children's awareness of morphological structures that are shared in spoken and standard Arabic is higher than their awareness of unique standard Arabic morphemes (Schiff & Saiegh-Haddad, 2018). Thus, in the current study, we only used shared morphological units (inflections and derivational).

Because they differ in complexity and in the way they are represented in written form, separate tasks were constructed to test awareness of inflectional and derivational morphology and separate scores were calculated. Whereas inflections are built by a simple linear process, derivations require awareness of the root morpheme and the pattern morpheme.

Part 1: Awareness of inflections

This task targeted two productive inflectional categories: noun pluralization and possessive forms. These two systems include regular transparent forms and irregular forms that are less transparent and involve morpho-phonological alternations. The task was comprised of a total of 18 items: nine plural inflections—four regular sound masculine and sound feminine plurals (e.g.,*/muʔalim-muʔalimu:n/*'male teacher-s';*/taliba–taliba:t/*'female pupils') and five irregular broken plurals (e.g.,*/qalb-qulu:b/*'heart-s')—and nine possessive inflections (four regular involving the simple addition of the*/i/*possessive morpheme, e.g.,*/qalam- qalami* 'pen-my pen') and five irregular involving the addition of the allomorph*/ti/*, e.g.,*/kura-kurati/*'ball-my ball'. In both inflectional sections, the distractors were wrongly inflected words created by attaching an incorrect suffix.

In plural formation, students were presented with a singular target noun followed by two plural forms of that noun separated by a slash: the correct plural and the distractor, an incorrect plural form. The students were asked to choose the correct plural form from the two options. In the possessives, students were presented with a singular target noun and a possessive pronoun (my, his, her, etc.) (e.g.,*/bayt li/*'my house'). Next to the noun and the possessive pronoun there appeared three complex possessive forms separated by a slash (e.g.,*/bayti, baytuhu, baytuha/*'my house, his house, her house'), and the students were asked to choose the correct possessive form. Note that unlike English, Arabic possessives are expressed as bound suffixes that agree with the noun in person, number and gender. The morphological awareness score of each subtest was the percent of correct answers out of the total number of items in that subtest. Cronbach's α for the inflection test was 0.93.

Part 2: Awareness of derivations

Because of its complexity for second graders, and in order to enable children to complete the test, this section consisted of just six derivational items, all involving deverbal nouns. Deverbal nouns, namely nouns constructed from basic verbs, are predominant in the Arabic language, both in Spoken and in Standard Arabic. Yet, they are varied in that they use different derivational patterns depending, inter alia, on the syntactic-semantic properties of the derived noun (patterns denoting place, instrument, agent, etc.) and on the pattern of the basic verb (CVCVC, CVCCVC). In our test, the items targeted three different such patterns, all of which are shared in Spoken and Standard Arabic, although their surface phonetic form in the two varieties may be different. (e.g., SpA taCCi:Cun—StA tiCCi:C; SpA CaCC-StA CaCiC).

After completing a sample item, students were presented with a pair of words that included the default third person singular perfective form and its transformation to deverbal noun using the correct derivational nominal pattern. Then they were presented with another new perfective verb form and were asked by analogy to identify the right deverbal form out of three given options (note that in Arabic this transformation is a derivation and it requires choosing the right derivational pattern according to the pattern of the given example).

To identify the correct derivation, the child had to analyze the morphological root-and-pattern structure of the example pair, locate and extract the root from within the new word, and weave it into the derivational pattern introduced in the example. The distractors included words with the same root as the root source but with different nominal patterns (e.g.,*/ʔadrusu-darsan/*'I study—studying' is like *ʔazraçu* 'I plant'—***/zarçan/***'planting' (correct response)—*/mazraçatun* 'farm/plantation'*/muza:riçun* 'farmers'). Although the roots and the word patterns were frequent and familiar to second graders, children might not be aware of how such words are morphologically constructed. The goal of the task is to examine this capability. The score was calculated as the percent of correct answers out of the total number of items. Cronbach's α for this task was 0.86.

High correlations were found between awareness of inflections and derivations, at the beginning of the year (r = .64, $p < .001$) and at the end (r = .70, $p < .001$). Thus, in addition to a separate score for inflections and derivations, a total morphological awareness score was calculated based on the means of both tasks as presented in Table 1.

Word recognition and reading comprehension tests

Sub-tasks of the Arabic version of the Elul assessment battery (Shatil, Nevo, & Breznitz, 2007) were used to test phonological decoding and reading comprehension. The Arabic Elul battery was developmentally designed, with age-appropriate versions from first to ninth grade, to identify low-achieving readers. It was validated on a large random sample of children and includes national norms. For the phonological decoding test, Elul was developed and validated on 596 Arabic-speaking second graders and for the comprehension test on 553 students. All tests were presented in the fully vowelized Arabic orthography and were timed according to battery instructions.

Part 1: Phonological decoding (total N = 41)

This word-level test consisted of two columns: in the right column, high-frequency words (28 nouns and 13 verbs in the present tense) appeared in a fully vowelized form, and pictures appeared opposite them in the left column. Each test sheet included eight to nine items. Participants were asked to read the words silently and draw a line between the word and the picture which represented it. Scores were the percentage of correct answers. The reliability of the test was α = 0.96.

Part 2: Reading comprehension

Students were instructed to read two narrative texts in the allotted time (13 min for each text) and answer 14 multiple choice questions consisting of a correct answer and three distractors. The first text ("Who Am I?") was 27 words long and was followed by seven multiple choice questions; the second ("Our Home") was 31 words long and was followed by another seven multiple choice questions in the same format. Comprehension scores were the percentage of correct answers. The reliability

of the test was $\alpha = 0.91$. High correlations were found between the two narrative reading comprehension sub-tests, both at the beginning of the year ($r = .70$, $p < .001$) and at the end of the year ($r = .76$, $p < .001$). Hence a total reading comprehension score was calculated based on the means from both tasks.

Procedure

The reading and morphological awareness tests were administered by two research assistants in groups of ten students in the students' homerooms at the beginning of the school year (October) and at the end of the school year (June). Each pupil was given a notebook and was asked to listen carefully to the instructions, which were read out by the researcher; the instructions also appeared at the top of each test sheet. Written examples were presented first, and the test began when the training items had been answered correctly. When the time limit of each reading test was reached, participants were asked to stop. The tests were given in the following order: phonological decoding, reading comprehension, morphological awareness. The number of correct answers was calculated for each test separately.

Each question on the morphological test was presented visually on the screen and read aloud to the students, who were instructed to circle the correct answer in each part, with no time limit. This was done to narrow the effect of reading skills on MA. The test began after the students received an answer sheet including two printed sample items. Administration of all tasks took a total of about 30 min.

Data analysis

Differences in the study variables at the beginning of second grade were examined by school and gender with a series of *t*-tests. Differences by year of study at the same time point were examined with one-way analyses of variance. Differences in the students' performance from the beginning to the end of the academic year were examined with repeated measures analyses of covariance, controlling for school, gender, and year of study. Multiple regressions were used to predict reading comprehension at the end of the year with morphological awareness at the beginning of the year, controlling for phonological decoding, school, gender, and year of study. Next, cluster analysis was used to divide the students into high and low subgroups of morphological awareness. Finally, multiple hierarchical regressions were used to predict reading comprehension at the end of the year with the dimensions of morphological awareness at the beginning of the year, comparing the two reader clusters.

Results

Differences in the study variables at the beginning of the second grade were examined by school on a series of *t*-tests. They were all found significant: reading comprehension: $t(709.47) = 6.38$, $p < .001$, phonological decoding: $t(545.89) = 5.34$, $p < .001$, and morphological awareness: $t(732) = 8.29$, $p < .001$), implying that

Table 1 Means, Standard deviations, and F values for the students' performance by time and group of morphological awareness (N = 734)

	Total		Low MA readers		High MA readers		F_{time} (1, 729) (η^2)	F_{group} (1, 729) (η^2)	$F_{time\ X\ group}$ (1, 729) (η^2)
	Beginning *M* (*SD*)	End *M* (*SD*)	Beginning *M* (*SD*)	End *M* (*SD*)	Beginning *M* (*SD*)	End *M* (*SD*)			
Reading comprehension	65.18 (31.44)	82.26 (25.91)	45.62 (31.22)	71.61 (31.08)	80.55 (21.53)	90.63 (16.78)	44.86*** (.058)	245.06*** (.252)	49.27*** (.063)
Phonological decoding	90.41 (19.12)	96.57 (12.08)	82.90 (24.81)	94.35 (15.08)	96.31 (9.51)	98.32 (8.56)	6.07* (.008)	68.66*** (.086)	41.18*** (.053)
Morphological awareness	49.15 (27.76)	67.98 (26.64)	22.79 (16.59)	55.86 (30.08)	69.87 (13.56)	77.50 (18.76)	85.30*** (.105)	719.90*** (.497)	180.82*** (.199)
Inflections	60.38 (31.34)	75.35 (27.24)	34.43 (26.51)	62.90 (31.15)	80.77 (16.05)	85.13 (18.61)	38.81*** (.051)	511.50*** (.412)	139.43*** (.161)
Derivations	37.98 (29.94)	60.57 (30.55)	11.15 (14.26)	48.82 (34.01)	58.98 (20.85)	69.88 (23.75)	82.35*** (.102)	554.55*** (.432)	118.97*** (.140)

*$p < .05$, **$p < .01$, ***$p < .001$

students in one of the two schools outperformed the other on all measures. Further, pre-study differences by gender were significant for reading comprehension ($t(728.49) = 2.49$, $p = .013$) and phonological decoding ($t(713.14) = 2.68$, $p = .007$), revealing higher scores among girls than boys. Pre-study differences by year of study were examined with analyses of variance and were significant for reading comprehension ($F(3, 730) = 3.98$, $p = .008$ $\eta^2 = .016$) and morphological awareness ($F(3, 730) = 7.13$, $p < .001$ $\eta^2 = .028$). In both cases, scores for 2014 were higher than for other years. In light of these initial differences, analyses were conducted while controlling for school and gender (defined dichotomously as dummy variables), as well as year of study (defined dichotomously as 2014 vs. other years).

Table 1 presents differences in the students' performance between the beginning and at the end of the academic year, as found with repeated measures analyses of covariance, controlling for school, gender, and year of study.

Results show significant increases in reading comprehension, morphological awareness, inflectional awareness, and derivational awareness between the beginning and the end of the year. No change was observed in phonological decoding, as initial scores were rather high.

Table 2 presents Pearson correlations among the variables of the students' performance, by time. All correlations are significant and positive, revealing that better performance in some reading skills is related to better performance in others.

Table 3 presents a multiple hierarchical regression predicting reading comprehension at the end of the year based on morphological awareness at the beginning of the year, controlling for phonological decoding. Control variables (school, gender, year, and phonological decoding) were entered at Step 1, and the research variables (inflections and derivations) were entered above and beyond them at Step 2.

Results show that the regression model is significant, and the variables explain 25% of the variance in reading comprehension at the end of the year. Beginning of year morphological awareness positively predicts end of year reading

Table 2 Pearson correlations among the variables of the students' performance, by time ($N = 734$)

	1.	2.	3.	4.	5.
Beginning					
1. Reading comprehension	–	.53***	.67***	.67***	.55***
2. Phonological decoding			.42***	.42***	.35***
3. Morphological awareness total				.91***	.90***
4. Inflections					.64***
5. Derivations					–
End					
1. Reading comprehension	–	.49***	.69***	.69***	.58***
2. Phonological decoding			.42***	.43***	.35***
3. Morphological awareness				.91***	.93***
4. Inflections					.70***
5. Derivations					–

***$p < .001$

Table 3 Multiple regression of reading comprehension at the end of the year, with morphological awareness at the beginning of the year, and by subgroups of morphological awareness ($N = 734$)

	Total			Low morphological awareness ($n = 323$)			High morphological awareness ($n = 411$)		
	B	*SE*	β	*B*	*SE*	β	*B*	*SE*	β
Step 1									
Gender	−1.66	1.75	−.03	−2.53	3.26	−.04	−1.44	1.44	−.05
Phonological decoding	0.52	0.05	.39***	0.41	0.07	.33***	0.50	0.08	.31***
Adj.R^2	.17***			.14***			.11**		
Step 2									
Gender	−1.42	1.66	−.03	−1.83	3.19	−.03	−1.35	1.43	−.04
Phonological decoding	0.35	0.05	.26***	0.35	0.07	.28***	0.45	0.08	.27***
Inflections	0.22	0.04	.26***	0.28	0.06	.24***	0.09	0.05	.09*
Derivations	0.08	0.04	.09*	−0.17	.11	−.08	0.08	0.04	.11*
Adj. ΔR^2	.08***			.05***			.02**		
Model:	Adj.$R^2 = .25$, $F(6, 724) = 42.37$, $p < .001$			Adj.$R^2 = .19$, $F(6, 316) = 13.32$, $p < .001$			Adj.$R^2 = .13$, $F(6, 404) = 11.17$, $p < .001$		

School and year of study were controlled for, defined as dummy variables

*$p < .05$, **$p < .01$, ***$p < .001$

comprehension, over and above school, gender, year of study, and phonological decoding, so that the higher the initial levels of morphological awareness, for both inflections and derivations, the better the end of year reading comprehension. Both inflectional awareness and derivational awareness are positively and significantly predictive of reading comprehension, yet the contribution of inflectional awareness to reading comprehension ($B = 0.22$, $SE = 0.04$, $\beta = .26$, $p < .001$) is significantly greater than that of derivational awareness ($B = 0.08$, $SE = 0.04$, $\beta = .09$, $p = .035$) ($Z = 2.68$, $p = .007$). It is interesting to note that the variable of school is not significant in Step 1, yet with the addition of inflections and derivations in Step 2, it becomes significant. This contribution turns significant between the steps due to the large sample size, yet its magnitude does not change significantly from the first to the second step ($\beta = .04$, $p = .209$, vs. $\beta = .11$, $p = .001$, $Z = 1.42$, $p = .156$), and school is controlled for in both cases.

In order to assess whether morphological awareness predicts reading comprehension differently for students with high versus low morphological awareness, the K-Means cluster analysis was used. This procedure divides the observations into a predefined number of clusters according to proximity of means. Here, it was used to divide the students into two subgroups according to their morphological awareness. Clustering was based on initial scores of inflectional and derivational awareness, resulting in one subgroup with high morphological awareness ($M = 69.87$, $SD = 13.56$, $n = 411$) and another with low morphological awareness ($M = 22.79$, $SD = 16.59$, $n = 323$). The two groups differed in their initial reading comprehension (respectively, $M = 80.55$, $SD = 21.53$ vs. $M = 45.62$, $SD = 31.22$, $F(1, 729) = 267.35$, $p < .001$, $\eta^2 = .268$), as well as in their final reading comprehension ($M = 90.63$, $SD = 16.78$ vs. $M = 71.61$, $SD = 31.08$, $F(1, 729) = 102.53$, $p < .001$, $\eta^2 = .123$).

Multiple hierarchical regressions were used to predict reading comprehension at the end of the year with the dimensions of morphological awareness at the beginning of the year, comparing the two reader clusters. School, gender, year of study, and phonological decoding were controlled for. Table 3 presents both regression models.

Results in Table 3 reveal that both models are significant, explaining 19% and 13% of the variance in reading comprehension in readers with low and high morphological awareness, respectively. For readers with low morphological awareness, inflectional awareness (but not derivational) positively predicts final reading comprehension, whereas for readers with high morphological awareness, both inflectional and derivational awareness positively predict final reading comprehension.

Discussion

The primary goal of the present study was to examine the contribution of morphological awareness (inflection and derivation) to reading comprehension in the second grade among Arabic-speaking students. In particular, we examined whether morphological awareness at the beginning of the year predicted reading comprehension at the end of the year, and whether there were differences in the prediction of reading comprehension between readers with low versus high levels

of morphological awareness. The basic assumption underlying this study was that initial awareness of both inflectional and derivational would make a unique contribution to predicting reading comprehension at the end of the year in this young group of Arabic readers, beyond phonological decoding. Moreover, these morphological awareness-reading relations would differ for readers with high morphological awareness (HMA) versus readers with low morphological awareness (LMA).

The results of the study, based on a relatively large sample of students, support our predictions and show that awareness of inflections and derivations are both correlated with reading comprehension at both time points: beginning and end of second grade. Moreover, students improved in their inflectional and derivational awareness, as well as in their reading comprehension skills, between the beginning and the end of the school year. Nonetheless, more rapid improvement was observed on all measures in the LMA students, who functioned poorly in both morphological awareness and reading tests at the beginning of the year. Also, beyond phonological decoding, morphological awareness at the beginning of the school year predicted success in reading comprehension at the end of the school year. Finally, although not fully developed, both inflectional and derivational awareness, as well as phonological decoding, predicted reading comprehension in HMA students, whereas in LMA readers, awareness of derivational awareness did not predict reading comprehension, whereas the other variables all did.

These results generally align with previous studies conducted in other languages such as English, which show a significant relationship between morphological awareness and reading comprehension (Apel & Diehm, 2014; Wolter & Dilworth, 2013; Deacon et al., 2014; Deacon, Tong, & Francis, 2017). However, the results of the current study extend previous findings in two ways, and specifically with regard to Arabic: first, they show that these significant relations hold for both inflectional awareness and derivational awareness; second, they show that the significant relationship between morphological awareness and reading comprehension, especially in derivational morphological awareness, holds even at a relatively young age. So, although second graders are still in the process of developing their morphological awareness and reading comprehension in Standard Arabic, they appear to be relying on that awareness in their attempt to comprehend text. This result lends support to Frost's (2012) claim that writing systems reflect the cognitive procedures by which readers comprehend a text. Moreover, they lend support to the MAWRID Model (Saiegh-Haddad, 2018) which argues that young Arabic-speaking readers use morphological cues in reading in parallel to phonological decoding.

A possible explanation for this relationship between morphological awareness and reading comprehension can be found in earlier research indicating that young native Arabic readers use morphological cues in their word reading even in their second year of learning to read (Abu Ahmad et al., 2014; Saiegh-Haddad & Schiff, 2016; Schiff & Saiegh-Haddad, 2018). This might, in turn, indirectly contribute to explaining the observed relationship between MA and reading comprehension. The MAWRID Model (Saiegh-Haddad, 2018) elaborates on this possibility and argues that

> [Morphological processing is] an emergent processing mechanism that develops in response to the properties of the Arabic language and orthography; it is a naturally developing processing reflex to the transparent representation of the morphological structure of the word in its letter representation … among native speakers of Arabic whose lexicons are organized around a morphological principle (p. 454).

Nevertheless, it should be borne in mind that the MAWRID Model focuses on word-level reading and not directly on reading comprehension. Thus, despite the contribution of morphological awareness to word-level reading, which earlier research has demonstrated (e.g., Abu-Rabia, Share & Mansour, 2003; Asadi et al., 2017a, 2017b; Layes et al., 2017; Saiegh-Haddad & Taha, 2017), the question of whether there are direct or indirect routes from morphological awareness to word reading to reading comprehension in Arabic remains open and should be examined in future research.

Results of the study imply that Arabic readers who have comparatively well-developed morphological awareness, may use their awareness of morphemes to enhance their reading comprehension at an early age, unlike English readers who usually gain this ability in the upper grades of elementary school (e.g., Levesque et al., 2017). This offers evidence for the claim that, very early in its development, morphological awareness plays an important role in reading comprehension in Semitic languages (Vaknin-Nusbaum et al., 2016a, 2016b; Vaknin-Nusbaum, 2018).

The important role of morphological awareness in reading comprehension in Arabic aligns with earlier research (Asadi et al., 2017a, 2017b; Layes et al., 2017) and is directly reflected in the prediction findings indicating that measures of morphological awareness taken at the beginning of the second grade uniquely predict reading comprehension at the end of the year, beyond measures of phonological decoding. Yet, it is important to note that in the current study, children with low morphological awareness seemed to benefit less from this metalinguistic resource and exhibited lower reading achievement than the students with high morphological awareness.

The present results showed that morphological awareness predicted 8% unique variance in reading comprehension, suggesting that morphological awareness plays a stronger role in reading comprehension than previously shown in research conducted in English among second graders demonstrating a unique contribution of just 4% (Kirby et al., 2012). This implies that the role of morphological awareness in reading comprehension may be stronger in Arabic, a language with a rich morphology and a morphologically transparent orthography (Saiegh-Haddad & Henkin-Roitfarb, 2014). Nonetheless, this conclusion should be treated with caution because the two studies target very different populations and the results may hence be affected by other unmatched pedagogical and environmental factors.

One unique contribution of the current study is that it tested inflectional and derivational morphological awareness separately. The results showed that awareness of inflections and derivations, which reflect different cognitive processes, can each be an independent predictor of reading comprehension in this group of young second graders. Whereas inflections involve a simple linear process, derivations usually require a nonlinear procedure based on awareness of the word

pattern and the root morphemes. The root is the core semantic entity of the Arabic word and it is assumed to be represented independently in the mental lexicon (Boudelaa, 2014) and is an integral part of almost all content words in Arabic. Therefore, semantic and syntactic acquisition involves the analysis of words into roots. This results in early awareness of and use of the root in language processing (Saiegh-Haddad, 2013; Saiegh-Haddad & Taha, 2017; Taha & Saiegh-Haddad, 2017). Given that the root aids in accessing the meanings of familiar and new words and strengthens semantic links in memory facilitating new word learning, semantic inferencing and reading comprehension, it is not surprising to find that derivational root-based awareness predicts reading comprehension and differentiates between different types of readers. In addition to the morphological richness of the Arabic language, and the transparent manner in which morphemes are represented in the Arabic orthography, the early contribution of morphological awareness to reading comprehension in Arabic demonstrated by the current research may be attributed to the diglossic context of Arabic (Saiegh-Haddad, 2018). Diglossia might encourage young readers to rely on information beyond the phonological word in their reading, such as morphemes, which can help in accessing meaning from the orthographic letter string. This is because of the remarkable phonological and lexico-phonological distance between the spoken forms of words and their parallel standard written forms (Saiegh-Haddad & Spolsky, 2014). The ability to discern morphological ties between the phonological forms of the word in SpA and StA might help prevent readers from becoming distracted by differences in phonetic form and in so doing, compensate for and alleviate the disruptive impact of phonological distance (Saiegh-Haddad & Taha, 2017), especially as most of the derivational patterns are shared between SpA and StA, even though their surface phonetic representation may be different (Laks, Hamad, & Saiegh-Haddad, 2019). This might also explain why derivational awareness, which was found in other languages to relate to reading comprehension at more advanced reading levels, was found in the current research to predict reading comprehension scores in the second grade.

Although phonological decoding was not central to the current study, an important result that the current study demonstrated pertains to the contribution of phonological decoding to reading comprehension at the two examined time points. In a previous study conducted in Hebrew-speaking second graders, phonological decoding was a significant predictor of reading comprehension before morphological awareness was entered into the regression analysis, but not after (Vaknin-Nusbaum, 2018). In contrast, in this study, phonological decoding remained a stable predictor highly correlated with reading comprehension after morphological awareness was entered and in both low and high MA learners. It might be the case, as suggested by Saiegh-Haddad (2018), that given the transparent relationship between spelling and sound in Arabic orthography, early readers rely mainly on phonological decoding (Saiegh-Haddad & Taha, 2017). Yet they start to use morphological processing alongside phonological decoding early on in their reading acquisition process in response to the centrality and transparency of morphology in the Arabic written word. This may be particularly true when readers are still in the process of developing word decoding skills. With the development of reading and the automaticity of

word decoding in higher grades, readers might rely more heavily on morphological processing.

Another explanation pertains to the lexico-phonological distance between SpA and StA (Saiegh-Haddad & Haj, 2018) and the resulting 'functional opacity' of the Arabic orthography (Daniels & Share, 2018; Saiegh-Haddad & Henkin-Roitfarb, 2014). Arabic-speaking second graders seem to be at a crossroad: they use their morphological awareness for fast word recognition and reading comprehension but cannot inhibit the bottom-up phonological decoding that the phonological and lexical distance between SpA and StA confronts them with, especially when words are vowelized (Saiegh-Haddad & Schiff, 2016). They seem to need to manage both routes to overcome the diglossia challenge and comprehend text. One can expect that as readers become more experienced in reading and basic phonological decoding skills are acquired and practiced, readers will shift to a more morphological strategy in their reading especially when reading the unvoweled orthography (Nunes & Bryant, 2011; Saiegh-Haddad & Taha, 2017).

In Arabic, these two processes seem to develop in parallel at a rather young age, and their development might also depend on variations among children in mastering basic lexical skills in standard Arabic. A closer look at the results reveals differences in reading comprehension scores between readers with high and low morphological awareness. We predicted that the contribution of morphological awareness at the beginning of second grade to reading comprehension at the end of the school year would differ for these two groups of readers. In line with our predictions, high morphological awareness readers earned significantly higher scores in reading comprehension than low morphological awareness readers, at the beginning and the end of the school year. Also, whereas inflectional awareness predicted reading comprehension among both examined groups of readers, derivational awareness predicted reading comprehension only in readers with high morphological awareness. Generally, although scores in derivational awareness weren't high, they did predict success in reading comprehension and differentiated strongly between the two groups of readers. This is true at least for the specific forms targeted in this study (i.e., deverbal nouns constructed from basic verbs, which are predominant in the Arabic language, both SpA and StA). It seems that with practice in reading, readers with high morphological awareness pay more attention to the words' morphological structure and use morphological processes to extract meaning from print (Deacon et al., 2017). This ability might enable them to further develop their derivational awareness and to rely on it in their reading (Carlisle, 1995).

In summary, the study shows that morphological awareness has an important role in predicting reading comprehension in Arabic in second graders with high and low morphological awareness levels. Additionally, although morphological awareness has an important role in reading comprehension, awareness of derivations is a stronger predictor among Arabic-speaking second graders than inflectional awareness; Finally, readers with low sensitivity to complex forms such as derivations showed poor achievement in reading comprehension. This implies that assessment of children's morphological awareness should be delivered as early as the beginning of the second grade and used as a diagnostic tool to prevent future difficulties in reading. Moreover, explicit instruction is needed for complex morphological forms

along with reading acquisition, as suggested by Nunes and Bryant (2011), in particular for children with low morphological awareness, at least in languages characterized by a rich and an orthographically transparent morphology like Arabic.

Limitations

Despite the unique contribution of morphological awareness to reading comprehension found in this study, several limitations should be considered. Vocabulary, a variable that has a reciprocal relationship with morphological awareness and with reading comprehension, was not examined in this research. Taking into account vocabulary knowledge as an additional predictor may offer a more accurate picture of the reading comprehension process in Arabic. Looking at the inflectional task, irregularity should also be considered. Because irregular inflections have been found to be processed more slowly than regular inflections in Semitic languages (Vaknin-Nusbaum & Shimron, 2011), irregular forms may be a source of difficulty for young children, and each inflection type can also have a different contribution to the process of reading. In the present study, only the total score of each inflectional part was calculated without differentiating between these two forms of inflections.

In addition, because of the difficulty of the analogy test for young readers, the number of items in the derivation test was small and limited to only three morphological patterns; therefore, caution is needed with regard to the interpretation of the results, and a follow-up study should be conducted by using a more detailed derivational assignment which will make it possible to examine the contribution of various derivational patterns to reading comprehension. Future research should take these aspects into consideration and examine the morphological awareness—reading comprehension relationship across the elementary grades, closely following the development of this relationship with a particular focus on derivational morphology.

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