frontiers | Frontiers in Communication

TYPE Systematic Review
PUBLISHED 16 December 2022
DOI 10.3389/fcomm.2022.984340

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Language Sciences, a section of the journal Frontiers in Communication

RECEIVED 13 August 2022
ACCEPTED 24 November 2022
PUBLISHED 16 December 2022

CITATION
Bin Sawad N, Law JM, Tibi S and Boese K (2022) Arabic metalinguistic knowledge predicts reading comprehension: A scoping review. *Front. Commun.* 7:984340. doi: 10.3389/fcomm.2022.984340

Arabic metalinguistic knowledge predicts reading comprehension: A scoping review

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Arabic is a language with unique characteristics, yet the role metalinguistic skills (i. e., phonological awareness, morphological awareness, and orthographical knowledge) play in the development of reading and reading comprehension in Arabic is not well understood. This review aims to: (1) synthesize studies that examine metalinguistic skills' contribution to reading comprehension in Arabic, (2) emphasize gaps and limitations within the current body of literature, and (3) offer recommendations for further research. This review followed a five-stage methodological framework to identify studies. Sixteen studies examined the relation between metalinguistic skills and reading comprehension in Arabic. These studies involved students in grades 1–12. Morphological awareness was found to be the strongest predictor of reading comprehension among Arabic children; in addition, phonological awareness and phonemic diacritics were found to be associated with reading comprehension in early grades. Lastly, this review identified a significant gap in the literature, as few studies have investigated orthographical knowledge in relation to Arabic reading development and outcomes. This literature review supports the claim that metalinguistic variables can predict reading comprehension among Arabic readers. Yet, the generalization of findings is cautioned due to the influences of dialect and the small number of studies involved in the review. These results are discussed in relation to the current teaching guidelines for instructing Arabic reading comprehension.

KEYWORDS

metalinguistic, Arabic, morphological awareness, phonological awareness, orthographical knowledge

Introduction

Reading comprehension is a complex process involving the mastery and acquisition of several different skills (Carlisle, 2003). Across various alphabetic languages, metalinguistic skills, such as morphological awareness, phonological awareness, and orthographic knowledge, have been demonstrated to be a vital contributing factor in the

development of reading comprehension skills (English: Siok and Fletcher, 2001; Fielding-Barnsley and Purdie, 2005; Tong et al., 2011; Zhang et al., 2012; French: Casalis and Louis-Alexandre, 2000; Spanish: González and del González, 2000; and Arabic: Tibi and Kirby, 2019).

According to the Reading Systems Framework proposed by Perfetti and Stafura (2014), the acquisition of reading comprehension is achieved *via* decoding and language comprehension, both of which have been shown to be underpinned by direct and shared effects of metalinguistic awareness. Metalinguistic awareness may be defined as the conscious ability to think and reflect upon, understand, and manipulate the structural elements of written and spoken language (Apel and Masterson, 2001; Ehri, 2005; Nagy et al., 2006). According to the Reading Systems Framework, metalinguistic awareness contributes to reading comprehension *via* three distinct processes: (a) phonological awareness; the ability to explicitly and consciously interpret and manipulate spoken sounds (i.e., the manipulation of syllables, rimes, onsets, and phonemes) (Goswami, 1990; Ehri et al., 2001), (b) morphological awareness; the awareness of, and ability to reflect on and manipulate, the smallest meaningful units (morphemes) in spoken language (i.e., consciously manipulate affixes to uncover meanings and accurately pronounce single words) (Feldman, 1995; Deacon and Kirby, 2004; Law and Ghesquière, 2017), and (c) orthographical knowledge; understanding the writing system of a language, letter patterns, and word structure (i.e., the acquisition of letter formations which enable written words to be directly mapped into mental representation) (Seymour et al., 2003; Cain, 2007; Apel et al., 2012; Conrad et al., 2013).

Previous inquiries into reading development have confirmed that reading acquisition is fundamentally metalinguistic (Nagy and Anderson, 1984). Across numerous alphabetic languages, phonological awareness, morphological awareness, and orthographic awareness have been found to be significant predictors of reading achievement independent of non-verbal skills, vocabulary, and word reading skills (morphological awareness: Nagy et al., 2006; Foorman et al., 2012; Kirby et al., 2012; Law and Cavalli, 2020; Law and Ghesquière, 2022; Lefèvre et al., 2022; phonological awareness: Goswami, 1990; Ehri et al., 2001; Carlisle, 2003; Roman et al., 2009; and orthographic knowledge: Snowling, 2000; Goswami, 2005; Florit and Cain, 2011). For instance, past intervention studies focusing on systematic instruction and explicit instruction in metalinguistic awareness skills have demonstrated its ability to improve children's early reading skills and reduce reading failure (Moats, 1994; Bos et al., 2001; Mather et al., 2001; Hurry and Sylva, 2007; Arrow et al., 2019; Washburn and Mulcahy, 2019). For example, in a longitudinal study examining the predictive relationship between early acquisition of phonological awareness skills and reading development in 191 first grade students, Clayton et al. (2020) reported phonemic awareness as a strong predictor of reading development. While, in a study of 967 German primary school students, Knoepke et al. (2014) found that both phonological and orthographical skills predicted reading comprehension at all grade levels. Similarly, in a four-year longitudinal study of English-speaking children (grades 2–5), morphological skills significantly contributed to reading comprehension development (Deacon and Kirby, 2004). Although much is known about the contribution of these variables to reading comprehension outcomes across various alphabetic languages, less is known about their relation to reading in Arabic. Therefore, the aim of this paper is to complete a scoping review to study the contribution of metalinguistic skills to reading comprehension in Arabic.

Metalinguistic awareness and the Arabic language

Given the unique features of the Arabic language, consideration for the instruction of phonological and morphological awareness alongside orthographic knowledge during early reading acquisition is essential in Arabic. Saiegh-Haddad (2018) argues that reading acquisition in Arabic is unique as the development of word reading in Arabic is shaped by three prominent features of the Arabic language and orthography, ultimately resulting in direct and indirect influences on reading comprehension development among Arabic readers.

The first of these unique features is Arabic diglossia (Ferguson, 1959). The Arabic language consists of two different variations of the language, differing in phonology, morpho-syntax, and lexicon, and distinguishable by function: (1) Standard Arabic, which is the language of conventional writing and used in formal speech, and (2) Spoken Arabic, the language spoken in the home and informal community settings (Saiegh-Haddad, 2018). As a result, Arabic-speaking children are tasked with learning to read in Standard Arabic written form while typically only having acquired oral proficiency in Spoken Arabic. For example, the following sentences (my father went to his work early in the morning) in Spoken Arabic look like بابا راح للشغل من الصبح بدري while in Modern Standard Arabic looks like أبي الى العمل باكراً ذهبَ). This linguistic distance of diglossia within the phonological, lexical, and morphological domains has been found to inhibit the acquisition of several reading and metalinguistic skills among Arabic-speaking children (Saiegh-Haddad et al., 2011, 2020; Asaad and Eviatar, 2013; Eviatar and Ibrahim, 2014; Schiff and Saiegh-Haddad, 2017; Saiegh-Haddad, 2018).

The second of these unique features of the Arabic language is the use of vowelization, or the use of diacritics (tiny visual signs placed above or below the consonants) to map short vowel phonemes, consonantal germination, and other features of word articulation. The Arabic writing system uses two sets of diacritic marks that differ in form, distribution, and linguistic function (Saiegh-Haddad and Schiff, 2016; Saiegh-Haddad, 2018). The

first set consists of phonemic diacritics, which mainly consist of the diacritical marks that map the three short vowels of Arabic (والضمة الكسرة، الفتحة،); they can appear on almost all of the letters within the word and map semantically contrastive phonemic information about words. In contrast, the second set of diacritics is morpho-syntactic and appears at the end of the words. These morpho-syntactic diacritics map abstract syntactic roles, such as the case for nouns (and adjectives) and mood for verbs (for a detailed account see Saiegh-Haddad and Henkin-Roitfarb, 2014; Saiegh-Haddad and Schiff, 2016; Saiegh-Haddad, 2018).

The effect diacritical vowelization plays in reading Arabic has been thoroughly explored in several studies (Ibrahim, 2013; Saiegh-Haddad and Henkin-Roitfarb, 2014; Saiegh-Haddad and Schiff, 2016). For instance, the phonemic diacritics was shown to play a role in word reading accuracy, reading comprehension and reading fluency (Mahfoudhi et al., 2010; Taibah and Haynes, 2011; Layes et al., 2015; Tibi and Kirby, 2018). However, vowelization was also found to slow reading speed (Ibrahim, 2013), increase the number and length of fixations when reading, and impose a perceptual strain on expert readers' word processing (Saiegh-Haddad and Schiff, 2016; Schiff and Saiegh-Haddad, 2017). It should be noted though that the phonemic and morpho-syntactic sets of diacritics were not differentiated in the current study. Future research should explore this distinction which was underscored by Saiegh-Haddad and Schiff (2016) and Saiegh-Haddad (2018).

The third unique feature of the Arabic orthography Saiegh-Haddad (2018) highlights which helps to bridge the phonological distance between standard and spoken Arabic, is the predominance of derivational morphology and the parallels in the morphological structure between Standard and Spoken Arabic. It has been theorized that explicit awareness of a word's morphological structure (roots and word-pattern) may consolidate and augment phonological decoding and facilitate word recognition in Arabic, even in the absence of vowelization (Saiegh-Haddad and Henkin-Roitfarb, 2014; Daniels and Share, 2018). Unvoweled orthography can convey regular and transparent morphological forms while representing deep and underspecified phonology. The word-pattern morphological structure can overcome the absence of vowels in Arabic text (Saiegh-Haddad, 2018). For example, the unvoweled orthographic form *mtruk* متروك is orthographically deep since the short vowel in the first syllable is absent. However, the awareness of word-pattern can infer the missing short vowel, which in this instance, *mful*مفعول, the initial consonant /m/ characterized by the letter/ م/ and the long vowel /u/ characterized by the letter / م/, both represented by letters, indicate the word-pattern to the reader and, therefore, the omitted short vowel, which in this case can only be /a/ (Saiegh-Haddad, 2018; Schiff and Saiegh-Haddad, 2018).

As a result, morphological awareness has repeatedly been found to predict word reading, even when phonological awareness is controlled for (Saiegh-Haddad and Taha, 2017), especially in cases of non-vowelized text reading (Mahfoudhi et al., 2010). According to the MAWRID Model of Arabic word reading proposed by Saiegh-Haddad (2018), children in second-grade transition from a decoding system reliant on phoneme-grapheme mappings to a morpho-orthographic mechanism by placing a greater reliance on morphological awareness. It has been argued that this early transition is a natural response to the transparent representation of morphology in the written word (Abu Ahmad et al., 2014; Saiegh-Haddad, 2018; Schiff and Saiegh-Haddad, 2018). Given the predictive role of word reading in reading comprehension outcomes, as represented by the Reading Systems Framework, morphological awareness could be argued to be a significant contributor to reading comprehension development and attainment among Arabic readers.

Despite being extensively researched across numerous Indo-European languages and their importance to reading development and instruction, research examining the contribution of morphological awareness, orthographic knowledge, and phonological awareness to the development of reading comprehension in Arabic is limited. Given the uniqueness of the Arabic language as described above, this gap in knowledge has a direct impact on limiting the design of evidence-based explicit metalinguistic pedagogies and teacher training programmes. For instance, in the Saudi Arabian education system, as well as in other Arab countries such as Jordan and Kuwait (Abu-Hamour, 2013; Saiegh-Haddad and Everatt, 2017), reading instruction initially focuses on orthographical skills with instruction focusing on letter recognition and reading whole words as units; thus, neglecting phonological skills and the teaching of letter-sound mappings (i.e., decoding) in the early years. Furthermore, morphological awareness is not explicitly mentioned in the National Framework For Public Education Curricula Standards in Kingdom of Saudi Arabia (2021) until 5th grade, only to emphasize the spelling of roots, their inflections, and their derivations as they relate to grammar and syntax. Instruction on the use of morphological awareness as a means of facilitating the identification of unknown derived words is absent. Through the exclusion of early morphological and phonological skill instruction, reading instruction in some Arab countries does not reflect current theoretical reading models in the Arabic language, potentially impacting later reading comprehension achievement (Taibah and Haynes, 2011; Abu-Hamour, 2013; Al Ghanem and Kearns, 2015).

Significance of the study

Given the dearth of knowledge about metalinguistic variables and their contribution to reading comprehension in Arabic, this review will consolidate and synthesize current evidence regarding this matter in the Arab-speaking world. This scoping review will highlight the current knowledge and identify unknowns related to metalinguistic knowledge's predictive role in Arabic reading comprehension achievement, inform educational approaches to enhance explicit teaching of specific

metalinguistic skills, and in addition, provide a comprehensive survey of the literature for researchers and educators in the field. As noted by Munn et al. (2018), scoping reviews may be chosen as a method instead of systematic reviews where the purpose of the review is to identify knowledge gaps, scope a body of literature, or clarify concepts, thus justifying the selected approach of this review. Furthermore, scoping reviews have been demonstrated to be a valid approach for examining and identifying available evidence, evaluating the quality of extracted results, and reporting summarized findings (Drager et al., 2010; Munn et al., 2018). To achieve these ends, this review aims to: (a) identify existing evidence of metalinguistic skills' contribution to Arabic reading comprehension; (b) synthesize key outcomes; (c) identify any specific gaps in knowledge and their implications for teaching practice; and (d) offer recommendations for further research.

Materials and methods

This study follows the five-stage framework set out by Arksey and O'Malley (2005), which provides researchers with a framework to investigate the scope and range of research performed on a particular subject while helping to recognize gaps in the available literature, to disseminate and summarize research findings, and to make recommendations for future studies (Peters et al., 2015). Arksey and O'Malley outline specific stages which will be followed in this review to ensure accuracy during the review. These stages involve determining the research purpose, identifying relevant studies, performing study selection, charting and collating the data, and reporting summarized findings.

Inclusion and exclusion criteria

The following inclusion criteria were used during the selection of included literature: (a) the study investigated one or more of the linguistic variables morphological awareness, phonological awareness, and orthographic knowledge as predictors of reading comprehension in Arabic; (b) participants were native Arabic speakers; (c) participants were school-age students (6–18 years of age) in an educational setting where Arabic is used as the official language; and (d) the study was published in a peer-reviewed journal.

Studies were excluded from the current review if they did not follow the selection criteria, such as studies that examined the adult population, or participants who are not native Arabic speakers. Due to the limit of available studies on this topic, no methodological requirements of included studies were specified. In addition, no time limit was specified; all studies up to December 2020 were included. Similarly, no restrictions were placed on the region where included studies were conducted.

Identifying relevant studies

A comprehensive search of the following electronic databases was used to identify relevant studies (PsycINFO, APA PsycNET, ProQuest, EBSCO, Google Scholar, Scopus, and ERIC). An additional search through Arabic databases (Al Manhal and Saudi Digital Library SDL) was also conducted to ensure the inclusion of any Arabic language manuscripts. Databases were searched using the descriptors or terms: "morphological awareness, knowledge or skill" OR "morphological contribution," "phonological awareness, knowledge or skill" OR "phonological contribution," "orthographic knowledge, awareness or skill" OR "contribution of orthographic awareness" in combination with "Arabic." Also, the following terms were included: "reading comprehension" OR "predictors of reading comprehension" AND "Arabic reading comprehension" OR "reading comprehension and morphology in Arabic" OR "reading comprehension and phonology in Arabic" OR "reading comprehension and orthographic knowledge in Arabic" AND "Arabic early reading acquisition" OR "Arabic reading acquisition." In the Scopus database the following strategy was used: TITLE-ABS-KEY ((reading comprehension OR "metalinguistic contribution" OR "morphological awareness" OR "phonological awareness" OR "orthographical knowledge") AND (metalinguistic knowledge contribution to reading comprehension)) AND (LIMIT-TO (Arabic)). Equivalent descriptors or terms were used when searching the Arabic databases:

مراحل القرائي الفهم على والصرف النحو تأثير – السمعي الفهم – القرائي الفهم الصوتي الوعي تأثير – الهجاء علم القرائي- الفهم على الاملاء تأثير – القراءة تعلم للقراءة وتطويره الصوتي الوعي – القرائي الفهم على "

Additionally, a manual backward search was conducted by examining the reference pages of each of the selected studies to locate any additional papers that met the study criteria and were not identified within our initial database search. Lastly, a manual search in key journals (e.g., Scientific Study of Reading, Review of Research in Education) was conducted.

After removing duplicate studies resulting from the initial database search, details of each paper (i.e., title and abstract) were exported to Excel. Included articles were initially screened against the inclusion criteria through an examination of titles and abstracts. Thirty-five articles were selected for a full reading. Nineteen were found not to meet the inclusion criteria after the full-text screening, so they were excluded. The decision to include or exclude a specific paper after the full-text screening was discussed by the first and second authors; in cases of disagreement, one of the other authors would blindly review the paper to break the tie.

Exclusion of studies was conducted for the following reasons: (i) 16 studies did not examine reading comprehension specifically but rather word reading or reading fluency, (ii) two studies did not meet the age requirement for inclusion as they investigated an adult-aged population, and (iii) one study

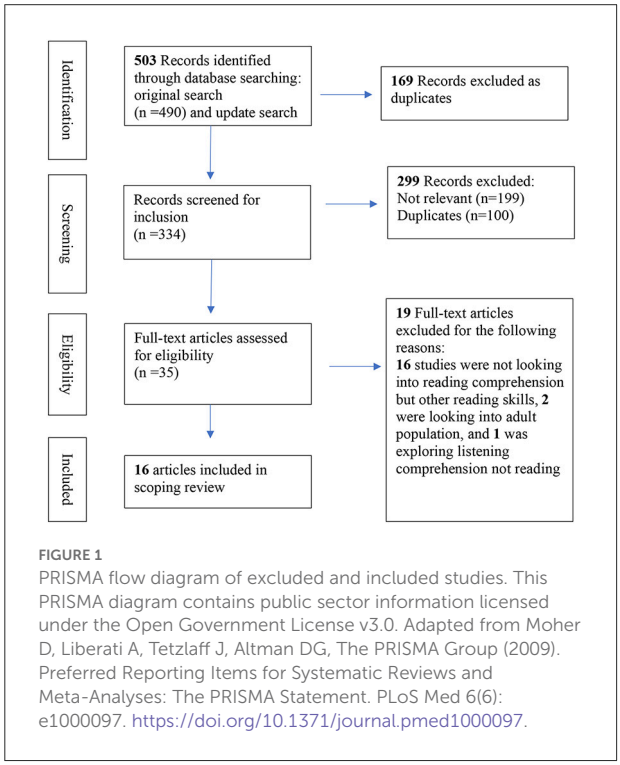

FIGURE 1
PRISMA flow diagram of excluded and included studies. This PRISMA diagram contains public sector information licensed under the Open Government License v3.0. Adapted from Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. https://doi.org/10.1371/journal.pmed1000097.

examined listening comprehension and did not include any measures of reading comprehension.

A total of 16 studies were included in the final review. Following the guidelines of Peters et al. (2015), a PRISMA flow diagram was produced. Figure 1 summarizes the details of the screening process conducted for this scoping review.

Charting and summary of the data

Following the fourth and fifth stages of Arksey and O'Malley's (2005) framework, Table 1 presents extracted information from each included study, including (1) author(s), year of publication; (2) characteristics of participants (including grade level, sample size, type of reading participants: typical readers/reading disorder, SES or social-economic status; (3) study location or region (4) type of outcome measure and predictive variables; (5) findings summary. The initial extraction sheet was pilot tested using ten randomly selected included studies and then refined. The lead author extracted the data from included studies while a co-author checked the extracted data.

To address the main aim of this review, a thematic summary (Gough et al., 2017) was used as a method for organizing the selected studies. Articles were arranged within thematic categories based on metalinguistic predictors of reading comprehension found within each study. Studies examining similar variables and their contribution to reading comprehension in Arabic were grouped in the following themes: (1) morphology theme; (2) phonology theme, which contains two sub-sections: phonological awareness and vowelization; and (3) orthographical knowledge theme. Several articles appear in multiple themes due to the nature of their study design and included measures.

Results

Overview of the 16 studies

The included studies ranged in the year of publication between 1999 and 2020 in a variety of predominantly Arabic-speaking countries, including seven studies from Israel (pre 1948 Palestine), three from Kuwait, two from Dubai, two from Algeria, one from Jordan, and one from Saudi Arabia. The included studies varied in their: participant demographics (different region, SES, participant reading ability); outcomes (correlating status); measures (type and number of tasks used); and study designs (longitudinal and cross-sectional). However, all 16 studies were quantitative in design and investigated prediction and correlation among metalinguistic variables and Arabic reading comprehension.

Thirteen studies investigated the relationship between phonological awareness and Arabic reading comprehension, with four of the included 13 studies investigating vowelization effects. Eight studies reported on the contribution of morphological awareness to reading comprehension in Arabic. While only two studies were found to examine the contribution of orthographic knowledge to reading comprehension. A synthesis of participant characteristics, measures, and summary and discussion within each of the themes (morphological awareness, phonological and vowelization awareness, and orthographic knowledge) is reported below.

Theme one: Morphological awareness

Across various alphabetic languages, morphological awareness (MA) has been found to contribute to reading comprehension (Carlisle, 2000; Kuo and Anderson, 2006) with an increase in contribution with age (Carlisle, 2000; Nagy et al., 2006). In line with this literature, all eight of the Arabic language studies which examined morphological awareness in this review reported similar findings.

Participant characteristics

Of the eight included studies, four studies, as shown in (Table 1: 5, 6, 8, 15), compared typical and poor readers; while the remaining studies focused solely on typical readers (Table 1: 3, 4, 9) or participants with reading difficulties (Table 1: 1). Definitions and assessment methods related to the classification of reading difficulties varied widely across studies with some relying on past diagnoses with a learning disability (LD) by the state psychological services (Asadi, 2020; Bishara, 2020)

TABLE 1 Characteristics of selected studies.

Study identifier	References	Study Title	Country/ Region	Participants characteristics		SES	Study design	Predictor variables			Outcome variables	Summary finding
1.	Bishara (2020)	Association between phonological and morphological awareness and reading comprehension among special-education children in Arab Elementary Schools	Israel (pre 1948 Palestine)	–	RD Third G, 9 years. $n = 20$ Fourth G, 10 years $n = 20$	Medium	Cross-sectional study	MA Oral MA test production and judgment $\alpha = 0.76$	PA Test phoneme segmentation $\alpha = 0.82$	OK –	RC test (close questions and multiple choices) $\alpha = 0.71$	MA found a highly significant correlation with RC PA positively contributes to RC
2.	Elbeheri et al. (2011)	Orthographic processing and reading comprehension among Arabic speaking mainstream and LD children	Kuwait	TR 2nd G, 7 years. $n = 63$ 3rd G, 8 years. $n = 55$ 4th G, 9 years. $n = 101$ 5th G, 10 years. $n = 98$	RD 3rd G, $n = 9$ 4th G, $n = 105$th G, $n = 16$	–	Cross-sectional study	–	PA Test sound deletion	OK Test Orthographic discrimination or distinguishing test	RC Fluency: incomplete sentences with four choices. Time given, 180 s $\alpha = 0.85$	OK contribute to RC in TR and RD PA contribute to RC in TR in 2nd and 3rd G PA did not contribute to RC in RD
3.	Asadi et al. (2017)	How simple is reading in Arabic? A cross-sectional investigation of reading comprehension from first to sixth grade: Is the Simple View of Reading valid for Arabic?	Israel (pre 1948 Palestine)	TR 1st G, 6–7 years. $n = 115$ 2nd G, 7–8 years. $n = 253$ 3rd G, 8–9 years. $n = 252$ 4th G, 9–10 years. $n = 255$ 5th G, 10–11 years. $n = 256$ 6th G, 11–12 years. $n = 254$	–	Low, medium and high	Cross-sectional study	MA Oral MA test inflecting verbs and nouns $\alpha = 0.88–0.91$ Derivation of words in context $\alpha = 0.60–0.62$ Root awareness: $\alpha = 0.82–0.91$ Pattern awareness $\alpha = 0.72–0.81$	–	OK Test parsing identifies the orthographically wrong word	RC Test vowelized text (narrative and informative)—multiple choice questions. $\alpha = 0.81–0.90$	OK show stable correlation with RC MA was contributing consistently higher at all G levels
4.	Vaknin-Nusbaum and Saiegh-Haddad (2020)	The contribution of morphological awareness to reading comprehension in Arabic-speaking second graders	Israel (pre 1948 Palestine)	TR 2nd G, 7–8 years. $n = 734$	–	Low	Longitudinal study	MA Written MA test Awareness of inflections and derivations	–	–	RC Assess vowelized reading using multiple choice questions. $\alpha = 0.91$	MA predicts RC increasingly
5.	Layes et al. (2017)	Study on morphological awareness and rapid automatized naming through word reading and comprehension in normal and disabled reading Arabic-speaking children	Algeria	TR 4th G, 9–10 years. $n = 18$ 6th G, 11–12 years. $n = 20$	RD 6th G, 11–12 years. $n = 20$	–	Cross-sectional study	MA Oral MA test judgment relationship task–production task–pattern recognition task–dismantling task	–	–	RC Assess short sentences and represented pictures as multiple choices	MA significantly correlate with RC ($p < 0.01$). MA can discriminate between TR and RD

(Continued)

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TABLE 1 (Continued)

Study identifier	References	Study Title	Country/ Region	Participants characteristics		SES	Study design	Predictor variables			Outcome variables	Summary finding
6.	Abu-Rabia (2007)	The role of morphology and short vowelization in reading Arabic among normal and dyslexic readers in Grades 3, 6, 9, and 12	Israel (pre 1948 Palestine)	TR 3rd G, 8–9 years. $n = 30$ 6th G, 11–12 years. $n = 30$ 9th G, 14–15 years. $n = 30$ 12th G, 17–18 years. $n = 30$	RD 3rd G, 8–9 years. $n = 30$ 6th G, 11–12 years. $n = 30$ 9th G, 14–15 years. $n = 30$ 12th G, 17–18 years. $n = 30$	Medium	Cross-sectional study	MA Oral Morphological identification: $\alpha = 0.81–0.88$ Written morphological production: $\alpha = 0.83–0.91$	Short vowels knowledge Adding short vowels to sentences: $\alpha = 0.82–0.91$	–	RC Assess vowelized narrative texts-explicit and implicit multiple-choices. $\alpha = 0.78–0.82$	MA contributes to RC in TR MA predicts RC in RD in 6th and 12th G Short vowel knowledge distinguishes TR and RD but did not correlate to RC
7.	Abu-Rabia (1999)	The effect of Arabic vowels on the reading comprehension of second- and sixth-grade native Arab children	Israel (pre 1948 Palestine)	TR 2nd G, 7–8 years. $n = 71$ 6th G, 11–12 years. $n = 74$	–	Medium	Cross-sectional study	–	Short vowels knowledge Assess vowelized and unvowelized reading ability: $\alpha = 0.86–0.88$	–	RC Assess vowelized and non-vowelized story-multiple choice questions. $\alpha = 0.86–0.86$	Short vowel knowledge contributes to RC in TR 2nd and 6th G
8.	Mahfoudhi et al. (2010)	The role of morphological awareness in reading comprehension among typical and learning disabled native Arabic speakers	Kuwait	TR 3rd G, 8 years. $n = 37$ 4th G, 9 years. $n = 74$ 5th G, 10 years. $n = 43$ 6th G, 11 years. $n = 39$	RD 3rd G, 8 years. $n = 9$ 4th G, 9 years. $n = 10$ 5th G, 10 years. $n = 16$ 6th G, 11 years. $n = 11$ 7th G, 12 years. $n = 17$ 8th G, 13 years. $n = 23$	–	Cross-sectional study	MA Assess written morphological segmentation and production	PA Assess sound deletion	–	RC Assess reading fluency: incomplete sentences with four choices Time constrains 180 second $\alpha = 0.85$	MA predicts RC in TR in all G levels RD perform better then controls on MA tasks (except 3rd G) but their scores did not predict RC PA predicts RC in TR
9.	Tibi and Kirby (2019)	Reading in Arabic: How well does the Standard Model apply?	Dubai	TR 3rd G, 8 years. $n = 201$	–	Middle and high class	Cross-sectional study	MA Assess word analogy orally Assess sentence completion and root recognition using writing tasks	PA Assess phoneme deletion: initial, middle, final Assess syllable deletion and sound blending	–	Maze RC Assess reading using multiple choices within passage, to assess explicit and inferential understanding	MA strongly contributes to RC PA didn't contribute to RC
10.	Tibi and Kirby (2018)	Investigating phonological awareness and naming speed as predictors of reading in Arabic	Dubai	TR 3rd G, 8 years. $n = 201$	–	Middle and high class	Cross-sectional study	–	PA Assess phoneme deletion: initial, middle, final Assess syllable deletion and sound blending	–	Maze RC Assess reading using multiple choices within passage, to assess explicit and inferential understanding	PA show strong prediction to RC
11.	Taibah and Haynes (2011)	Contributions of phonological processing skills to reading skills in Arabic speaking children	Saudi Arabia, Jeddah	TR K, 6 years. $n = 90$ 1st G, 7 years. $n = 64$ 2nd G, 8 years. $n = 43$ 3rd G, 9 years. $n = 40$	–	Medium	Cross-sectional study	–	PA Assess elision: initial, middle, final Assess syllable and sound blending	–	RC Assess reading fluency; retell read text using own words in 1 min	PA correlate significantly with RC

(Continued)

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TABLE 1 (Continued)

Study identifier	References	Study Title	Country/ Region	Participants characteristics	SES	Study design	Predictor variables	Outcome variables	Summary finding
12.	Elsayyad et al. (2017)	The influence of working memory on reading comprehension in vowelized vs. non-vowelized Arabic	Kuwait	TR 6th G, 11 years. $n = 49$ –	–	Cross-sectional study	– PA Assess phoneme deletion: $\alpha = 0.85$ –	RC Assess vowelized texts and non-vowelized literal and inferential multiple-choice questions $\alpha = 0.70$	PA contributes to RC
13.	Layes et al. (2015)	Phonological and cognitive reading related skills as predictors of word reading and reading comprehension among Arabic dyslexic children	Algeria	TR 4th G, 9 years 5th G, 10 years $n = 108$ RD 4th G, 9 years 5th G, 10 years $n = 23$	–	Cross-sectional study	– PA Assess phoneme deletion –	RC Assess short sentences and represented pictures as multiple choices	PA explain significant variables in RC ($R2 = 0.28$) in both readers type
14.	Abu Rabia and Hijjazi (2020)	The role of vowelization in reading comprehension of different Arabic genres	Israel (pre 1948 Palestine)	TR 5th G, 10–11 years 7th G, 12–13 years. 9th G, 14–15 years. $n = 80$ –	–	Cross-sectional study	– Short vowels knowledge Assess answering questions of four different text with and without vowels –	RC Assess vowelized and non-vowelized "newspapers-informative text-Quran and poetry" using literal and inferential multiple-choices	Vowelized text proposed higher level of success than non-vowelized text Short vowel knowledge contributes to RC in 5th and 9th G but not 7th
15.	Asadi (2020)	Predicting reading comprehension in Arabic- speaking middle schoolers using linguistic measures	Israel (pre 1948 Palestine)	TR 7th G, 12–13 years. $n = 77$ 9th G, 14–15 years. $n = 75$ RD 7th G, 12–13 years. $n = 79$ 9th G, 14–15 years. $n = 77$	Low, medium, and high	Cross-sectional study	MA Assess root awareness: $\alpha = 0.96–0.92$ Pattern awareness: $\alpha = 0.95$ PA Assess phonemic deletion: $\alpha = 0.92$ and phonemic segmentation: $\alpha = 0.94$ –	RC Assess vowelized narrative and informative text-using literal and inferential multiple-choices $\alpha = 0.93–0.95$	Linguistic components of MA and PA predicts RC in both groups but higher portion was observed among RD PA contribution to RC only among RD in 7th G
16.	Abu-Hamour et al. (2013)	The effect of short vowelization on curriculum-based measurement of reading fluency and comprehension in Arabic	Jordan	TR 5th G, 10 years. $n = 89$ RD 5th G, 10 years. $n = 42$	Medium	Cross-sectional study	– Short vowel knowledge Assess vowelized and unvowelized text –	RC Assess reading using multiple choices	Short vowel knowledge contribute to RC in TR and RD

MA, Morphological Awareness; PA, Phonological Awareness; RC, Reading Comprehension; OK, Orthographical Knowledge; RD, Reading Difficulty; TR, Typical Readers; SES, Socioeconomic Status; α, alpha; n, number of participants; G, grade level.

10.3389/fcomm.2022.984340

(Table 1: 1, 15), while others deemed children as having a reading difficulty due to their enrollment in special classes in math and/or literacy based on their needs (Mahfoudhi et al., 2010) (Table 1: 8). However, others applied a label of dyslexia based on student performance on standardized literacy tests and non-verbal ability compared to a typical reading control group (Abu-Rabia, 2007; Layes et al., 2017) (Table 1: 5, 6).

Studies examining morphological awareness ranged in grade levels from 1st to 12th grade (6–18 years old). Three studies (Table 1: 1, 4, 9) inspected only primary schools, while others (Table 1: 6, 8, 3, 5, 15) included multiple grade levels from primary to high school. Of the included studies in this review, social-economic status (SES) for most participants ranged from medium to high (Table 1: 1, 3, 6, 9, 15), while only one study (Table 1: 4) reported on low SES children. Two of the included studies (Table 1: 5, 8) did not include any measure or note of SES.

Measures

Morphological awareness measures

Of the eight studies examining morphological awareness one (Table 1: 9) utilized an analogy test that implicitly required students to express or derive words orally following given pairs (e.g., *"pull: pulled: write: ___"*) (بنت: :: ولد:أولاد__) (Nunes et al., 1997). While on the other hand, six studies (Table 1: 1, 3, 4, 5, 6, 9) assessed morphological awareness using word-related tests where participants were directed to judge whether pairs of words were morphologically related (e.g., bet-better, reception-receive-مَسَكَ-ممسوك, خُلود-دُخول) (Wilson-Fowler and Apel, 2015) . Sentence completion tasks were additionally used (Table 1: 1, 3, 5, 6, 8) to examine students' ability to produce the correct inflected form of a word related to a given root to complete grammatically and morphologically accurate sentences.

Only two of the included studies clearly stated the examination of both derivational[1] and inflectional[2] morphology (Abu-Rabia, 2007; Vaknin-Nusbaum and Saiegh-Haddad, 2020) (Table 1: 6, 4). This distinction revealed differences in the contribution of morphological awareness to reading comprehension when students were compared on the basis of reading ability. For instance, Vaknin-Nusbaum and Saiegh-Haddad (2020) (Table 1: 4) revealed that only inflectional morphology predicted reading comprehension of students with low performance while reading comprehension of students with higher reading performance benefited from both derivational and inflectional morphology.

The modality of task presentation (visual vs. oral) is important to consider when comparing studies, as differences in student performance across modalities have been reported (Huxham et al., 2012). For instance, Cavalli et al. (2017) noted that the use of visual tasks could confound the results as reading ability may influence the performance of the task. Four of the included studies used oral measures (Table 1: 1, 3, 5, 15), and two studies (Table 1: 4, 8) reported the use of written tasks; however, Tibi and Kirby (2019) (Table 1: 9), and Abu-Rabia (2007) (Table 1: 6), explored both oral and written skills.

Outcome measures

The bulk of included studies assessed reading comprehension using cloze questions (fill in the blanks) while two used different assessing elements. In one case (Table 1: 8), the reading comprehension task was applied within a timed condition to allow for the assessment of what they referred to as fluency of reading comprehension. In this study, the scoring of the reading comprehension task was based on the number of correctly answered questions in 180 s. Morphological awareness was found to contribute to reading comprehension in both reading ability groups, among 4th and 5th graders, when an untimed reading comprehension measure using pictures as multiple choices rather than written words was used.

Summary and discussion

Typical readers

Among typically developing Arabic readers, morphological awareness was found to contribute to reading comprehension consistently (Table 1: 3–6, 8, 9), with the exception of Asadi (2020) (Table 1: 15), who reported a significant contribution of morphological awareness among children with reading difficulties (grade 7th and 9th), but not for typical readers in the same grades. Asadi theorized that the weak contribution of morphological awareness to reading comprehension among typical readers may be explained by the reduced reliance on morphological information in middle school. Morphological awareness contributed to reading comprehension in earlier grades, as Asadi et al. (2017) (Table 1: 3) reported in first to sixth-grade children. However, Asadi's (2020) results (Table 1: 15), differed from those reported by Abu-Rabia (2007) (Table 1: 6), who reported a significant contribution of morphological awareness in the same age group. One potential explanation for these differences may be due to the differences in the modality of the morphological awareness measure used. Asadi (2020) used an orally administered assessment focusing on morphological structure and root awareness, while Abu-Rabia (2007) relied on a visually presented morphological identification task. It could be argued that the use of a visual task could potentially confound morphological awareness and word reading skills as a predictor of

1 Derivational morphology causes changes in the base words by the addition of affixations (e.g., prefix, un- or suffix-er), which results in producing new words which are different in meaning and word class (Kirby et al., 2012). For instance, the noun (player - LaAiBon-لاعبٌ) is produced by the matching process between the root (LAAB- لعب) and the pattern (FaAiLon-(فاعلٌ, which produces the active participle form.

2 Inflectional morphology often modifies and manipulates the grammatical structure of the word while the base word is kept intact: for instance, it results in tense changes (e.g., look, looked and looking) (أنظر، ينظر نظر،) (Kirby et al., 2012).

reading comprehension. Thus, the possibility cannot be excluded that any observed relationship between reading comprehension and visually assessed morphological awareness may instead be a result of word reading skills.

Students with reading difficulties

Four studies (Table 1: 1, 5, 6, 15) reported that students with reading difficulties scored significantly lower than their typical reading peers on measures of morphological awareness. However, most studies (Table 1: 1, 5, 6, 15) noted a significantly positive correlation between morphological awareness and reading comprehension among these children with reading difficulties. The one exception to this was Mahfoudhi et al. (2010) (Table 1: 8), who found that students with reading difficulties performed better on morphology tasks than typical readers, yet morphological awareness was not found to relate to the reading comprehension of children with reading difficulties. One potential explanation for these results may be due to the existence of a floor effect. Mahfoudhi et al. (2010) reported a large concentration of participants scoring at or near the lower limit for potential responses on the morphological tasks. A floor effect was especially observable when examining the reported results of children with learning disabilities on the grade 3 morphological protection task: a task with a max potential score of 25; however, a mean score of 0.33 was reported. Based on the presence of the floor effect it is likely that participants found the task too difficult. As a result, variance is restricted due to no variation being found at the lower end of its potential range. This restriction threatens the validity of the regression results analyses increasing the likelihood of biased estimates. Therefore, results indicating the lack of observed contribution of morphological awareness to reading comprehension reported by Mahfoudhi et al. (2010) should be interpreted with caution.

Alternatively, the uniqueness of the results of Mahfoudhi et al. (2010) (Table 1: 8) could be explained by differences in the curriculum offered to participants. For instance, Mahfoudhi's study included students with reading difficulties from schools specializing in the education of students with special needs. While comparable studies (Table 1: 1, 5, 6) reported on children with reading difficulties enrolled in mainstream education. It could be argued that children attending specialized schools may have received more individualized tutoring or specialized curriculum resulting in the observed relative strength in morphological awareness skills when compared with other typical readers from mainstream education; however, details of the specific curriculums and instruction received by the children in Mahfoudhi's study was not reported.

In summation, the results of the reviewed studies provide convincing support for the relationship between morphological awareness and Arabic reading comprehension across various ages, regions, and assessment methods. Mahfoudhi et al. (2010), for example, demonstrated a relationship between written morphological production and segmentation measure and a timed cloze test of reading comprehension among Kuwaiti students in grades 3–6. The contributions were still significant even after accounting for grade, gender, and phonological awareness. Another study by Tibi and Kirby (2019) found that morphological awareness, as measured by various morphological awareness tasks, was able to account for unique variations in grade three students' text reading fluency and maze reading comprehension measures. Similarly, a longitudinal investigation by Vaknin-Nusbaum and Saiegh-Haddad (2020) found that after controlling for word reading, morphological awareness at the start of the second grade in Arabic-speaking students predicted success in reading comprehension at the end of the school year. Results from this longitudinal study indicated a stronger relation between derivational morphology and reading comprehension than inflectional morphology.

Taken together, the results reported by the studies included in this review demonstrate a significant relationship between morphological awareness and reading comprehension in Arabic and support previous studies conducted in other alphabetic languages (Feldman, 1995; Deacon et al., 2014, 2017; Law and Ghesquière, 2017). However, this review highlights the significant lack of Arabic language longitudinal and instructional studies.

Theme two: Phonological awareness and vowelization awareness

Phonological skills have been found to be a strong predictor of Arabic reading comprehension among 1st to 8th grade levels (e.g., Abu-Rabia, 1999; Mahfoudhi et al., 2010) (Table 1: 7, 8) and word reading (e.g., Abou-Elsaad et al., 2016; Saiegh-Haddad and Taha, 2017; Schiff and Saiegh-Haddad, 2018; Tibi and Kirby, 2018). Two main distinctions could be made across the included studies that explored the contribution of phonological skills to Arabic reading comprehension, that being: (i) the contribution of phonological awareness (PA) and (ii) the contribution of short vowels. These two distinctions will be used to structure the discussion of the literature contained within this theme.

Participant characteristics

Phonological awareness

Similar to the morphological theme, definitions used in the classification of children with reading difficulties varied across included studies with some (Table 1: 1, 15) relying on past diagnoses of a learning disability by the state psychological services, while others (Table 1: 2, 8) deemed participants as having a reading difficulty due to their enrollment in special classes (i.e., math and/or literacy) based on their needs. One study by Layes et al. (2015) (Table 1: 13) applied a label of dyslexia based on student performance on standardized literacy tests and non-verbal ability compared to a typical reading control group.

Typical readers ranged from kindergarten to 9th grade levels. The majority of typical readers fell into the category of 2nd to 5th grade levels. Students with reading difficulties on the other hand ranged from 2nd to 9th grade levels, and most participants fell within this range.

Knowledge of vowels

Among the four studies which examined the contribution of added short vowels to reading comprehension, participants varied based on reading skill and grade level. Two studies (Table 1: 7, 14) explored typical readers only, while two others (Table 1: 6, 16) explored typical readers and students with reading difficulties. Students with reading difficulties in study 6 were classified as dyslexic based on literacy tests and non-verbal ability performance, while study 16 deemed participants as having a reading difficulty based on their teachers' identification and nomination. The grade level of participants across all four studies ranged from 2nd to 12th.

Measures

Phonological awareness

Studies included in this review varied slightly in their use of phonological awareness measures which commonly require participants to identify and manipulate syllables, rhymes, and individual phonemes (Goswami and East, 2000). All but one study (Bishara, 2020) (Table 1: 1) included phoneme deletion, a widely accepted phonological awareness measure (Wagner and Torgesen, 1987; Castles and Coltheart, 2004), where participants are required to pronounce a given word after removing a target syllable or phoneme (e.g., *say the word "brush" now say the word without the /b/ sound: "rush"*) (بدون الكلمة قل الان "مخاطر" كلمة قل خاطر /م/ صوت).

Blending and phoneme segmentation tasks, which are highly associated with early reading acquisition, were used in studies 1, 9, 10, 11, and 15. Participants were asked to decompose a word into its individual phonemes or to blend given phonemes into a target word (e.g., *sound out the word "crush": /k/ /r/ /u/ /sh/)* :"يقول" "اي/ ق/ او/ ل/) (Neuman and Dickinson, 2001). Bishara (2020) (Table 1: 1) reported exclusively using phoneme segmentation to measure phonological awareness.

Reading comprehension assessment measures were similar to those reported in the morphological theme. All studies reported the use of classic reading comprehension measures; however, three studies added timed assessment, which they called reading comprehension fluency, as in studies 2, 8 and 11 found in Table 1.

Knowledge of vowels

To assess the contribution of knowledge of short vowels to reading comprehension, four studies (Table 1: 7, 14, 16) used a decoding task requiring children to read vowelized and unvowelized texts followed by comprehension questions to assess the influence of voweled texts on reading comprehension. However, Abu-Rabia (2007) (Table 1: 6) utilized a different activity to test students' understanding of short vowels which focused on participants' accuracy related to active silent vowelization. In their phonology task, students had to add word-internal phonemic diacritics and word-final morpho syntactic diacritics to given sentences containing three words. To control for syntax, the final-word morpho syntactic diacritics were not considered for scoring.

Summary and discussion

Typical readers: Phonological awareness

Six studies out of eight (Table 1: 2, 8, 10–13), reported positive correlations between measures of phonological awareness and reading comprehension in typical readers, with the exception of Tibi and Kirby (2019) (Table 1: 9) who explored 3rd grade children, and Asadi (2020) (Table 1: 15) who examined children in 7th and 9th grade. One possible explanation for the lack of observed contribution of phonological awareness reported by Tibi and Kirby (2019) may be due to differences in the hierarchy of predicting variables in the regression analysis (Lankau and Scandura, 2002). The study found that morphological awareness, rather than phonological awareness, was the most important predictive variable for reading comprehension.

Another explanation for the lack of relation between phonological awareness and reading comprehension may be a feature of Arabic reading, specifically relating to the structurally linguistic distance between children's spoken and aural language and the written script resulting from the diglossic nature of the Arabic language (Tibi and Kirby, 2019) (Table 1: 9). Research has helped anchor the premise that reading acquisition is embedded in oral language skills as epitomized by the Simple View of Reading (Gough and Tunmer, 1986). This model of reading represents oral and aural language comprehension as essential skills to develop reading (i.e., reading is the result of decoding and linguistic comprehension). Yet Arabic diglossia brings extra challenge since students are required to develop concurrently novel linguistic ability and literacy in the unfamiliar Standard Arabic language (e.g., in Saudi Arabian vernacular, the word /kað*aleka/ (also) is pronounced /kaman/) (Maamouri, 1998; Saiegh-Haddad, 2003; Saiegh-Haddad and Joshi, 2014).

While on the other hand, as children age, they are presented with increased levels of non-vowelized text, reducing the transparency of the text within Arabic language texts, which can lead to ambiguity in word pronunciation and/or meaning because of the lack of short-vowel markers (Boudelaa and Marslen-Wilson, 2005; Mahfoudhi, 2007). As a result, decoding through a reliance on the conversion of letters to sounds becomes less reliable. Mahfoudhi et al. (2010) (Table 1: 8) theorized that this reduction in orthographic transparency would lead children to

rely more on context and additional linguistic features, such as morphology, to support word identification and comprehension. This is a possible explanation for the lack of relation observed between reading comprehension and phonological awareness by Asadi (2020) (Table 1: 15). Further support was provided by Elbeheri et al. (2011) (Table 1: 2) who examined orthographic processing and phonological awareness's relation to reading comprehension among both typical and atypical readers across multiple grade levels. Findings indicated that the orthographic measure significantly predicted variability in the comprehension independent of phonological awareness in the older children (grades 4 and 5) but not in the younger grades (2 and 3), where children were still engaging with text dominated by short vowel markers.

Students with reading difficulties: Phonological awareness

Among children with reading difficulties, phonological awareness was found to relate to reading comprehension in four out of the five studies included (Table 1: 1, 8, 13, 15). However, the one exception, Elbeheri et al.'s (2011) (Table 1: 2) findings have indicated that the group of children with reading disabilities showed little evidence of the contribution of phonological awareness to reading comprehension outcomes, while orthographic processing did contribute to reading comprehension outcomes. The results of Elbeheri et al. may be a function of the timed reading comprehension measure. Dyslexia is a reading disorder in which the fundamental problem involves poor decoding ability, poor phonological awareness, trouble with letters and words order, and a general slow reading rate not linked to low intelligence or insufficient instructions (Snowling, 2000; Signor et al., 2020; Hudson et al., 2021). Accordingly, it could be argued that the addition of the time element to reading comprehension tasks, as in Elbeheri's study, affects the performance of students with reading difficulties. The timed element may have had a confounding effect on the reading comprehension measure due to the general slow reading rate typical of children with dyslexia.

Short-vowel contribution

Three (Table 1: 6, 7, 14) of the four studies to investigate the contribution of vowelization to Arabic reading comprehension took place in Israel (pre 1948 Palestine), while one (Table 1: 16) study took place in Jordan. Three studies (Table 1: 7, 14, 16) reported evidence suggesting vowelization contributed to reading comprehension among typical (Table 1: 7, 14, 16) and disabled readers (Table 1: 14, 16). However, Abu-Rabia (2007) (Table 1: 6) reported that the use of vowelized texts did not contribute to reading comprehension among both typical and disabled readers, differing not only from the other studies reported in this review but also from other findings in Hebrew (i.e., a Semitic language similar to Arabic in many characteristics; Shimron and Sivan, 1994), which have frequently found vowelization to be a critical factor in facilitating word reading and reading comprehension for typical students and students with reading difficulties.

One possibility for the absence of vowelized texts' contribution to reading comprehension among typical and poor readers, as reported in Abu-Rabia (2007) (Table 1: 6), could be due to the type of assessment. All three studies which reported a relationship between vowelized text assessed students' reading and comprehension using voweled and non-voweled texts, while, Abu-Rabia (2007) employed a task that required students to make explicit decisions concerning the placement of internal and final word diacritics. It could be argued that the demand of this task requires readers to have more explicit knowledge of diacritics, particularly word-internal phonemic diacritics, and to be more proficient in syntax and grammar compared to implicit demands of reading voweled and non-voweled texts as used in the other three studies. In light of the combined findings of the studies, more research is needed to examine how phonological awareness and vowelization influence Arabic word reading and reading comprehension while taking the type of assessment into account (Saiegh-Haddad, 2005; Taha and Saiegh-Haddad, 2017).

Theme three: Orthographical knowledge

Many researchers across alphabetic languages conclude that orthographic knowledge is a consequence of skilled reading and print exposure (e.g., Ehri, 2005; Castles and Nation, 2008; Kirby et al., 2012; Conrad et al., 2013). Within this review, two studies were found to examine orthographic knowledge's relation to reading comprehension in Arabic (Elbeheri et al., 2011; Asadi et al., 2017) (Table 1: 2, 3).

Participant characteristics

Elbeheri et al. (2011) and Asadi et al. (2017) (Table 1: 2, 3) examined the relationship between orthographic knowledge and Arabic reading comprehension in grades 1–6. Elbeheri et al. explored students with reading disorders, while Asadi et al. investigated typical readers. Both studies were previously thoroughly described regarding participants' characteristics.

Measures

Orthographic knowledge

The two studies differed sharply in the methods used to assess orthographic knowledge. Elbeheri et al. (2011) (Table 1: 2) utilized two traditional measures which offered participants an orthographic choice between word pairs. One measure contained the correct spelling of a word and a non-word homophone of the word that was spelt incorrectly (e.g., rain–rane) (مُشْتهِدٌ-جتهِدٌ)), while the second assessment presented two non-word homophones (e.g., vage–vayj), one containing

a frequently occurring orthographic unit in the participants' language [i.e., in English (-age)] while the other did not. While on the other hand, Asadi et al. (2017) (Table 1: 3) utilized a sentence parsing task requiring participants to identify words from a sequence of letter strings with no spacing among them (i.e., *Iamfeelinggreat* would result in the response *I/am/feeling/great*) (بِشعورٍ أشعُر – ع ئ ا ر ر و ع ش ب رائع).

Summary and discussion

Both studies demonstrated that orthographic knowledge and reading comprehension in later grade levels have a positive association, which is consistent with earlier studies (e.g., Ehri, 2005; Castles and Nation, 2008; Kirby et al., 2012; Conrad et al., 2013). These results were in line with what would be expected due to the decrease in orthographic transparency of the available text that children are exposed to. As discussed earlier, a decrease in transparency would lead children to place greater reliance on context cues and morphology to support word identification and comprehension (Mahfoudhi et al., 2010) (Table 1: 8). However, among second and third graders, in the presence of vowelized text, Asadi (2020) (Table 1: 15) reported a positive relationship between orthography and reading comprehension, contrasting sharply with the findings of Elbeheri et al. (2011) (Table 1: 2) who did not find evidence of such a relationship in the earlier grade levels.

One possible explanation for these differences may be a result of differences in reading comprehension measures used in each study. In their reading comprehension assessment, Asadi (2020) (Table 1: 15) used a full vowelized transcript which has been shown to reduce reading errors in children (Abu-Rabia, 1995, 1996, 1997, 1998, 1999; Abu-Hamour et al., 2013; Abu-Rabia and Taha, 2016). This contrasted sharply to the added task demands of Elbeheri et al.'s (2011) (Table 1: 2) timed non-vowelized reading comprehension measure which may have compromised the overall performance of younger readers resulting in reduced variance within groups.

The results of the studies highlight some important theoretical implications. Firstly, evidence suggests a potential role of orthographic knowledge in the development of Arabic reading comprehension. Secondly, the effect of orthography on Arabic reading comprehension might have been mediated by the level of phonological information available to the reader (Elbeheri et al., 2011) (Table 1: 2). However, caution related to the generalization of these findings is urged due to the limited sample sizes and the need for longitudinal and intervention studies to fully understand the causal link between orthographic knowledge and reading comprehension in Arabic.

General discussion

Sixteen studies from across the Arab-speaking world were identified and included in this review. Results from the studies included support the importance of metalinguistic knowledge in the development of Arabic reading comprehension. However, this review does highlight the scarcity of studies examining some aspects of metalinguistic skills (i.e., orthographic knowledge). In this section, we highlighted a number of gaps that emerged from our examination of the literature on the functions of morphological awareness, phonological awareness, and orthographic knowledge in Arabic reading comprehension. In addition, teaching and educational implications are discussed, as well as recommendations to improve Arabic reading curricula and effective reading instructions.

Based on past English language studies, we theorized that metalinguistic awareness would be a significant predictor of reading comprehension among school-age Arabic-speaking students. Findings confirmed this hypothesis and demonstrated a strong direct and indirect relationship between metalinguistic awareness and reading comprehension across a diverse array of contexts and participant demographics.

It is encouraging to report that most reviewed studies in this literature indicated that reading comprehension and metalinguistic variables are inextricably linked. Morphological awareness and orthographic knowledge appear to gain strength as a predictor of reading comprehension with age from the onset of unvowelized text. While phonological awareness contributes to reading comprehension with age and increased orthographic complexity of the text children encounter.

The reviewed studies generally align with earlier research conducted in other languages like English, which demonstrates a strong correlation between metalinguistic awareness and reading comprehension (morphological awareness: Nagy et al., 2006; Foorman et al., 2012; Kirby et al., 2012; phonological awareness: Goswami, 1990; Ehri et al., 2001; Carlisle, 2003; Roman et al., 2009; and orthographic knowledge: Snowling, 2000; Goswami, 2005; Florit and Cain, 2011). However, research is still lacking, specifically examining the unique features of the Arabic language, such as diglossia and the role of derivational and inflectional morphology. For instance, examining the Arabic vernacular (spoken dialect) and its effects on young children's vocabulary, morphological awareness (oral and written tasks), and reading comprehension across the early grades is one area where the literature is lacking, notably since Schiff and Saiegh-Haddad (2018) demonstrated how diglossia affects the function of morphological awareness in reading. Future research should also investigate identifying different reading profiles of Arab children across the early grades and compare the skilled readers to the poor readers on their morphological awareness (inflectional and derivational) and reading comprehension. Based on past work in other alphabetic languages, it predicted that morphological awareness would be significant in the reading outcomes given

the importance of morphology in alphabetical languages and orthography, and it did in fact have a significant influence among readers in English (Nagy et al., 2006; Foorman et al., 2012; Kirby et al., 2012) and Arabic (Abu-Rabia et al., 2003; Asadi et al., 2017; Tibi et al., 2019). The review provided further clear evidence that Arabic morphological awareness is a fundamental factor in reading comprehension; hence, explicitly teaching morphological awareness in the classroom can affect and promote young children's Arabic reading comprehension (Tibi, 2010; Asadi et al., 2017). Additionally, more longitudinal studies, including different samples from different Arabic-speaking populations, are needed to: (a) examine the effect of the various dialects on reading in general and reading comprehension in particular, and (b) investigate the role of derivational morphology in reading comprehension using detailed tasks of derivational morphology that include different word patterns and different levels of root frequencies.

In addition, an understanding of the contribution of each of these variables is important for curricula design. For instance, in Saudi Arabia and Jordan, morphology is only addressed in middle and high school (Alsamadani, 2012; Abu-Hamour, 2013). In addition, the current form of morphological instruction represented in the national curricula does not present morphological instruction as a specific word or text-level reading skill but instead is delivered as part of grammar instruction. Based on the findings of the studies in this review, along with evidence from English language research on reading development (for a review, see Bowers et al., 2010; Goodwin and Ahn, 2010), reading comprehension among Arab children with and without reading disabilities could be better supported through the introduction of explicit morphological instruction in earlier primary grades.

Furthermore, reviewed studies including Arabic phonological awareness mirror the work of Carlisle (2000) and Nagy et al. (2006) who found that phonological skills among English-speaking students are important for early reading comprehension success. In fact, beginning readers who received phonetic instructions showed more reading improvement and became more independent readers (Connelly et al., 2001; Reyhner, 2001). According to the Simple View of Reading, reading comprehension is the product of decoding and language comprehension (Gough and Tunmer, 1986); therefore, early exposure to explicit phonological instructions in Standard Arabic would support literacy acquisition. As stated, learning to read in Arabic is influenced by diglossia (Asaad and Eviatar, 2013), consequently, Feitelson et al. (1993) and Abu-Rabia (2000) endorsed the usefulness of early exposure to Standard Arabic orally to facilitate literacy skills, including phonology. Incorporating these instructional approaches will support the adjustment to Arabic diglossia. However, this approach is not reflected in some Arabic national curriculums. The Saudi Arabian curriculum, for instance, mainly follows more traditional instructional approaches (Alfarhan, 2016). The primary curriculum focuses on the rote practice of grammatical rules, rather than teaching language-related knowledge explicitly (Alfarhan, 2016). Researchers' recommendations regarding the inclusion of explicit phonological skills training for teachers (e.g., Cain and Oakhill, 2007; Stuebing et al., 2008; Kirby et al., 2012; Clayton et al., 2020) should be considered. Supporting children's phonological skill development could have the potential of providing increased print exposure and enhancing motivation, ultimately better preparing children for the transition to reading unvowelized text.

A recent longitudinal study (Clayton et al., 2020) explored the predictive relationship between phonological awareness skills and early reading development in first-grade students (n = 191) and reported a reciprocal relationship between reading development and early phonological awareness. This longitudinal study supports the inclusion of phonological instruction in the first year of reading (i.e., phoneme, syllable, onset, and rhyme awareness skills) to promote early reading growth. Even though little research in the Arabic language has been conducted to identify the best means forward in terms of phonological skills instruction and early reading comprehension development, findings of English Language studies can apply to Arabic. Both languages have an alphabetical system that allows phonemes to convert to written letters. It has been suggested that teachers may benefit from placing a focus on tasks known to be difficult for younger students, such as syllable deletion and phoneme segmentation (Tibi, 2010). In addition, Tibi (2010) suggests a developmental hierarchy of phonological skills in Arabic that teachers could follow to guide the delivery of this instruction: sound categorization, rhyme oddity, syllable deletion, and phoneme segmentation.

Results of this review support the role of orthographic knowledge as a strong predictor of Arabic reading comprehension, increasing with age from the initial presentation of unvowelized text. Given the importance of orthographic skills, the majority of Arabic national curricula focus on the teaching of orthographic skills seems to be in alignment with the available evidence (Alsamadani, 2012; Abu-Hamour, 2013). For example, the National Reading Curriculum of early grade levels in Saudi Arabia (2021) requires children first to identify letters by their alphabetical names, then read and spell out one syllable and gradually increase the number of syllables, leading to a point where children are required to recognize a substantial number of whole words before any work focusing on comprehension is carried out.

Reading instruction in some Arab countries, such as Jordan and Saudi Arabia, follow whole-class instruction, offering little in terms of differentiation (Alsamadani, 2012; Abu-Hamour, 2013). More specifically, the National Framework For Public Education Curricula Standards in Kingdom of Saudi Arabia (2021) requires teachers to use the same texts, exercises, and teaching approaches; however, there is no evidence that phonological and morphological approaches are included in the

Saudi Arabian standardized reading curriculum (Al-Jarf, 2007; Al Ghanem and Kearns, 2015; Alfayez, 2022). As supported by the included studies in this review, Arabic-speaking children with reading difficulties may benefit from a more diverse approach to reading instruction that focuses on the metalinguistic skills found to contribute to reading comprehension outcomes (i.e., phonological awareness and morphological awareness) (Bos et al., 2001; Ryder et al., 2008). Preparing students to use orthographic skills alone does not meet the needs of all readers. Clear instruction incorporating all metalinguistic skills, starting as early as possible, can help prevent reading comprehension difficulties from the beginning.

The results of the studies reviewed support metalinguistic skills' contribution to reading comprehension, therefore, supporting the introduction of more explicit teaching methods. Compared with unsystematic or implicit forms of instruction, explicit teaching of metalinguistic has been found to produce better gains in reading outcomes consistently (phonics instruction: Coltheart, 2005; Podhajski et al., 2009; Carlisle et al., 2011; morphological awareness instruction: Carlisle, 2003; Tong et al., 2011; Wolter and Dilworth, 2014; and orthographic awareness instruction: Goswami, 2005; Florit and Cain, 2011). It is thought that as teachers' metalinguistic knowledge increases, they become better equipped to detect errors and offer correction and support through means of explicit instructions (Bos et al., 1999; Moats and Foorman, 2003; Podhajski and Nathan, 2005). For instance, Hurry et al. (2005) noted that among teachers who had attended a course on the role of morphemes in literacy, morphological awareness increased, which in turn was reflected in their practice and increases in pupils' performance on literacy measures, compared to a control group. Similar findings support the relationship between teachers' explicit knowledge of metalinguistic and student reading performance and development (Bos et al., 1999; Moats and Foorman, 2003; Podhajski and Nathan, 2005). Therefore, enhanced teacher preparation in the area of systematic metalinguistic content knowledge and instruction would support their pedagogical practices and positively influence the reading achievement of their students (Bos et al., 1999; Stark et al., 2016; Goldfeld et al., 2020).

Limitations and recommendations

This review has several limitations that are worth noting. Fundamentally, this literature review was limited by the number of currently existing studies on the effects of metalinguistic in Arabic. There is a need for more fine-grained research on morphological and phonological interventions and instruction to determine how to maximize their influence on students' performance. Additional longitudinal studies in all Arabic metalinguistic variables at different elementary grade levels may inform our understanding of the degree of influence of different variables or skills on reading comprehension. Another limitation is that most studies had been held in different regions and places, where all participants used different dialects and were tested with different measuring tools. In fact, studies were collected from six different Arab countries. Another confounding variable is that each country has a totally different educational system and reading curriculum (Chekayri, 2018).

The main focus of this review was reading comprehension in Arabic; therefore, reading fluency and word reading were not reported. Further review studies should examine and incorporate in depth the relationship between Arabic metalinguistic awareness and word reading (Saiegh-Haddad, 2005; Taha and Saiegh-Haddad, 2017). Additionally, since the participants in the studies explored here were native Arabic readers in grades 1–12, other readers' experiences were excluded (e.g., adults, non-native learners). Therefore, the results do not provide a complete understanding of Arabic reading development. Consequently, more research on Arabic reading should be conducted to expand awareness on how to improve reading instruction across a wider population.

Overall, the results of the studies investigated in this review provide promising evidence of the role of metalinguistic awareness in reading comprehension; however, a considerable amount of work remains to be done. It is advised that morphological and phonological instruction be embedded in the reading curriculum from first grade, in a sustained manner, rather than being added at a later date. Results also suggest that morphological and phonological influences may have more potential in fostering reading comprehension than has yet been realized. Therefore, it is hoped that this review sheds light on effective reading instruction.

Conclusion

This review of research into the effect of metalinguistic awareness on reading comprehension in Arabic revealed several insights. First, morphological awareness and phonological awareness strongly contribute to reading comprehension in Arabic. Secondly, measurement variations were observed in all tasks but mainly in morphological tasks, thus highlighting the need for official standardized tests. Lastly, evidence supports the inclusion of morphological and phonological instruction in early grade levels.

Although these insights are encouraging, they are more suggestive than conclusive. The goal set for this review was to examine metalinguistic variables and their role in facilitating Arabic reading comprehension. Additionally, this review investigated the nature of the effectiveness of these variables

and considered their contribution to reading comprehension to inform research and education. Although there is an observed diversity between studies, the findings generally indicate the unique features of the Arabic language, making it difficult to draw firm conclusions. However, the most robust results suggest the need for explicit metalinguistic instruction and increased awareness of morphology, phonology, and orthography to enhance reading comprehension.

Research in the area of reading comprehension in Arabic and metalinguistic contributors is developing; breaking down metalinguistic knowledge into three smaller variables, as we have done in this review, can lead to the design of educational resources that promote Arabic reading comprehension in young children by using more explicit classroom instruction. This review supports the need to better inform and prepare teachers for changes that will result in greater reading achievement for beginning readers.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

NB had done database searches, analyzed the data, and written the main parts of the manuscript. JL had developed the conceptual framework, aided in the analysis, and revisions of the manuscript. KB and ST edited and aided in interpretation and presentation of the data. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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