Arabic Morphology: Assessing Morphological Knowledge Through Diverse Measures

BY

Lama Bergstrand Othman

Ph.D. Associate Professor, Special Education - University of Wisconsin

Lauren Zepp

Ph.D. Assistant Professor, Special Education - University of Wisconsin

Doi: 10.21608/jasep.2025.423396

استلام البحث : ٣ / ٣ /٢٠٢٥

قبول النشـــر: ٢٥ / ٣ / ٢٠٢٥

Othman, Lama Bergstrand & Zepp, Lauren (2025). Arabic Morphology: Assessing Morphological Knowledge Through Diverse Measures. ***The Arab Journal of Educational and Psychological Sciences***, Arab Institute for Education, Science and Arts, Egypt, 9(48), 835-870.

http://jasep.journals.ekb.eg

Arabic Morphology: Assessing Morphological Knowledge Through Diverse Measures

Abstract:

Morphological knowledge involves understanding word structure and formation with a specific focus on morphemes, which are the basic components of meaning in a language. Proficiency in morphology enables individuals to identify, examine, and manipulate words, thereby expanding their lexicon and enhancing their comprehension abilities. In addition to the distinctive morphological features of a language, researchers must account for variables beyond the level of morphology, such as the modality of stimuli and/or the modality of response. This systematic review provides a comprehensive overview of morphological knowledge tasks as well as a discussion of their nature, the ways in which they compare to the unidimensional and multidimensional conceptualizations of morphology in Arabic, and their relationship to research on the representation of morphology in the mental lexicon in the context of Arabic.

Keywords*:* Morphology, Arabic, derivational morphology, inflectional morphology, priming studies, morphological dimensionality.

Introduction

Understanding the concept of morphological knowledge is necessary for the development of measures that aim to assess it (i.e., construct validity) (AERA, 2014; Deacon et al., 2008; Layes et al., 2017). Therefore, it is essential to focus on the unique morphological landscape of a language as part of any attempt to measure morphological knowledge. Morphological knowledge refers to the mental representation and manipulation of morphemes, which are the smallest units of meaning. Such

ISSN: 2537-0464 eISSN: 2537-0472

concept has been described as knowledge of the morphemic structure of words and the ability to reflect on and manipulate that structure (Carlisle, 1995). Moreover, morphemes combine root and affixes to generate stems that can integrate additional affixes. For example, the word "new" serves as a root, with "re" and "-al" serving as affixes, thus leading to the derivation "renewal".

In the early stages of learning to read, the influence of basic literacy skills, such as phonological awareness, orthographic awareness, morphological knowledge, names of letters knowledge, vocabulary knowledge, and rapid automatized naming, are expected to have an effect on the ability to read words fluently. Moreover, many fundamental literacy abilities may have a unique correlation with the ability to read texts fluently, separate from their association with the fluency of reading individual words (Kim, 2015). It is important to distinguish between morphological awareness and morphological processing. Morphological awareness is a stronger form of morphemic representation, implying that the more efficiently individuals access morphological representations, the more efficiently they manipulate the morphological aspects of words. Carlisle (1995) defined morphological awareness as the conscious and explicit recognition and manipulation of the morphemic structures of words. This type of conscious knowledge of morphemes is often tested using the “strategic morphological analysis task”. An example of this task is when a student is given a root word such as “get”, which is then used to provide the morphologically related words “gotten, getting, getter” (Goodwin et al., 2017).

On the other hand, morphological processing is often measured using performance on more implicit tasks, such as lexical decision tasks, which require intuitive and tacit

ISSN: 2537-0464 **eISSN: 2537-0472**

knowledge. For example, participants are asked to read aloud a list of derived words, e.g., "forgiveness, action, likable, helpless, personally". Then, they are asked to read a list of the roots of these derived words "give, act, like, help, person" (Goodwin et al., 2017). The implicit task example presented here requires students to employ their word decoding skills but does not necessitate the generation of derived components, as those components are already provided. This approach differs from the explicit task, which requires students to generate or judge derived words from the root and vice versa.

Arabic Morphology

Arabic is written from right to left and includes consonants, long vowels and, to a much lesser degree, short vowels. The Arabic alphabet includes 28 letters, each of which can take on several forms depending on its position in the word (initial, medial, final, or solitary). In most situations, the letters are connected to form a cursive writing system. Short vowels are represented by diacritics, which are rarely used in advanced literature and books or those targeted at adults (deep orthography). For example, the word (كَتَبَ, write) is pronounced /kataba/ and is written as (كتب). As a result, roots are always fully realized in the orthographic string of consonants, but the complete vocalic components of words are not always represented orthographically due to the absence of short vowels. That is, each word pattern is unique not only because of the variations in consonants and long vowels but also because of the variations in short vowels, which are not orthographically represented in most texts. For example, the word (/kaatib/ كاتب (which means "writer")) is represented by the consonantal root {ktb} and a long vowel (-aa---) and is pronounced /kaatib/; however, the phonological components that correspond to the

ISSN: 2537-0464 eISSN: 2537-0472

short vowel /----i-/ that contributes to the word form are not orthographically presented. The optional nature of Arabic orthography may result in ambiguity in written Arabic because word pattern identification must be disambiguated depending on the context or frequency of words (Boudelaa, 2014; Boudelaa & Marslen-Wilson, 2005).

Arabic morphology features a unique linguistic structure and functions (Boudelaa & Marslen-Wilson, 2010; Ghanem & Kearns, 2015). The roots, which include consonants, carry the general meaning of the lexeme, while the word pattern, which is mainly vocalic, imparts phonological and morphosyntactic information (Holes, 2004). Most Arabic morphological variation can be described as inflectional or derivational (Boudelaa & Marslen-Wilson, 2010; Ghanem & Kearns, 2015). Inflection morphology employs prefixes and suffixes to reveal grammatical functions (e.g., person, number, tense). For example, the base {Katab} is inflected for number, e.g., singular (kitab) vs. plural (kutub); person, e.g., first person (aktub), second person (taktubii), third person (taktub); or multiple inflections, e.g., first person, past, singular, female (katabtu); first person, present, singular, female (aktubu); or first person, future, singular, female (sa'aktubu). Derivational morphology involves forming words by combining two bound morphemes—base and word patterns—in a linear or nonlinear way. The process of combining consonantal roots (3-4 consonants) with word patterns to yield surface forms is unique and different from the process that occurs in English because the word base is combined with different word patterns. For example, the root {ktb} is combined with vowels to create the base word {katab, wrote}, which is further reshaped using additional short and long vowels and/or consonants to add derived meaning to the base, such as (maktab, office or desk), (kitaab, book), or (kateb, writer). The English

ISSN: 2537-0464 **eISSN: 2537-0472**

meanings (semantic field) of these words differ, a situation which stands in contrast to English semantic fields and reveals the productive nature of Arabic morphology (Boudelaa & Marslen-Wilson, 2015). In addition to its linear and nonlinear aspects, the intricate interaction between word base and word patterns that occurs in Arabic requires compositional and decompositional processes (Boudelaa, 2014; Boudelaa et al., 2010).

Morphological Knowledge in Arabic

Given the productive yet intricate morphological structure of the Arabic language, it is natural to conclude that morphological knowledge is closely linked to mental lexicon representations and plays an important role in reading and writing. For average readers, the ability to decode real words and pseudowords, alongside reading comprehension, correlates positively with morphological knowledge (Carlisle, 2000). Many studies have investigated the role of morphological knowledge in reading at different reading levels and have highlighted the significant role played by morphological knowledge in reading acquisition (Abu-Rabia, 2007; Abu-Rabia & Saliba, 2008; Ghanem & Kearns, 2015; Wang & Liu, 2020). Dyslexic readers, on the other hand, have been reported to have significantly less morphological knowledge than their average-skilled peers or reading-matched groups (Joanisse et al., 2000; Leikin & Hagit, 2006; Taha & Saiegh-Haddad, 2016). In the case of Arabic, the ability to conduct morphemic composition and decomposition has significant positive impacts on word reading and the development of reading in general (Boudelaa & Marslen-Wilson, 2015; Ghanem & Kearns, 2015). Furthermore, morphological intervention programs have been found to improve students'

ISSN: 2537-0464 eISSN: 2537-0472

reading ability at all reading levels (Taha & Saiegh-Haddad, 2016).

Researchers have investigated the representation of morphemes in the mental lexicon to determine whether roots and patterns are perceived as inseparable entities, which is known as stem-based morphology, or whether each morpheme is represented independently in the mental lexicon, which is known as root-based morphology. It has been proposed that in the context of Arabic, morphological units of word base and patterns are represented as distinct entities, thus reflecting the productive nature of the Arabic derivational and inflectional system (Abu-Rabia & Awwad, 2004; Boudelaa & Marslen-Wilson, 2015; Taha & Saeigh-Haddad, 2016). Wattad and Abu Rabia (2020) investigated the organization of the mental lexicon among struggling readers in the sixth, eighth, and tenth grades and in both age-matched and reading-matched groups. The researchers used masked priming and cross-modal repetition tasks to investigate word identifications as well as the status of roots and patterns in the mental lexicon. These researchers found significant differences in word identification among the three groups and attributed these differences to a morphological flaw in lexical processing, which results in an underdeveloped lexical organization among struggling readers. By combining auditory and visual morphological priming techniques, the researchers concluded that the weak morphological representation in the mental lexicon is evident across both visual and auditory modalities. Previous research on the development of Arabic morphology has highlighted the significance of morphological knowledge and its representation in the lexicon as well as the significant relationship between such knowledge and reading performance.

ISSN: 2537-0464 **eISSN: 2537-0472**

Inflection in Arabic covers eight major grammatical categories: tense/aspect, person, voice, mood, gender, number, case, and definiteness. Inflectional categories in Arabic are more numerous and complex than in English, including gender, number (singular, dual, plural), and case (nominative, genitive, accusative), which are less common in English. Tense and aspect refer to the time and completeness of actions, with two basic tenses: past and present, as well as future tense. Person inflects for first, second, and third person, with gender and number distinctions. Voice can be either active or passive, depending on whether the agent of the action is known. The mood categories that reflect contextual modalities are indicative, subjunctive, imperative, and adjective. Nouns, adjectives, pronouns, and verbs are all gender-marked. Numbers are classified as singular, dual, or plural, and they interact with gender and humanness. Suffixes distinguish the nominative, genitive, and accusative case. Definiteness is denoted by the definite marker (al-) and the indefinite marker. Verbs inflect for tense/aspect, person, voice, mood, gender, and number, whereas nouns and adjectives inflect for gender, number, case, and definiteness. Inflectional classes classify words based on their phonological structure and origins, with paradigms for each class. Case and mood are special inflectional categories marked by short vowel suffixes, which play a central role in Arabic syntactic theory (Ryding, 2005).

One would expect measures of Arabic morphological knowledge to include the most important aspects of its derivational and inflectional system, as discussed above. Furthermore, measurements should include conditions that allow for the testing of various modalities. For instance, in English, according to Deacon et al. (2008), Morphological tasks, can be presented and completed orally or in writing, with each

ISSN: 2537-0464 eISSN: 2537-0472

presenting unique challenges and considerations, particularly for poor readers. Although oral tasks may appear less stressful at first because they do not require reading, they can be complicated by articulation and verbal short-term memory issues. Written tasks, on the other hand, may better leverage morphological skills because of the consistent preservation of morphology in English orthography; however, if individuals are unable to read the task, it is inaccurate to assume they have a morphological weakness without further confirmation with oral tasks. Written tasks may help readers avoid phonological weaknesses if they have sufficient reading ability, but written responses may put more strain on working memory. Another feature we expect to see in morphological knowledge tasks is a clear distinction between tasks that can be classified as tacit morphological knowledge and strategic morphological analysis. The former involves the subconscious use of morphemes to support word processing and spelling, relying on the mental lexicon's quality and contributing to reading fluency without explicit attention to word structure. It enhances basic reading skills beginning in the early stages. Strategic morphological analysis, on the other hand, is a deliberate, reflective process in which students analyze word structures, focusing on morphemes in order to deepen understanding and improve vocabulary and comprehension. It develops through formal education and targeted activities (e.g., Deacon et al., 2008; Goodwin et al., 2014; Saiegh-Haddad & Taha, 2017; Tibi & Kirbi, 2017).

Researchers have investigated whether morphological knowledge is unidimensional or multidimensional. One assumption made in this context is that morphological knowledge is a unidimensional construct; in this case, researchers use tacit morphological tasks or strategic morphological analysis tasks interchangeably. This practice is

ISSN: 2537-0464 **eISSN: 2537-0472**

based on the idea that any valid morphological task must reflect on individual morphological knowledge whether it involves identifying the roots of derived words or reading morphologically complex words based on the individual's knowledge of familiar morphemes (Goodwin et al., 2017). Some research has provided evidence indicating that morphological knowledge is unidimensional and can be explained by a single latent general variable. They investigated unidimensionality using tacit morphological tasks and strategic morphological tasks in the context of elementary and middle school students across various task modalities (written vs. oral, judgment vs. production, implicit vs. explicit, context vs. isolated word); the results emphasized the unidimensionality of morphological knowledge (Nagy et al. 2006; Tighe & Schatschneider, 2015).

Several studies have suggested that morphological knowledge is multidimensional (Berninger et al., 2010; Cho et al., 2013; Goodwin et al., 2014, 2017). For example, Goodwin et al. (2017) found that morphological knowledge is a construct that is represented by a general factor as well as seven dimensions or specific factors. This set of seven tasks cannot be reduced to a smaller number, thus indicating that these morphological assessment tasks include common morphological processing as well as showing that performance differences cannot be attributed to other nonmorphological factors related to the nature of the task at hand (e.g., oral/written stimuli, written/oral response).

While a great deal of research in English has investigated the dimensions underlying morphological knowledge (Muse, 2005; Spencer et al., 2015; Tighe & Schatschneider, 2015), the exploration of such dimensions in Arabic has been limited to one study conducted by Tibi and Kirby (2017), who investigated the

ISSN: 2537-0464 eISSN: 2537-0472

dimensionality of morphological knowledge and its relationship to reading in Arabic. The measures that the researchers employed were designed to cover a wide range of morphological features in Arabic. These features encompassed distinctions in spoken dialect versus standard Arabic, inflectional versus derivational morphology, linear vs. nonlinear morphology, implicit versus explicit tasks, word versus sentence-level tasks, composition versus decomposition tasks, oral versus written stimuli/response tasks, and judgment versus constructed response tasks. The results demonstrated that morphological knowledge in Arabic is primarily unidimensional but that under certain conditions, this factor can be divided into oral and written morphological components. These findings, whether they are viewed as unidimensional or two-dimensional (i.e., oral vs. written), support the construct validity of morphological knowledge and explain a significant and comparable proportion of the variance in reading, thus confirming the predictive usefulness of this approach in Arabic.

This systematic review investigated the nature of the tasks used in research on students' morphological knowledge in Arabic as well as the relation of such knowledge to other aspects of literacy performance. The findings of this review are discussed in relation to task modalities and dimensionality of morphological knowledge. The findings are also discussed in relation to the representation of morphology in the Arabic mental lexicon. This systematic review seeks to answer the following questions:

- What are the main features of the tasks that have been used in previous research to assess morphological knowledge among school-aged native Arabic speakers? How much are they related to the Arabic language morphological landscape discussed above?

ISSN: 2537-0464 **eISSN: 2537-0472**

- To what extent do these morphological tasks control for variables that could indicate researchers' unidimensional or multidimensional understanding of this concept?
- What are the implications of the representation of Arabic morphology in the mental lexicon for the tasks used to study the morphological knowledge of school-aged children?

Method

To answer these research questions, we examined research papers that explored morphological knowledge among native Arabic speakers with a specific emphasis on understanding the nature of morphological tasks. During the initial identification phase, a comprehensive search was conducted in Academic Search Complete, APA PsycArticles, APA PsycInfo, Education Research Complete, and ERIC. The keywords used in the search were Arabic, Morpholog* and Read. This search produced a total of 365 papers. Following the initial search, a screening process was used to narrow down the most relevant articles. Filters were used to eliminate papers that did not focus on native Arabic speakers or were unrelated to the core topics of morphological knowledge. These filters excluded papers that addressed translations, patients, velocity, and labor productivity. After applying these filters, 37 papers were excluded, reducing the total to 328. The search was narrowed to exclude papers that were not peer reviewed or had bilingual, multilingual, or ESL participants. This step resulted in the exclusion of an additional 107 papers, leaving 221 total. Further refinement and manual revisions of the abstract and method were carried out based on the following criteria: 1. The study must look into the impact of morphological knowledge and/or its relationships with other processes; 2. The study must discuss the nature of the morphological knowledge tasks used, even if

ISSN: 2537-0464 eISSN: 2537-0472

briefly. 3. The study should focus on native Arabic speakers who received instruction in Arabic. After applying these criteria, an additional 102 papers were excluded for a variety of reasons: 21 did not meet the first criterion, three did not meet the second criterion, and 76 did not meet the third. Finally, during the inclusion process, the remaining papers were thoroughly read and analyzed to ensure that they met the criteria. This process resulted in the identification of 19 papers that were the most relevant and critical for investigating morphological knowledge measurements among native Arabic speakers. It is worth noting that because the focus of this study is specific, no year filter was used, and we included papers that described the natures of the morphological tasks, even if the description was brief (Figure 1).

To ensure the accuracy and consistency of the qualitative analysis, the method of inter-rater negotiated agreement method was followed. This involved the first author and a professor of English, who is also native Arabic speaker who works at a college in the Middle East. At first, both professors conducted separate analyses of the data. Afterwards, they held a virtual meeting to deliberate on their findings and interpretations. Throughout this meeting, there was extensive discussion regarding any differences in data interpretation. This process facilitated a constructive exchange of perspectives between the raters, enabling them to question and support their respective interpretations, resulting in a more profound and refined understanding of the data. The collaborative and iterative approach employed in this study ensured that the final analysis was strong and reliable, as it incorporated a wide range of perspectives and enhanced the overall credibility of the research findings.

ISSN: 2537-0464 **eISSN: 2537-0472**

Results

In this section, we provide an overview of the tasks that have been used in previous research to investigate students' morphological knowledge and then discuss the nature of these tasks in light of dimensionality and priming studies. Table 1 contains a list of these tasks, along with examples and their type (explicit/implicit and judgment task/production task) and modality (oral or written stimulus/response). The most salient feature of these tasks, which allows them to be classified easily into two groups, is the nature of the process in question, which requires the student to either make a judgment about words or produce words.

Word Root/Pattern Production Tasks

After analyzing the tasks used in each of the reviewed studies, there were several types of measures that can be described production rather than judgment tasks. The names of some tasks were slightly modified to reflect their nature, particularly if the name was inconsistent word for word across the examined studies. Examples of correct participant answers were either superscripted or typed in bold font. Table1 includes a brief description of each task a long with an example typed in both the International Phonetic Alphabet (IPA) and Arabic (Table 1):

- The morphological production of word by root task (row-a): Students use their knowledge of different patterns to derive a certain root. For example, such a task could involve asking the student to derive words from the base {ʕad, count}: /ʕadad/"number" /ʕaddad/"counting" /tiʕda:d/"enumeration".
- The word analysis task (row-b): Students analyze a given complex word to produce a smaller meaningful word. For example, the words /mudarris/"teacher" can be analyzed to

ISSN: 2537-0464 eISSN: 2537-0472

produce /dars/"lesson", /madrasa/"school", /dirasa/"studying", and /madru:s/"passive of study".

- The morphological composition task (row-c): Students were given words with non-attached affixes and were asked to add the affixes through linear or non-linear morphological derivations.
- Morphological decomposition in context or into clitics tasks (rowsd and e): Students complete a sentence using the correct pattern of a given derived complex word. For example, the complex word /amtˤarat/"rained" is provided alongside the sentence /yahtˤulu ____?/almatˤaru/"rain" fi:aʧʧitaʔ/"the rainfalls in winter". Note that the expected correct derivation is shown in superscript.
- The sentence completion task (row-f): Students were asked to complete a sentence using the correct pattern for a given root. For example, the word {naðˤj:f} "clean" was provided alongside the sentence /yaʒib an nuħa:fiðˤ ʕala: ?/naðˤa:fat/"cleanliness" asˤsˤaf/ "We must maintain the cleanliness of the classroom.".
- Morphological production/analogy of word patterns task (row-g): Students were given a word that follows a certain pattern and were asked to produce words that feature the same pattern (xabba:z/"baker": /laħħa:m/"welder", /dahha:n/"painter", /naʒʒa:r/"carpenter"). They all share the pattern /faʕʕa:l/.
- Sentence analogy by pattern task (row-h): Participants were given two sentences, the first was morphologically transformed into the second, and then were asked to apply the same morphological change to a given sentence using regular and irregular transformation/phonological shifts. For example, if (/ha:ðihi ʒari:da/ this is a newspaper-/ha:ðihi

ISSN: 2537-0464 **eISSN: 2537-0472**

ʒara/ :ʔid/ these are newspapers) then (/ha:ða: qalam/ this is a pencil /ha:ðihi ___?) /aqla:m/ pencils (note that "pencils" is irregular plural in Arabic)

- Word analogy by pattern task (row-i): Requires students to derive a word based on a given pattern of derivation (If /kataba/-/katib/ then /haraba/-__?__ /harib/).
- The sentence completion given a root word task (row-j): Students were given an incomplete sentence and a simple target word and were asked to complete each sentence using the correct derivation of the target word. For example, participants were given the target base ({ħaraq} burn something): and were given a sentence that requires they make certain derivation that matches the meaning of the sentence.

Word Root/Pattern Judgment Tasks

The second group includes tasks that required students to make a judgement about a given words or pairs of words instead of producing a targeted stimulus. These tasks are listed in table 1 with a brief description of each along with an example written in IPA and Arabic:

- Morphological judgment by root task-two words (row-k) or morphological relatedness by root task 3-4 words (row-l): Students were given 2-4 words and asked to determine whether the pair shared the same root or to select the word that had a different root than the other 2-3 words presented. For example, (/ʕamila/"worked"-/ ʕa:mil/"worker") yes or (/maħkama/"court"-/ʕada:la/"justice") No.
- Morphological judgment by pattern task two words (item-m) or relatedness by pattern task 3-4 words (item-n): Involves presenting the student with 2-4 words and asking the student to determine whether the pairs share the same pattern or to

ISSN: 2537-0464 eISSN: 2537-0472

select the different pattern in cases featuring 3-4 words (for example, /maʕqu:l/"reasonable"-**/muʕtadil/"moderate"**-/madʒhu:l/"unknown"-/maqlu:b/"inverted"). The bold font indicates the expected correct answer

- Root awareness by target word task (row-o): Requires implicit root knowledge. For example, participants are presented with a target word such as /zaraʕa/"planted", and then are asked to choose the word that shares the same root from a list of 3-4 words that may or may not share the same pattern as the target word: /baraʕa/"excelled", **/za:riʕ/"planter"**, /tawzi:ʕ/"distribution".
- Pattern awareness by target word task (row-p): Participants were presented with a target word and three other words. They were asked to select the word that followed the same pattern as the target word.
- Sentence selection tasks (row-q): Participants were given four sentences, and they must choose the sentence which includes the correct morphological form (derivational and inflectional)
- Picture choice (row-r) task: Is commonly used among younger students. This task entails presenting the student a word orally alongside four pictures and asking the student to choose the picture that best represents the base word. The student may also be shown a picture and asked to describe it using the correct inflection of the word depicted in the picture.
- Morphological segmentation (row-s): participants identify linear morphemes in words (stems, suffixes, or prefixes) by indicating the morphemic boundaries within a word.

ISSN: 2537-0464 **eISSN: 2537-0472**

Task Modality

The studies employing morphological knowledge tasks exhibit both convergence and divergence in their task selection. While there is a notable similarity in the utilization of certain tasks, variations are evident in the adoption or exclusion of other tasks. Predominantly, these tasks are characterized as explicit in nature, with a majority employing oral response. The modality of stimuli—oral or written—associated with specific tasks tends to demonstrate consistency across various studies. knowledge of roots and patterns has been embedded in tasks used to investigate the morphological knowledge of students (e.g., 2012; Asadi, 2020; Layes et al., 2017; Saiegh-Haddad & Taha, 2017; Taha & Saie Abu-Rabia gh-Haddad, 2017). The majority of studies have included examples of tasks used to measure students' knowledge of inflectional and derivational morphology and roots. However, no entire collection of test items was provided; instead, varying numbers of examples were provided to represent each of the tasks used to assess morphological knowledge.

Each task is classified as either a production or a judgment task, as well as whether it requires explicit or implicit knowledge. The task 'Morphological production of words by root/verbs' (Task a) appears to be the most used among the studies examined. It appears several times in studies and uses both oral and written formats for stimuli and response. In terms of task usage, "Layes et al., 2021" used the most morphological tasks, as evidenced by the large number of entries across various task types. In contrast, studies such as "Mahfoudhi et al., 2010" and "Al Ghanem & Kearns 2014" used fewer tasks.

The consistency with which the stimuli and the responses are used for each morphological task varies significantly between tasks. For example, Task a is used in a variety of ways, with

ISSN: 2537-0464 eISSN: 2537-0472

some studies using oral stimuli and responses, others using written formats, and several cases where the type of stimuli and response is unknown. Tasks such as 'Morphological Judgment by Root' (Task k) and 'Morphological Judgment by Pattern' (Task m) have generally consistent response types, primarily pointing or yes/no answers, though the stimuli differ between oral and written formats. Other tasks, such as 'Morphological decomposition into clitics' (Task e) and 'Morphological segmentation' (Task s), exhibit more specific usage patterns—Task e frequently uses oral stimuli and responses, with some response types not provided, whereas Task s is sparsely used, only being mentioned once with written stimuli and a pointing response. Tasks such as 'Root and Pattern Awareness by Target Word' are less common but show some consistency, with written stimuli and pointing responses.

The analyzed morphological tasks are classified into judgment or production tasks, reflecting the nature of the activities required of participants. There are 10 tasks classified as judgment tasks, which typically involve evaluating or making decisions about word structure. In contrast, nine tasks are classified as production tasks, which require participants to actively generate or construct morphological forms. Production tasks include Task a, Morphological production of words by root/verbs (Explicit Production), and Task d, Morphological decomposition in context.

Tasks in the studied material are also classified as implicit or explicit based on their design and purpose. Five tasks are classified as implicit: Task f, which involves sentence completion given a root word (Implicit Production), and Task k, Morphological Judgment by root (Implicit Judgment), are two examples of implicit tasks. On the other hand, 14 tasks are classified as explicit: Task a, which focuses on the

ISSN: 2537-0464 **eISSN: 2537-0472**

morphological production of words by root/verbs (Explicit Production), and Task b, which involves word analysis (Explicit production). Three studies used implicit categorization tasks with a production focus and four studies included tasks that combined implicit categorization, focusing on participants' ability to manipulate morphological forms. On the other hand, a greater number of studies use explicit tasks. Fourteen studies used tasks that combined explicit categorization, requiring participants to consciously to analyze and/or manipulate morphological forms.

Discussion

Research Question1: The Nature of the Morphological Knowledge Tasks

Although a complete collection of test items was not provided, examples were given to represent each task used to assess morphological knowledge. It is challenging to determine how well these tasks reflect the Arabic morphological landscape of derivation and inflectional morphology previously described. Nevertheless, there are some findings that we can discuss. According to Table 1, the morphological knowledge tasks encompass a diverse array of Arabic morphologies landscape (root vs. pattern, derivational vs. inflectional morphology, linear vs. nonlinear morphology). Furthermore, the tasks are similar to those used in studies investigating morphological knowledge in English, and are classified as implicit versus explicit tasks, production versus judgment tasks, and oral versus written stimuli and responses.

The distinction between implicit and explicit tasks is not always straightforward. In pattern judgment tasks, for example, students are presented with pairs of words that either do or do not share a pattern; these students must respond "yes" in the former case or "no" in the latter case. Morphological relatedness

ISSN: 2537-0464 eISSN: 2537-0472

by pattern tasks requires students to select the words that feature different patterns from a set of four given words. Despite the fact that both tasks involve oral responses and a judgment process, they differ in terms of difficulty, with the former situation being described as implicit in some studies and the latter situation being described as explicit in other studies. Several researchers have incorporated both of these difficulty levels into their morphological measures (Layes et al., 2017; Saiegh-Haddad & Taha, 2017), while others have included only one of the two difficulty levels (Taha & Saiegh-Haddad, 2017).

While the studies employed various morphological tasks that collectively represent the morphological features of the Arabic language, there is a notable inconsistency in the types of measures and, in some cases, the modalities used from one study to another. This variability might suggest that researchers are assuming Arabic morphology to be unidimensional, which could explain the differences across studies. This issue will be explored more thoroughly in the next section.

Research Question2: Dimensionality of Morphological Knowledge

The reviewed studies show inconsistencies in the deployment of tasks in terms of format and required response types. While some tasks use stimuli and response formats consistently, others differ significantly. For example, 'Morphological Production of Words by Root/Verbs' (Task a) has a wide range of applications, with some studies using oral stimuli and responses, others using written formats, and a few not specifying a format at all. Implicit tasks involve tacit morphological knowledge, in which participants use morphemes subconsciously to aid word processing and spelling, improving reading fluency from early stages of reading without explicitly focusing on word structures. This is heavily influenced by the

ISSN: 2537-0464 **eISSN: 2537-0472**

quality of the mental lexicon. Explicit tasks, on the other hand, require strategic morphological analysis, which is a deliberate process in which participants consciously dissect word structures to expand their vocabulary and comprehension. Moreover, Production tasks require an output and can reveal morphological strengths in active language use, whereas judgment tasks assess the ability to critique morphological forms. Furthermore, while oral tasks may appear to be less demanding, they can be complicated by articulation and verbal short-term memory issues, potentially obscuring true morphological competence. Written tasks could strain working memory or be inaccessible to those with reading difficulties. Thus, consistency in task modalities across studies is important for ensuring that conclusions about morphological knowledge are based on comparable and accurate assessments of underlying linguistic capabilities.

When examining the application of morphological tasks in various studies, an inconsistency emerges in both the types and numbers of tasks used. While some tasks, such as 'Morphological Production of Words by Root/Verbs' (Task a), appear frequently across studies, others, such as 'Morphological Segmentation' (Task s), are used infrequently. This variation highlights a discrepancy in methodological approaches to assessing morphological knowledge, with certain tasks preferred or omitted depending on the study's focus or design. Furthermore, the difference in the number of tasks used by different studies, as demonstrated by the extensive use in "Layes et al., 2021" compared to the smaller number of tasks Mahfoudhi et al., (2010) and Al Ghanem & Kearns (2014), suggests varying levels of understanding in how morphological knowledge is measured. Therefore, the studies under examination exhibited

ISSN: 2537-0464 eISSN: 2537-0472

both similarities and differences in terms of the number and types of morphological measures they used, thus indicating a possible unidimensional interpretation of morphological knowledge as a construct that can be assessed using any of the valid morphological tasks. However, the inclusion of diverse task types within individual studies (e.g., Asadi, 2020) may lead to a different interpretation, according to which researchers view morphological knowledge as a construct that is composed of distinct, multifaceted skill sets that must each be measured and taken into account.

Overall, the variation in the types and numbers of tasks used across studies emphasizes the need for a more standardized approach to morphological evaluation. This would allow for more robust comparisons between studies while also improving the reliability and validity of findings in morphological knowledge research.

Research Question 3: Consideration of Priming Studies

A key similarity between presenting a morphological task to assess students' morphological knowledge and conducting priming tasks lies in the presentation of word pairs. If facilitatory effects are demonstrated in priming studies, these effects are also likely to be evident in morphological tasks. This likelihood increases with the extended exposure to these word pairs in morphological tasks. First, we will briefly review the findings from previous priming studies. Then, we will explore these results in the context of morphological tasks.

Arabic makes primitive, verbal, and deverbal nouns from complex words. Boudelaa & Marslen-Wilson (2015) define /Kataba/ as a surface form, with {katab} representing "write" and {faʕala} marking a singular, active verb. While the base defines the word, the patterns pronounce it /kataba/ and add number, person, tense, gender, and case. The Arabic word base is used

ISSN: 2537-0464 **eISSN: 2537-0472**

with close morphophonemic word patterns to reflect the semantic field and syntactic denotations of "study," but the English meaning correspondences do not share the root morpheme or phonological aspects (Boudelaa & Marslen-Wilson, 2015). The verb-deverbal noun priming effect on target facilitation was significant. Word patterns for Arabic deverbal nouns and verbs are mental lexicon properties, unlike stem-based accounts. Even if they share a precise or partial phonological feature, deverbal nouns have no priming effect when the prime and target words differ in morphosyntactic functions, emphasizing the independence of morphological units from phonology and meaning overlaps.

Verbal word patterns do not diverge like deverbal noun word patterns, making Boudelaa and Marslen-Wilson (2015)'s unexpected priming effect between verbal target and prime pairs that "differ" in morphosyntactic roles hard to Lesser discrepancies between prime and target verbal pairs do not appear to negatively impact target word identification, unlike deverbal noun word patterns that diverge in morphosyntactic function If the target and prime share morphosyntactic function, semantics do not affect deverbal noun priming. Deverbal nouns and verbs have similar but distinct syntactic patterns. The verb /qaraʔa/"read" and the deverbal noun /qaariʔ/"reader" share roots but feature distinct patterns and syntactic categories. Due to bases and word pattern morphosyntactic function's facilitative role and phonological and semantic overlaps' underwhelming role, previous research on word patterns and base contrasts in morphological knowledge tasks is important.

Priming research examined facilitative factor pair overuse in Table 1. Numerous studies tested students' pattern and root knowledge using deverbal nouns and verbal word pattern pairs.

ISSN: 2537-0464 eISSN: 2537-0472

Root priming was important when a verb was the target and a deverbal noun was primed (Boudelaa & Marslen-Wilson, 2015). Non-priming task analysis studies were examined in this paper, but verb-deverbal noun pairs may help. Students used word analogy to derive a verb's deverbal noun from an analogous verb-deverbal noun conversion pattern. /kataba/-/katib/ then /haraba/-? /harib) may help students understand patterns. In some morphological judgment by pattern tasks, students had to determine if verb-deverbal noun pairs with the same root and semantic field were related (Layes et al., 2017 Morphological analogy of patterns required students to create deverbal nouns like a given noun without root facilitation, unlike the verb-deverbal pair task. Knowing and deriving deverbal nouns from verbs is important to Arabic morphology, but word pattern testing should balance pattern and non-pattern processing. Boudelaa and Marslen-Wilson (2015) suggest that /fuʕu:lun/ can represent two morphosyntactic functions: a deverbal masculine noun (/suku:nun/) meaning "tranquility" and a plural term (/ʒuru:ħun/) meaning "injuries". Deverbal nouns in the prime and target pairs that share morphosyntactic function facilitate priming even with minimal phonological overlap (Boudelaa & Marslen-Wilson, 2015; Frost et al., 2000). The target and prime deverbal nouns have similar phonological features but different morphosyntactic functions, so no priming effect is observed. Because similar word patterns may share phonological features but not morphosyntactic roles, we must balance morphological processing facilitation in analogous pairs or words. Students were asked to identify morphosyntactic functions in pairs of patterns by Saiegh-Haddad & Taha (2017) Facilitating the singular, masculine words /ʕa:zif/"musician"-/ʕa:lim/"scientist" is suitable. According to Asadi et al. (2017), students inflect words by morphosyntactic function. Few studies have examined

ISSN: 2537-0464 **eISSN: 2537-0472**

task items that tested students' morphosyntactic processing and awareness with similar words. Students may have completed morphological tasks with similar examples. Morphological task items must be examined to determine what helps young- and poor-average-skilled readers respond.

Conclusion

Understanding the construct of morphological knowledge is critical with regard to the task of designing valid assessment measures, thus highlighting the importance of integrating language-specific morphological structures. Arabic morphology, which is characterized by an intricate relationship between word base and word patterns, includes compositional and decompositional processes (Boudelaa, 2014). In contrast to stem-based models, Arabic lexical representation consists of word bases that provide overall meaning as well as patterns that provide phonological molding as well as morphosyntactic information. Research on Arabic morphology has emphasized its importance across many literacy domains, including reading accuracy, comprehension, vocabulary, fluency, and writing.

The research examined in this review demonstrated both similarities and differences in morphological tasks, thus highlighting a potential unidimensional interpretation of morphological knowledge due to the use of different measures in some instances. Another interpretation is that researchers, although they employed similar measures in some cases, also used different measures, thus highlighting a multidimensional view that necessitates the use of various measures.

Studies on Arabic morphological processing suggest that word patterns in deverbal nouns and verbs exhibit strong prime-to-target facilitation. However, when morphosyntactic functions

ISSN: 2537-0464 eISSN: 2537-0472

deviate, no significant priming effect is observed, thus highlighting the independence of morphological units regardless of phonological and semantic similarity. Furthermore, because of the significant facilitation of priming targets in morphosyntactically comparable pairings, studies that included tasks such as word analogy via a pattern task might have enhanced participants' performance beyond the level attained by studies that did not include that task or a similar task. It is difficult to evaluate the extent to which the analogous examples presented to the students in the reviewed studies facilitated or did not facilitate their completion of the morphological tasks. As a result, it is important to study these items in morphological tasks to acquire a better understanding of the factors that facilitate students' responses.

Finally, the research examined in this study used both implicit and explicit tasks interchangeably. Nevertheless, the utilization of explicit tasks greatly surpasses that of implicit tasks. If designed carefully, implicit tasks can offer a more effective way of detecting distinctions among younger or poor readers. The limitations of this study stem from the inherent challenges of conducting systematic literature reviews, such as variations in the criteria for selecting studies, assessing their quality, and interpreting findings. Furthermore, the research relied on studies available in accessible databases, which may not have covered the entire body of research on morphological knowledge. Another limitation was the inability to obtain all the items from the tasks used in these studies. As a result, the researchers suggest conducting an in-depth examination of each item within the morphological assessment tasks, with a special focus on insights gained from priming studies.

ISSN: 2537-0464 **eISSN: 2537-0472**

References

Abu-Rabia, S. (2007). The role of morphology and short vowelization in reading Arabic among normal and dyslexic readers in grades 3, 6, 9, and 12. *Journal of psycholinguistic research*, *36*, 89-106. https://doi.org/10.1007/s10936-006-9035-6

Abu-Rabia, S., & Saliba, F. (2008). The lexical status of basic Arabic verb morphemes among dyslexic children. *Australian journal of learning difficulties*, *13*(2), 115-144. https://doi.org/10.1080/19404150802380589

Abu-Rabia, S., & Awwad, J. (2004). Morphological structures in visual word recognition: the case of Arabic [Article]. *Journal of Research in Reading*, *27*(3), 321-336. https://doi.org/10.1111/j.1467-9817.2004.00235.x

Al Ghanem, R. A., & Kearns, D. M. (2015). Orthographic, phonological, and morphological skills and children's word reading in Arabic: A literature review. *Reading Research Quarterly, 50*, 83–109. doi:10.1002/rrq.84

Al-Janaideh, R., Tibi, S., Gottardo, A., Paradis, J., & Chen, X. (2023). Morphology and Reading skills in Arabic-speaking Syrian refugee children. *Reading Research Quarterly*, 58, 391–405.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (2014). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

ISSN: 2537-0464 eISSN: 2537-0472

https://www.aera.net/

Asadi, I. A. (2020). Predicting reading comprehension in Arabic-speaking middle schoolers using linguistic measures. *Reading Psychology*, *41*(2), 87-109. https://doi.org/10.1080/02702711.2020.1726846

Asadi, I. A., Khateb, A., Ibrahim, R., & Taha, H. (2017). How do different cognitive and linguistic variables contribute to reading in Arabic? A cross-sectional study from first to sixth grade. *Reading and Writing*, *30*, 1835-1867. doi: 10.1007/s10936- 009- 9130- 6

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of psycholinguistic research*, *39*(2), 141-163. doi: 10.1007/s10936-009-9130-6

Bishara, S. (2022). Association between phonological and morphological awareness and reading comprehension among special-education children in Arab elementary schools. *International Journal of Disability, Development and Education*, *69*(4), 1105-1122. https://doi.org/10.1080/1034912X.2020.1737319

Bishara, S. (2020). Association between Phonological and Morphological Awareness and Reading Comprehension among Special-Education Children in Arab Elementary Schools. *International Journal of Disability, Development and Education*, *69*(4), 1105–1122. https://doi.org/10.1080/1034912X.2020.1737319

ISSN: 2537-0464 **eISSN: 2537-0472**

Boudelaa, S. (2014). Is the Arabic mental lexicon morpheme-based or stem-based? Implications for spoken and written word recognition. In E. Saiegh-Haddad & R. M. Joshi (Eds.), *Handbook of Arabic literacy* (pp. 31–54). Dordrecht: Springer.

Boudelaa, S. & Marslen-Wilson, W. D. (2010). ARALEX: A lexical database for Modern Standard Arabic. *Behavior Research Methods*, *42*, 481. doi: 10.3758/BRM.42.2.481

Boudelaa, S., & Marslen-Wilson, W. D. (2005). Discontinuous morphology in time: Incremental masked priming in Arabic. *Language and Cognitive Processes*, *20*, 207–260. doi:10.1080/01690960444000106.

Boudelaa, S., & Marslen-Wilson, W. D. (2015). Structure, form, and meaning in the mental lexicon: Evidence from Arabic. *Language, cognition and neuroscience*, *30*(8), 955-992. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4673575/

Boudelaa, S., Pulvermüller, F., Hauk, O., Shtyrov, Y., & Marslen-Wilson, W. D. (2010). Arabic morphology in the neural language system: A mismatch negativity study. *Journal of Cognitive Neuroscience*, *22*, 998–1010. doi:10.1162/jocn.2009.21273.

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

ISSN: 2537-0464 **eISSN: 2537-0472**

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

Cho, S. J., Gilbert, J. K., & Goodwin, A. P. (2013). Explanatory multidimensional multilevel random item response model: An application to simultaneous investigation of word and person contributions to multidimensional lexical representations. *Psychometrika, 78*, 830-855. doi:10.1007/s11336-013-9333-5'

Dallasheh-Khatib, R. , Ibrahim, R. & Karni, A. (2014). Longitudinal Data on the Relations of Morphological and Phonological Training to Reading Acquisition in First Grade: The Case of Arabic Language. *Psychology, 5*, 918-940. doi: 10.4236/psych.2014.58103.

Deacon, S. H., Parrila, R., & Kirby, J. R. (2008). A review of the evidence on morphological processing in dyslexics and poor readers: A strength or weakness? In G. Reid, A. Fawcett, F. Manis, & L. Siegel (Eds.), *The Sage handbook of dyslexia* (pp. 212–237). London: Sage.

Frost, R., Deutsch, A., Gilboa, O., Tannenbaum, M., & Marslen-Wilson, W. (2000). Morphological priming: Dissociation of phonological, semantic, and morphological factors. *Memory & Cognition*, *28*(8), 1277-1288. doi: 10.3758/bf03211828

Ghanem, R. A., & Kearns, D. M. (2015). Orthographie, Phonological, and Morphological Skills and Children's Word

ISSN: 2537-0464 **eISSN: 2537-0472**

Reading in Arabic: A Literature Review. *Reading Research Quarterly*, *50*(1), 83–109. http://www.jstor.org/stable/43497207

Goodwin, A. P., Gilbert, J. K., Cho, S. J., & Kearns, D. M. (2014). Probing lexical representations: Simultaneous modeling of word and reader contributions to multidimensional lexical representations. *Journal of Educational Psychology*, *106*(2), 448. doi.org/10.1037/a0034754

Goodwin, A. P., Petscher, Y., Carlisle, J. F., & Mitchell, A. M. (2017). Exploring the dimensionality of morphological knowledge for adolescent readers. *Journal of Research in Reading*, *40*(1), 91-117. doi: 10.1111/1467-9817.12064

Holes, C. (2004). *Modern Arabic: Structures, Functions, and Varieties*. Washington, DC: Georgetown University Press.

Joanisse, M. F., Manis, F. R., Keating, P., & Seidenberg, M. S. (2000). Language deficits in dyslexic children: Speech perception, phonology, and morphology. *Journal of experimental child psychology*, *77*(1), 30-60. doi: 10.1006/jecp.1999.2553

Kim, Y.G. (2015). Developmental, Component-Based Model of Reading Fluency: An Investigation of Predictors of Word-Reading Fluency, Text-Reading Fluency, and Reading Comprehension. *Reading research quarterly*, *50(4)*, 459-481 .

Layes, S., & Bouakkaz, T. (2022). Predicting word and pseudoword reading in arabic speaking children: The

ISSN: 2537-0464 eISSN: 2537-0472

independent contributions of phonological and morphological awareness and visual attention. *British Journal of Special Education 49*(2), 230–60. https://doi.org/https://doi.org/10.1111/1467-8578.12403.

Layes, S., Kaddouri, A., Lalonde, R., & Rebai, M. (2021). Effects of morphological awareness training on reading accuracy in children with dyslexia and its transfer effect on phonological awareness. *Journal of International Special Needs Education*, *24*(2), 66-75. https://files.eric.ed.gov/fulltext/EJ1316032.pdf

Layes, S., Lalonde, R., & Rebaï, M. (2017). Study on Morphological Awareness and Rapid Automatized Naming Through Word Reading and Comprehension in Normal and Disabled Reading Arabic-Speaking Children [Article]. *Reading & Writing Quarterly*, *33*(2), 123-140. https://doi.org/10.1080/10573569.2015.1105763.

Leikin, M., & Hagit, E. Z. (2006). Morphological processing in adult dyslexia. *Journal of psycholinguistic research*, *35*, 471-490. https://doi.org/10.1007/s10936-006-9025-8

Mahfoudhi, A., Elbeheri, G., Al-Rashidi, M., & Everatt, J. (2010). The Role of Morphological Awareness in Reading Comprehension Among Typical and Learning Disabled Native Arabic Speakers. *Journal of Learning Disabilities*, *43*(6), 500-514. https://doi.org/10.1177/0022219409355478

Mansour-Adwan, A., Khateb, Y., Shalhoub-Awwad, R., Cohen-Mimran, R. (2023). The different linguistic profiles in

ISSN: 2537-0464 **eISSN: 2537-0472**

Arabic speaking kindergarteners and relation to emergent literacy. *Reading and Writing, 36,* 2577-2603,

McGee, L. M., Kim, H., Nelson, K. S., & Fried, M. D. (2015). Change Over Time in First Graders' Strategic Use of Information at Point of Difficulty in Reading. *Reading Research Quarterly*, *50*(3), 263–291. http://www.jstor.org/stable/43497222

Muse, A. E. (2005). *The nature of morphological knowledge* (Doctoral dissertation, The Florida State University). https://diginole.lib.fsu.edu/islandora/object/fsu:180396/datastream/PDF/view

Nagy, W., Berninger, V. W., & Abbott, R. D. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. *Journal of educational psychology*, *98*(1), 134. doi:10.1037/0022-0663.98.1.134

Ryding, K. C. (2005). *A reference grammar of modern standard arabic*. Cambridge University Press.

Saiegh-Haddad, E., & Taha, H. (2017). The role of morphological and phonological awareness in the early development of word spelling and reading in typically developing and disabled Arabic readers. *Dyslexia*, *23*(4), 345-371. doi: 10.1002/dys.1572. PMID: 29154451

Schiff, R., & Saiegh-Haddad, E. (2018). Development and relationships between phonological awareness,

ISSN: 2537-0464 eISSN: 2537-0472

morphological awareness and word reading in spoken and standard Arabic. *Frontiers in psychology*, *9*, 356.

Spencer, M., Muse, A., Wagner, R. K., Foorman, B., Petscher, Y., Schatschneider, C., ... & Bishop, M. D. (2015). Examining the underlying dimensions of morphological awareness and vocabulary knowledge. *Reading and writing*, *28*, 959-988. doi:10.1007/s11145-015-9557-0

Taha, H., & Saiegh-Haddad, E. (2016). The role of phonological versus morphological skills in the development of Arabic spelling: An intervention study. *Journal of psycholinguistic research*, *45*, 507-535. doi: 10.1007/s10936-015-9362-6

Taha, H., & Saiegh-Haddad, E. (2017). Morphology and spelling in Arabic: Development and interface. *Journal of Psycholinguistic Research*, *46*, 27-38. doi: 10.1007/s10936-016-9425-3

Tibi, S., & Kirby, J. R. (2017). Morphological awareness: Construct and predictive validity in Arabic. *Applied Psycholinguistics*, *38*(5), 1019-1043. doi:10.1017/S0142716417000029

Tibi, S., Edwards, A. A., Schatschneider, C., & Kirby, J. R. (2020). Predicting Arabic word reading: A cross-classified generalized random-effects analysis showing the critical role of morphology. *Annals of Dyslexia*, *70*(2), 200-219. https://doi.org/10.1007/s11881-020-00193-y

Tighe, E. L., & Schatschneider, C. (2015). Exploring the dimensionality of morphological awareness and its

ISSN: 2537-0464 **eISSN: 2537-0472**

relations to vocabulary knowledge in adult basic education students. *Reading Research Quarterly*, *50*(3), 293-311. https://doi.org/10.1002/rrq.102

Wang, L., & Liu, D. (2020). The role of morphological awareness in reading Chinese characters: The moderating effect of morpheme family size. *Scientific Studies of Reading*, *24*(2), 170-178. https://doi.org/10.1080/10888438.2019.1644338

Wattad, H., & Abu Rabia, S. (2020). The Advantage of Morphological Awareness Among Normal and Dyslexic Native Arabic Readers: A Literature Review [Article]. *Reading Psychology*, *41*(3), 130-156. https://doi.org/10.1080/02702711.2020.1768973

ISSN: 2537-0464 eISSN: 2537-0472