

Short Vowels Versus Word Familiarity in the Reading Comprehension of Arab Readers: A Revisited Issue

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Abstract

Arab readers, both beginning and advanced, are encouraged to read and accustomed to unvowelized and undiacriticized texts. Previous literature claimed that the presence of short vowels in the text would facilitate the reading comprehension of both beginning and advanced Arab readers. However, with a claimed strict controlling procedure, different results emerged, revealing that the only variable that affected the reading process of Arab adult skilled readers was word frequency, and its effect was limited to the time load of the reading process; this result raised the question of whether the neutral role of short vowels in the text reading process of experienced Arab readers would be maintained for less experienced readers, as represented by fourth graders, or whether word frequency would be the only variable that plays a role in their reading process. In experiment 1, 1,141 fourth-grade students were randomly assigned to 5 reading conditions: plain, only shaddah, short vowels plus shaddah, only short vowels, and finally the wrong short vowels plus shaddah. In experiment 2, 38 participants from the same population were assigned to a fully vowelized and diacriticized reading condition. Each participant was asked to read two texts, of high and low frequency words and then given recall and multiple-choice tests. In general, the multivariate analysis showed that the only manipulated variable that was found to affect their reading process in terms of reading time load and, to some degree, reading comprehension was word frequency, although its effect was marginal. Accordingly, pedagogical recommendations and future research were proposed.

Keywords: Arabic short vowels, Arabic beginning readers, Reading comprehension, Arabic orthography.

Introduction

Reading comprehension, both process and product, is affected by many factors that are related to the text, the reader, and the interaction between the text and the reader (Kendeou, Muis, & Fulton, 2010). Indeed, those factors can also be classified as either internal or external factors. Internal factors are considered to be factors that are related to the text per se, and thus they are considered to be textual, such as the words embedded in

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the text in terms of frequency and abstractness (e.g., Ryder & Hughes, 1985), syntactic structures, genre (e.g., Meyer & Freedle, 1984), and text organizing structure (e.g., Meyer, 1975). External factors, on the other hand, are considered to be exterior factors that are related to the reader, such as his/her prior knowledge of the topic (Bransford & Johnson, 1972; Kendeou, Rapp, & van den Broek, 2004, 2007; Kientch, 1988), reading skills, schemata and beliefs (Kardash & Howell, 2000; Kendeou et al., 2010), interest, and knowledge of and skills in using cognitive and metacognitive strategies (e.g., Zwaan & Brown, 1996).

One internal factor that is exclusive to texts written in Arabic is its orthography, which permits a dual representation of its scripts: a shallow, transparent orthography, in which the appropriate short vowels (*dhammah* ^{◌ُ}, *fatha* ^{◌َ}, and *kasrah* ^{◌ِ}) and diacritics (*shaddah* ^{◌ّ} and *skun* ^{◌ْ}) are supplement with the consonants in the text, and a deep orthography, in which only the consonants are presented and no appropriate short vowels or diacritics are provided (Abu-Raiba, 1995; Mahmoud, 1980; Seraye, 2004).

Arabic is a Semitic language written from right to left with an alphabetic-principle-based writing system that represents both consonants and short vowels, including the diacritics, separately and voluntarily. The Arabic writing system visually consists of two types of symbols: consonants that represent, to a large extent, the *trilateral/quadrilateral* root of words, and tiny visual signs that are affixed to the consonants and take the shapes of diacritics. However, by analyzing the script symbols in terms of functions, we could divide the Arabic writing system symbols into four types. (1) There are 26 consonants, including the three long vowels that represent both a consonant and a vowel under some conditions: “alif: ا,” “waaw: و,” and “yaa: ي.” (2) There are three short vowels, “*fathah*,” “*dhammah*,” and “*kasrah*,” that mark the equivalent short vowels in English, *a*, *u*, *i*, and take the forms of diacritics, and the following shapes: ‘◌ُ’, ‘◌َ’, and ‘◌ِ’ respectively. (3) Diacritics are very small visual signs that are superscripted to the consonants or the letters in a word: *skun* is represented with the symbol ‘◌ْ’ to indicate that the consonant is vowelless; *shaddah* is represented by ‘◌ّ’ and is used to indicate a doubled consonant “geminated,” and *maddah* is represented with the symbol ‘◌~’ and is placed over the consonant ‘◌’ to indicate the combination of two consonants, *alif* ‘ا’ and *hamza* ‘ء’. Finally, (4) the case-ending markings are very small visual symbols that take the following shapes “◌َ”, “◌ِ”, “◌ُ”, “◌ْ”, to indicate syntactically different cases, including the nominative, genitive, and accusative cases. The short vowels might be doubled to indicate nunation, which takes the following shapes: ◌ُ◌ُ, ◌ِ◌ِ, and ◌َ◌َ (Bateson, 1967; Campbell, 1997; Mahmoud, 1979).

The voluntariness of representing short vowels and diacritics in Arabic print that characterizes Arabic orthography has resulted in a dual representation of its print: a transparent orthography in which the appropriate diacritics are supplemented with the consonants, as can be seen in traditional and young children’s texts; and a deep orthography in which only the consonants and no appropriate diacritics are presented, as can be seen in public print, newspapers, and books written for adults.

This uniqueness of Arabic orthography of being of dual representation has attracted some researchers to evaluate its effect on the process of reading Arabic at all textual levels—word recognition, sentence understanding (specifically parsing), and text integration—using different populations and different types of materials and methodologies (see for example Abu-Rabia, 1995-2001; Ibrahim, 2013; Ibrahim, Eviatar, & Aharon Peretz, 2002; Seraye, 2004). Subsequently, researchers also examined word recognition, sentence parsing, and text reading and comprehension to assess the extent to which the departure of a writing system from representing speech, as can be realized in the absence of short vowels/pointings and diacritics from script, might influence the reading process (Chitiri, 1991; Seraye, 2004; Shimron, 1993). Such investigations would

help researchers in the field of reading to arrive at a universal explanation of the “blueprint of the reader” (Perfetti, 1999) through integrating other alphabetical writing systems and unique orthographies in the equation, constructing a reading model of the Arabic reading process. Finally, they would also help Arabic curriculum designers and policy makers to suggest appropriate reading instruction methods and reading scripts for school pupils.

One of the major concerns over the role of those missing tiny short vowels and diacritics from Arab students’ print/textbooks was its effect on students’ reading comprehension, a concern that drew the attention of some Arab researchers to investigate to what extent the absence of short vowels (and diacritics) from Arab reading materials would affect students’ reading process while they attempt to integrate the text in order to understand it. Abu-Rabia (1999) conducted two experiments to compare the effect of short vowels on the reading comprehension of two different populations: second graders (given the label “the beginning readers”) and sixth graders (given the label “the advanced readers”). In Experiment 1, 74 sixth graders, aged 12 to 12 ½, were divided randomly into two groups: in one group, the participants individually and silently read a vowelized short story taken from their “basic reader,” and answered 10 multiple-choice vowelized questions. In the other group, the participants individually and silently read the unvowelized version of the same text and answered 10 multiple-choice unvowelized questions. In a within-subject design, the researcher conducted the same procedure by asking 71 second graders, aged 7 to 8, to read two different narrative texts, one vowelized and the other unvowelized, and then answer seven multiple-choice vowelized questions, in two sessions with two days elapsing between them. The results showed that both the beginning readers and the advanced ones benefited from the presence of short vowels in the texts, which facilitated their reading comprehension, as can be realized from the significant difference between the means. The second graders on average scored higher with vowelized texts ($M= 6.34, SD= 1.58$) than with unvowelized ones ($M= 5.46, SD= 2.00$) with a maximum score of 7 for both tests, and the sixth graders on average scored higher with the vowelized text ($M= 7.20, SD= 1.70$) compared with the unvowelized one ($M= 6.10, SD= 2.22$) with a maximum score of 10 for both tests.

According to Abu-Rabia (1999), this result can be explained in terms of the role of short vowels in providing the text with phonological information that “affects working memory in processing text information in such a way that, if information is also phonologically coded in working memory, this will maintain that information longer during reading, which facilitates reading comprehension” (p. 100).

In another study (Abu-Rabia, 2001), three tasks were designed to investigate the role of short vowels, pointings (the counterpart of short vowels in Hebrew orthography), and context on the reading process of Arab adults as they read Arabic and Hebrew reading materials: words, short paragraphs, and short story texts. In one task, 65 native Arab adults, who were university students aged 22 to 30 years and were proficient in Arabic and Hebrew, were assessed on their reading comprehension in relation to the presence and absence of both short vowels and pointings as they read short story texts written in Arabic and Hebrew.

There were two different short stories: one written in Arabic and another written in Hebrew. From each story, two versions were constructed to present the reading condition: one was presented fully vowelized for the case of Arabic, or fully pointed for the case of Hebrew, and the other was presented fully unvowelized or unpointed, respectively. Although it is not clearly stated, it seems that the participants were divided into two groups, and each group received one reading condition. One group individually and silently read the vowelized Arabic text and the pointed Hebrew text, and the other group

individually and silently read the unvowelized Arabic text and the unpointed Hebrew one, then they answered six multiple-choice questions (with 6 as the ultimate score).

The results demonstrated that the participants on average performed better with the fully vowelized and pointed texts than with the ones presented without short vowels or pointings ($M= 4.51$, $SD= 1.20$ for the vowelized Arabic text, and $M= 4.10$, $SD= 1.56$ for the unvowelized Arabic text; $M= 2.43$, $SD= 1.39$ for the vowelized/pointed Hebrew text, and $M= 2.27$, $SD= 1.16$ for the unvowelized/unpointed Hebrew text). Abu-Raiba (2001) attributed these results to the presence of short vowels and pointings in the texts, which provided “additional phonological information” (p. 52) and subsequently helped in understanding the text.

This finding of a positive effect of short vowels on the reading comprehension of Arab adults does not just support Abu-Rabia’s (1999) previous study in showing a consistent result, but also empowers the role of short vowels in facilitating the reading comprehension process of Arabic readers regardless of their reading skill. Not just beginning readers but also experienced ones (adults) benefitted from the presence of short vowels in the texts they read. However, examining the mean values for both studies shows that the less experienced readers, second graders, benefitted much more from the presence of short vowels in the texts; they reached comparatively higher maximum scores than the experienced skilled readers, sixth graders and adults.

In the case of Hebrew texts, the positive effect of short vowels (pointings) on the reading comprehension of adults as they read a Hebrew text was in agreement with a previous study by Shimron and Sivan (1994), which showed that providing a Hebrew text with short vowels/pointings helped the adults comprehend the text to some degree better than they comprehended an unvowelized/unpointed text ($M= 1.75$, $SD= 0.44$ for correct answers for the vowelized text; $M= 1.42$, $SD= 0.72$ for the unvowelized text). However, reading comprehension, as can be assessed by the load reflected in the reading time it took the participants to read the texts, showed that on average it took the participants the same amount of time to read the vowelized/pointed and unvowelized/unpointed Hebrew texts ($M= 68.8$ s, $SD= 31.3$ s for the unvowelized text; $M= 69.0$ s, $SD= 30.4$ s for the unvowelized text).

It can be concluded from Abu-Rabia’s (1999, 2001) studies that short vowels (I use his term roughly here, because presenting the text fully vowelized does not mean providing the text with only short vowels but means providing it with other diacritics that also represent speech: *shaddah*, *skun*, and case markings) had an effect on the reading comprehension of Arab readers as they read a text silently for comprehension, and that was consistent regardless of the type of population involved in the process: beginning readers with less experience or advanced ones with more experience. Further, the effect was noticed on the product of the reading comprehension process as was assessed by the multiple-choice test. Other variables for assessing the reading comprehension process, as can be realized by the reading time it takes the subjects to read a text, were not incorporated in the two studies, although they reflect the reading comprehension process.

Thus, more than one drawback can be observed in Abu-Rabia’s (1999, 2001) studies. These drawbacks are related to the methodology applied, including the dissimilarity and type of texts used (e.g., the length of his experimental texts were equalized on the number of words, and not on the number of morphemes where they should due to the affixation feature of Arabic; nor they were equalized in terms of word frequency, syntactic structure, or genre) and their familiarity to the participants, especially in the 1999 study. The author also failed to manipulate the short vowels to the degree that their effect alone would be isolated, because the author included *shaddah* and *skun* as short vowels in Arabic. Further,

he included even the case endings, tiny signs take the shape of short vowels and the diacritic *skun*, which function in relation to the syntactic structure of the sentence. The measurement applied was insensitive (only a multiple-choice test was used, not a recall test), and finally the difference in the results was overestimated and the author did not point out to the slight difference between the means. In the 1999 study, the means were 7.20 out of 10 for the vowelized condition and 6.10 out of 10 for the unvowelized condition, a difference of 1.10, and 6.34 out of 7 for the vowelized condition and 5.46 out of 7 for the unvowelized condition, a 0.88 difference. It should be noted that the measurement scale involved one point for each correct answer, and therefore a 1.10-unit difference and a 0.88-unit difference between the means were equivalent to differences of 1.10 and 0.88 correct answers, respectively. Thus, the effects of short vowels on the reading comprehension of both advanced and beginning readers should have taken into account the sizeable difference between the means and the measurement scales employed in the study.

For the 2001 study, it was found that the participants performed better with the vowelized texts and with the pointed texts than with the texts that were presented plain—that is, without short vowels or pointings. However, examining the means between each pair of reading conditions shows the same phenomenon found in the 1999 study; only a very slight difference between the means was found. For the Arabic texts, the participants scored 4.51 on average for the vowelized Arabic text and 4.10 for the unvowelized Arabic text, a difference of 0.41; for the Hebrew texts, the participants on average scored 2.43 for the pointed Hebrew text and 2.27 for the unpointed text, a difference of 0.16, which equals a 0.16 difference in correct answers. Because the measurement scale involved one point for each correct answer, the 0.41-unit difference and the 0.16-unit difference between the means were equivalent to differences of 0.41 and 0.16 correct answers, respectively. Thus, interpreting the effects found for the short vowels and pointings on the reading comprehension of Arab adults should have taken into account the sizeable difference between the means and the measurement scales employed in the study.

Accordingly, attributing this difference in comprehension performance to the short vowels per se is still questionable under these conditions, as Abu-Rabia's studies did not control for the short vowels to the degree that would isolate their effect accurately, nor did they control for the texts used in terms of being identical, as he used two uncontrolled-for texts. Furthermore, he included other diacritics, such as the *shaddah* sign, ّ, as short vowel signs, which means that “the representation of the short vowels was not scientifically and experimentally manipulated to the degree that the extraneous variables were controlled” (Seraye, 2004, 56). Therefore, it was necessary to take such realities into account to reassess the role of short vowels in the reading comprehension of adult Arabs who were exposed only to unvowelized texts and to determine the degree to which such exposure would affect their reading process as they read vowelized texts versus unvowelized texts.

In Experiment 1 of a three-experiment study, Seraye (2004) study responded to such concern and assumed that, once we control for the reading materials used, the procedure, and the reading condition, the homographic phenomenon that characterizes the unvowelized Arabic text would not affect people's reading comprehension, nor would the presence of short vowels. He reasoned that Arab adults (considered to be experienced readers) would use their language experience, particularly the morphological stem of the Arabic root of the words, their trilateral/quadrilateral root, and the linguistic textual context, in understanding the text. Thus, Seraye (2004) used a matching procedure to construct matched texts on all textual levels. In terms of short vowels, he differentiated between full consonant representation and full “morphological short vowel” representation in order to exclude confounding effects of other diacritics (e.g., *shaddah*,

case-ending markings, and *skun*) and thus to determine the role of short vowels in comprehension. Further, he built a frequency effect into the design because word frequency could covariate with the vowelization effect. He also used a retelling procedure (recall), which is considered a better indicator of readers' performance on texts, in addition to a multiple-choice test (Lipson & Wixson, 1997).

For the purpose of the study, two texts were constructed, one high-frequency text (HF) and one low-frequency text (LF), by using a matching procedure to guarantee the identity between the texts, except in word frequency. The two texts, one HF and one LF, were of 504 words and 834 morphemes each and served as the main texts in the experiment. Five versions of each text were constructed to represent the reading conditions: in the first condition the text was given plain (no short vowels or *shaddah*), in the second condition the text was provided with only *shaddah*, in the third condition the text was provided with short vowels plus *shaddah*, in the fourth condition the text was provided with short vowels minus *shaddah*, and finally in the fifth condition the text was provided with wrong short vowels plus *shaddah*. The author included the only-*shaddah* and only-vowels conditions in his design for control purposes. The participants were 104 native Arabic speakers aged 19 to 40. They were randomly divided into five groups and then assigned randomly to the five reading conditions. Thus, in each reading condition, the participant silently read two texts, HF and LF, in two sessions separated by 14–20 days. The order of passage presentation was rotated to counterbalance reading materials and reading conditions within each group. The first group read the plain texts (no short vowels or *shaddah* were provided); the second group read the texts with only *shaddah* (only *shaddah* was provided with the text); the third group read the texts vowelized with *shaddah* (both short vowels and *shaddah* were provided); the fourth group read the vowelized texts (only short vowels were provided), and the fifth group read the texts wrongly vowelized with *shaddah* (both short vowels and *shaddah* were provided on the wrong positions in the words, which would lead, if they were read with the consonants, to phonemic distortion and not to graphemic distortion). After each reading, the participant was asked to recall what he read and then respond to 10 multiple-choice questions. There are three dependent variables collected: the reading time it took the participant to complete the text, measured in milliseconds; the propositions recalled after the reading task and the correct answers on the multiple-choice test; and two independent variables, the vowelization conditions and the text types, HF versus LF.

The results showed that for the reading time data, a significant main effect was found for text type (HF vs. LF), but not for reading condition. Further, there was no significant interaction between text type and reading condition. As a result, it did not matter which reading condition the participant was in; it always took him longer to read the low-frequency text than the high-frequency text. On average, it took the participant 206.32 s to read the LF text and 194.13 s to read the HF text.

For the number of propositions from the recall test data, no significant main effects for text type or reading condition were found. Further, the results did not show any significant interaction between text and reading condition. Thus, it did not matter which text the participants read or which reading condition they were in; their performance was on average the same. There was a 1.5-unit difference in recall between the marginal means for the LF and HF texts (30.83 and 29.31, respectively), with the note that the measurement scale involved one point for each meaningful proposition, and therefore a 1.5-unit difference was equivalent to a difference of 1.5 propositions.

For the number of correct responses as measured by the multiple-choice test, the analysis revealed exactly the same result that was obtained from analyzing the data of the recall test. That is, no significant main effects for reading condition or text type were

found, nor was there a reading condition \times text type interaction. Thus, it did not matter which reading condition the participants were in or which text they read; their performance was on average the same. In fact, the difference between the marginal means for reading condition and the difference between the marginal means for text was a fractional difference (only a 0.1 difference between the HF text marginal mean and the LF text marginal mean: 7.62 and 7.52, respectively). Note that the measurement scale involved one point for each correct response, with an ultimate score of 10 points.

In general, the results showed that the presence or absence of short vowels and diacritics in combination does not affect the reading process comprehension of skilled adult Arabic readers. In sum, the results demonstrated that the only variable that affects the reading process of skilled adult Arabic readers is word frequency.

Those findings of Seraye (2004) did not contribute positively to the subsequent investigations conducted by Abu-Rabia and others. For example, in a descriptive comparison study of dyslexics of Grade 8 ($n= 29$) and matching normal readers on both reading performance ($n= 29$ of Grade 6) and chronological age who had similar general ability performance ($n= 31$ of Grade 8), Abu-Rabia and Abu-Rahmoun (2012) compared the performance of the three groups on multiple tasks—phonological, orthographic, spelling, and reading comprehension tasks—under two reading conditions: vowelized and unvowelized. On the reading comprehension task, the participants were asked to read two different informational texts (only controlled and equalized on the number of lines), one fully vowelized and the other presented plain, which were chosen from their basal reader for Grade 8. The analysis revealed that all groups' participants benefitted from the presence of short vowels; that is, the participants performed better with the vowelized text ($M= 6.44$ vs. 5.33 for dyslexics, 7.66 vs. 4.83 for normal readers of matching reading level, and 9.48 vs. 8.32 for normal readers of matching chronological age, for the vowelized and unvowelized texts, respectively). Furthermore, the two normal groups comprehended the vowelized text much better than the dyslexic group. However, the size difference between the means, particularly for the dyslexics and the group of normal readers matching the dyslexics on age variable, was still a small difference, 1.11 and 1.16 units.

In line with Abu-Rabia's perspectives on the role of short vowels, Abu-Hamour et al. (2013) administered two tasks adopted from the curriculum-based management assessment in order to ensure its applicability in evaluating the reading performance of Arabic fifth graders. There were 131 fifth graders (divided into two groups: 89 of skilled reading ability, and 42 with struggling reading ability) and two tasks: oral reading fluency and silent reading comprehension. In the second task, which was designed to assess the reading comprehension of fifth graders in relation to the presence and absence of short vowels, the participants were given a text of 300 words with reading conditions (plain, partially vowelized, and fully vowelized) with every seventh word deleted and were asked to silently read the passage within three minutes and "restore" the right words from the three alternatives provided after every deleted word. Thus, the number of correctly restored words was the dependent variable in the study (42 were the maximum score). Thus, every participant was asked to read three texts under the three reading conditions and restore the deleted words from the three alternative options. Although the skilled readers scored higher than the struggling readers, both skilled and struggling readers performed better with the vowelized texts ($M= 24.19$, $SD= 5.64$ for skilled readers on the vowelized text and $M= 7.88$, $SD= 3.82$ for the plain text; $M= 14.19$, $SD= 5.51$, $M= 3.76$, $SD= 2.80$ for struggling readers on the vowelized and plain texts, respectively). Their justification for these results is that, unlike the situation with the plain text, vowelizing the text makes it transparent and reserves the attention needed for comprehension.

From the overall results, two factors were found to play a role in the Arabic reading process for reading time and reading comprehension: short vowels, as Abu-Rabia (1999; 2001), Abu-Rabia and Abu-Rahmoun (2012), and Abu-Hamour et al. (2013) observed; and word frequency, as observed by Seraye (2004). Therefore, the question is whether the effect of short vowels on reading comprehension, as found by Abu-Rabia (1999) and Abu-Hamour et al. (2013), holds with the correct categorization of less experienced readers, as represented by fourth graders—who are starting to read across the curriculum and for learning, and whose textbooks are written in a deep orthography, versus with second graders, who are still learning to read, or fifth graders, who were more advanced readers, when the appropriate experimental control is taken. Alternatively, should we find word frequency, as found in Seraye's (2004) study on Arab adults, to be the only variable that affects both populations' reading processes, with the more experienced readers represented by Arab adults (Seraye, 2004) and the less experienced readers represented by fourth graders in the current study? Therefore, a combination effect of both short vowels and word frequency on the reading comprehension process of fourth graders as they read connected texts is investigated. Such an investigation should accomplish the following aims: it should illustrate the role of short vowels, diacritics, and word frequency in the reading comprehension process of the less experienced readers, as represented by fourth graders, and subsequently tap into the results on how beginning readers' print and textbooks should be presented. Second, the results should help in building a model of the reading process in Arabic orthography by determining the factors that affect the process. Therefore, the goal of the current study is to assess the effect of short vowels per se, the word frequency per se, and the short vowels and word frequency in combination on the reading process of fourth graders' reading time and reading comprehension, as they read a connected text.

Therefore, two main questions were raised to represent the two main independent variables found to affect the reading process of Arabic texts: short vowels and word frequency. Since reading comprehension can be assessed as a process (reading time) and a product (correct responses), two sub-questions under each main question were constructed to assess the effect of short vowels and word frequency on the reading comprehension of skilled children Arab readers, as represented by fourth-grade students.

According to the previous observations, presenting the short vowels or the short vowels and diacritics in combination within an expository text should not affect the reading comprehension of fourth graders, as can be measured by the number of propositions they recall or the correct answers they score. The assumption is justified by the fact that skilled readers will use their linguistic knowledge, their knowledge of the *trilateral/quadrilateral* root that characterizes Arabic morphology, and the text context to compensate for the missing short vowels and diacritics from print (Abu-Rabia, 2002; Seraye, 2004; Abu-Rabia & Abu-Rahmoun, 2012). However, their reading process, in terms of the time they need to read the text, will be affected by the presence and absence of short vowels and diacritics: fourth graders should take more time to read a plain text than a vowelized one due to the heterophonic homographic phenomenon in Arabic words that, when starting a sentence, might garden-path the reader to the degree that it would force him/her to reread the sentence in order to choose the right word form (for more detail, see Experiment 2 in Seraye, 2004).

Further, it is assumed that word frequency might affect their reading time, but not their reading comprehension. Inserting 15–25% of the low-frequency words in the text should not affect their reading comprehension (Ryder & Hughes, 1985; Seraye, 2004), because the fourth graders would exploit their knowledge of the morphological roots of Arabic words, trilateral/quadrilateral roots, and the text context in constructing a textual

representation of the text they read. However, along with reading time, word frequency was found to affect Arab adult readers—the experienced readers (Seraye, 2004); subsequently, it is also expected to affect the less experienced readers, the fourth graders.

- 1) Do short vowels play a psychological role in the reading comprehension process of skilled Arab children as represented by fourth graders?
 - 1a) Is there a significant difference in the reading comprehension process, as measured by the reading time, of skilled fourth graders when reading a vowelized versus an unvowelized text?
 - 1b) Is there a significant difference in the reading comprehension product, as measured by the multiple-choice and recall tests, of skilled fourth graders when reading a vowelized versus an unvowelized text?
- 2) Does word frequency play a psychological role in the reading comprehension process of skilled Arab children, as represented by fourth graders?
 - 2a) Is there a significant difference in the reading comprehension process, as measured by reading time, of skilled fourth graders when reading a high-frequency versus a low-frequency text?
 - 2b) Is there a significant difference in the reading comprehension product, as measured by the multiple-choice and recall tests, of skilled Arab children when reading a high-frequency versus a low-frequency text?

Method

Experiment 1

Participants. One hundred and forty fourth-grade native Arab male students were chosen from three elementary public schools in Riyadh, Saudi Arabia. Their ages ranged between 9 and 10. They were offered R20 as compensation for their participation. All of them had normal vision and reported no learning or reading difficulties. The students' reading assessment scores from the first term were initially used to select suitable participants for the study, and other criteria—pre- and posttest procedures—were used to screen the participants, in terms of their reading proficiency level. Only those who had 40 or more correct readings from the 50-word list were included in the study. Further, a post-criteria judgment (reading a short passage) was administered in the second session for each participant to ensure that only those who expressed reading fluency were included in the experiment. Initially, 147 students were selected and then randomly divided into five groups, and then randomly into five reading conditions. Consent and admission were officially taken before administering the experiments. Out of the 147 participants who took part in the study, 6 participants were excluded from the study data due to either the post-criteria procedure, which revealed that they were under grade level in reading, or to their moving from the schools during the experiment

Materials. The use of controlled texts instead of familiar and different texts was necessary to address the questionable controlling issues observed in previous studies; thus, two long expository Arabic texts were constructed for experiment 1: one of high frequency (HF) and the other of low frequency (LF). To ensure equality between the two texts, a high-frequency text was constructed, and its low-frequency counterpart was created using a matching process. Other than the word frequency, the two texts were equalized on all aspects, including sentence structure, length, neighboring word size, and even on the number of words and morphemes, due to the affixation feature of the Arabic morphological system. In terms of the test's organizing structure, the event spots, pronoun names, and identities of the characters were replaced with other event spots,

pronoun names, and identities (see Seraye (2004) for more details on the matching technique). Thus, there were two texts of high and low frequency, respectively (each text contained 166 words and 320 morphemes). Sixteen words from the HF text (10% of the words in the text) were replaced with their low-frequency synonyms. Five versions of each text were created to control the short vowels and diacritics, as well as isolate the effects of the short vowels per se: one version was left plain—that is, unvowelized; the second was fully consonantly presented by providing the text with only the diacritic *shaddah*, (َ); in the third version, the text was presented with both short vowels and *shaddah*; with the fourth version, the text was supplemented with short vowels only and without any diacritics; finally, for a controlling procedure, the text in the fifth version was provided with the wrong short vowels and *shaddah* so that, if ignored and not assembled with the consonants, the text would resemble the plain text that the Arab readers were exposed to (see Table 1).

Table 1. Reading conditions

Reading condition	Arabic Script
1 Plain	عبدالعزيز يعيش هو وعائلته في قرية من ... السعودية
2 Fully consonantly: with shaddah only	عبدالعزيز يعيش هو وعائلته في قرية من ... السَّعُودِيَّة
3 short vowels with shaddah	عبدالعزيز يعيش هو وعائلته في قرية من ... السَّعُودِيَّة
4 Only short vowels	عبدالعزيز يعيش هو وعائلته في قرية من ... السَّعُودِيَّة
5 wrongly vowelized and shaddah	عبدالعزيز يعيش هو وعائلته في قرية من ... السَّعُودِيَّة

Further, a short passage of 100 words, written in both shallow and deep orthography, and a fifty-word list were constructed to assess the participants' reading proficiency level for the inclusion and exclusion criteria. The texts and word list were assessed and judged by experts in the Arabic teaching field, and by primary-grade reading teachers.

Measures. Three types of data were collected: the reading time in which the participant read the text, in milliseconds; and reading comprehension, as assessed by the recalling test based on the number of propositions recalled and by the correct answers based on the 10-item multiple-choice test. Both tests were judged by experts in the Arabic teaching field, and by primary grade reading teachers for their content validity, format, accuracy, etc. Both tests were piloted before the actual experiment. The recall test's reliability was examined using rater judgment, and the correlation coefficient was found to be $r = 0.97$. For the multiple-choice test, the alpha value was 0.67 for the HF test and 0.65 for the LF test. Further, a congruent validity was adopted, and the Pearson correlation coefficients between the recall and the multiple-choice tests were found to be significant ($r = 0.70$ for the HF test and $r = 0.69$ for the LF test).

Design. A split-plot factorial mixed 5 x 2 design was adopted for the current study (Kirk, 1982), with one between-subject factor (the five reading conditions) and one within-subject factor (the text type: HF vs. LF), in order to determine the role of each independent factor per se and in combination on the fourth graders' reading comprehension as they read a connected text. Counterbalance procedures were conducted between texts within every group in order to avoid the order effect.

Procedure. As explained before, previous studies do not to control for the carry-over effect from having the two texts read simultaneously, or from having a short time elapse

between the reading sessions. In one of Abu-Rabia (1999) experiments, for example, the task was given in two sessions with two days elapsing between them. Carry-over effect is possible in such a situation. Therefore, in order for the current study to have a controlled procedure, the carry-over and order effects were taken into account through counterbalancing and 14-20-day time interval between the experimental sessions (Seraye, 2004). Thus, in experiment 1, the participants were asked to read the two texts (the HF and LF texts) in two separate sessions, at intervals between 14 to 20 days. The tests were given in an empty, quiet room in the participants' schools. In session one, the participant was asked to read one of the texts for reading comprehension (either HF or LF) silently and at his pace; he was asked to read the other text in the second session. Directly following each reading, the participant was asked to recall the text he just read (prompts were used to prevent the participant from being selective in his recalling). The time it took each participant to complete the reading was calculated in milliseconds, and his recall was recorded. After the recalling task, the participant was given the multiple-choice test and instructed to avoid any guessing responses as well as to answer the questions according to what he read. The same procedure was followed for the second session, except that the participant was given a short passage at the end of the session to read orally and accurately, in order to double check the participant's reading skill, which would then be included or excluded from the data analysis. However, an additional procedure was taken for the group that was asked to read the wrongly vowelized and *shaddah* text. These participants were informed about the wrong short vowels and *shaddah* prior to reading. The order of text presentation was rotated within every group to counterbalance the texts and reading conditions. Both experiments were conducted and administered by the researcher.

Results. In order to answer the two questions and sub-questions proposed (a and b), three dependent variables were collected: reading time, as measured in milliseconds; the number of propositions, as assessed by the recall test; and finally, the number of correct answers, as assessed by the multiple-choice test. A multivariate analysis (a two-way repeated-measures analysis of variance) was adopted to determine whether there was a main effect for the short vowels per se, a main effect for the word frequency per se, or an interaction between the two independent variables, short vowels and word frequency, on the reading comprehension of the fourth graders.

Reading Time

For questions 1a and 2a on the reading time data ("Is there a significant difference in the reading process, as measured by reading time, among fourth graders when reading a vowelized versus an unvowelized text, and when reading a high-frequency versus low-frequency text?"), the analysis on the reading time data revealed a significant main effect for text type only (HF vs. LF), $F(1, 135) = 5.59, p = .019, \eta^2 = 0.04$, and not for reading condition $F(4, 135) = 0.277, p = .893$, nor there was a significant interaction between the text type and reading condition, $F(4, 135) = 0.878, p = .479$. However, the post hoc analysis conducted on each pair, using Tukey and Scheffe tests, did not show any significant differences between the compared pairs. Subsequently, despite the reading condition the participant was in, he would always take more time to read the low-frequency text than the high-frequency text. The participants spent 160.60 seconds reading the LF text and 151.53 seconds reading the HF text (see Table 2). Further, the pair means in Table 2 for the five reading conditions show that the participants in reading condition 3—compared with the other groups, in which short vowels and *shaddah* were provided with the text—spent less time, on average, reading the two texts (146.07 and 148.68 milliseconds for the HF and LF texts, respectively). However, both groups, the plain one and the vowelized one, spent on average the same time to read the HF text (146.87 and 146.07 respectively). This

result is inconsistent with the proposed assumption that beginning readers should require more time to read a plain text than to a vowelized text due to the heterophonic homographic words in Arabic, particularly with the garden-path sentences in the text.

The partial eta squared value (η^2) was calculated as a measure of effect size for the text type variable, the word frequency. Its value of 0.04 is considered to be of small to medium effect size (Kotrlík & Williams, 2003). It indicates that 4 % of the total variance in the dependent variable, the reading time, is attributed to the manipulated word frequency.

Table 2. Cell and marginal means on the reading time test by reading condition and text

Group	Reading Condition	Text				
		High Freq.		Low Freq.		Marginal
		M	SD	M	SD	
1	Plain: no short vowels or <i>shaddah</i>	146.87	69.49	156.33	73.67	151.60
2	Fully consonantly: with <i>shaddah</i> only	150.96	79.38	173.32	111.70	162.14
3	Vowelized: short vowels and <i>shaddah</i>	146.07	76.63	148.68	67.77	147.38
4	Vowelized: short vowels, with no <i>shaddah</i>	162.46	87.20	169.64	79.23	166.05
5	Wrongly vowelized: wrong short vowels and <i>shaddah</i>	151.62	78.01	154.92	82.01	153.27
	Marginal Means	151.53	77.32	160.60	83.45	156.06

Reading Comprehension

For questions 1b and 2b on the recalling test data (“Is there a significant difference in the reading comprehension, as measured by the number of propositions, of fourth graders when reading a vowelized versus an unvowelized text, and when reading a high-frequency versus a low-frequency text?”), the analysis on the number of propositions in general did not reveal any significant results: there were no main effects for text type, $F(1, 128) = .022$, $p = .883$, or reading condition, $F(4, 128) = 0.371$, $p = .829$, nor there was a significant interaction between text type and reading condition, $F(4, 128) = 0.508$, $p = .730$. Regardless of the text type and reading condition, the participants on average performed the same in recalling the texts’ propositions. In fact, the differences between the marginal means for the text type and between the pair means for every reading condition, as shown in Table 3, are very small, when we take into account that the measurement scale adopted in the study involved one point for each meaningful proposition recalled. Therefore, a 0.12 difference between the marginal means of the HF and LF texts (14.46 and 14.58, respectively) and the roughly one-proposition difference between the pair means for every reading condition (Table 3) are equivalent to a difference of 0.12, and one proposition, respectively.

Table 3. Cell and marginal means on the recall test by reading condition and text

Reading Condition	Text				Marginal
	High Freq.		Low Freq.		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
1	13.90	9.97	13.74	10.54	13.82
2	14.89	8.28	15.19	9.45	15.04
3	15.48	7.65	14.44	6.30	14.96
4	14.44	9.61	14.63	8.89	14.54
5	13.60	9.23	14.92	8.57	14.26
Marginal Means	14.46	8.95	14.58	8.75	14.52

For questions 1b and 2b on the multiple-choice data (“Are there any significant differences in the reading comprehension, as measured by the number of correct answers, of fourth graders when they read a vowelized versus an unvowelized text, and when they read a high-frequency versus low-frequency text?”), the analysis on the number of correct answers data revealed a significant main effect for text type (HF vs. LF) $F(1, 134) = 21.80$, $p = .000$, $\eta^2 = 0.14$, but not for reading condition $F(4, 134) = 0.28$, $p = .89$, nor for the interaction between text type and reading condition, $F(4, 134) = 0.61$, $p = .65$ (Table 4). Examining the marginal means for the HF and LF texts shows that the participants on average scored higher on the HF text, with a mean = 6.44, versus a mean = 5.56 for the LF text. However, even with the reported large effect size value of 0.14 (Kotrlík & Williams, 2003), the marginal means shows only a 0.88 unit difference, which is a very slight difference when the measurement scale adopted is taken into account. The current study adopted a measurement scale that involves one point for each correct answer; thus, a 0.88 unit difference is equivalent to a difference of 0.88 correct answer points. However, the post hoc analysis conducted on each pair, using Tukey and Scheffe tests, did not show any significant differences between the pairs of comparison.

The partial eta squared value (η^2) of 0.14 indicates that 14 % of the total variance in the dependent variable, number of correct answers, is accounted for by the manipulated word frequency variable.

Table 4. Cell and marginal means on the multiple-choice test by reading condition and text

Reading Condition	Text				Marginal
	High Freq.		Low Freq.		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
1	6.81	2.52	5.42	2.17	6.11
2	6.43	2.53	5.79	2.60	6.11
3	6.60	2.22	5.70	2.20	6.15
4	6.29	2.32	5.32	2.55	5.80
5	6.08	2.17	5.58	2.10	5.83
Marginal Means	6.44	2.35	5.56	2.33	6.00

General Results

Two main findings were revealed by the analysis: one is that vowelization is neither attributed positively nor negatively to the reading process of beginning readers, as represented by the fourth-grade students. That is, the supplemented vowelization did not affect their reading process for comprehension, as was measured by the time it took the fourth grader to read the text, or by the number of propositions recalled and the correct responses scored. Additionally, the only factor that played a role in the reading process of beginning readers was word frequency. Its role was observed with the reading time, and with the reading comprehension, as assessed by the correct responses scored, although its effect might not be practically affected due to the observed sizeable difference between the means and the measurement scales employed in the study. Furthermore, insignificant results were observed with the other comprehension assessment procedure—the recall test—which did not show such a difference. Such an effect of word frequency on the reading comprehension process of beginning Arabic readers indicates that students' reading experience, as reflected by word familiarity, in terms of its frequency, was obviously involved in such a process. This subsequently drew the researcher's attention to investigate the role of reading experience among the beginning readers, in terms of the type of print exposure those readers were familiar with. That is, the extent to which the familiarity with the print type (text representation) that the beginning Arabic readers were exposed to would affect the way they build a mental representation of the text. As was earlier laid out, beginning Arabic readers' performance did not differ according to the type of text representation, in terms of vowelization and diacriticizing. Their performance was the same, on average, whether they read a plain text or a vowelized text. However, in order for the researcher to isolate the effectiveness of short vowels per se, a strict sound controlling procedure ought to be followed, even if this procedure would lead the researcher to include unusual reading conditions, in which the texts are presented in a way that beginning Arabic readers might not be used to. For example, in one of the reading conditions, the text was supplemented with only short vowels, and no diacritics, such as *shaddah* or *skun*, were included. This raised a concern over the manipulation followed in Experiment 1 for control purposes: whether the manipulation of short vowels and *shaddah* (the third reading condition in the design) without the *skun* diacritic was insufficient to exclude the role of short vowels in the reading process of beginning readers, especially when we know that the term "vowelizing" (which should mean "providing the

text with short vowels only”), in a repeated uncontrolled procedure, would add *skun* (which means void of any short vowels) as part of the vowelization. Thus, adding the *skun* and *shaddah* diacritics along with the short vowels to the consonants when vowelizing a text would help to assess whether the Arab children’s reading process, particularly reading comprehension, is a habitual act that is directed, not only by the presence and absence of short vowels but rather by the diacritics, which represent both the presence and absence of the missing short vowels, the diacritics, *skun*, and *shaddah*, from the Arabic orthography. In other words, would the reading comprehension process of beginning readers be affected by how the text is printed and exposed to those children, rather than claiming that the effect should be attributed to short vowels alone? Therefore, a follow-up experiment in which the vowelization was manipulated differently was necessary in order to respond to such a concern. The experiment added another reading condition in which the text’s consonants were fully vowelized and discretized (to adhere to how previous studies controlled the reading conditions). Accordingly, a reading condition in which the text is presented in a familiar form that beginning readers of fourth grade have experienced should help in determining the extent to which reading experience is the operating factor in their reading comprehension process. Therefore, a reading condition in which the text was provided with short vowels, *shaddah*, and *skun* was constructed and tested.

Experiment 2

Participants. A different sample of 38 fourth graders drawn from exactly the same population in Experiment 1 participated voluntarily in this experiment. Only the data of 25 participants were analyzed due to students moving or transferring, or attendance circumstances. They were offered R 20 as compensation for their participation. None of them had ever participated in a similar study.

Materials. The same methodology adopted in Experiment 1 was applied in Experiment 2, in terms of text formats, measures, design and procedure, with exceptions only in how the two texts, HF and LF, were presented. That is, the same texts were supplemented with short vowels, *shaddah*, and *skun* (fully vowelized and diacriticizing). The vowelization and diacriticizing of the two texts were assessed and judged by a team of Arabic experts and reading teachers in primary grades (Table 5).

Table 5. Reading conditions

6	fully vowelized and diacriticized	عَبْدُ الْعَزِيزِ يَعِيشُ هُوَ وَ عَائِلَتُهُ فِي قَرْيَةٍ مِنْ ... السَّعُودِيَّةِ
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Results. As can be seen in Table 6, the participants spent 133.76 seconds on average reading the high-frequency text and 134.56 reading the low-frequency text; note the small difference between the two means (0.8 milliseconds difference). However, incorporating the current data of the fully vowelized and diacriticized reading condition with the previous reading conditions and reanalyzing the data show the following results: there were no significant main effects were found for text type, $F(1, 160) = .817, p = .37$, or for reading condition $F(5, 160) = 0.62, p = .68$, nor there was a significant interaction between text type and reading condition, $F(5, 160) = 0.79, p = .56$. Subsequently, the participants’ performance, in terms of their reading time for the two texts, was on average the same. However, observing the marginal means and the mean values for both texts (HF and LF) for all groups together and for group 6 individually shows that the participants, in general, took longer to read the low-frequency text than the high-frequency text (marginal means: 148.62 and 156.24, respectively; these values are after summing up the values for all reading conditions). Further, the participants in reading condition 6 (group 6) took less time on average to read both texts, compared with the other groups (133.76 seconds to

read the high-frequency text and 134.56 to read the low-frequency text; see Tables 2 and 6).

Table 6. Cell and marginal means on the reading time test by reading condition and text for group 6

Reading Condition	Text				Marginal
	High Freq.		Low Freq.		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6	133.76	51.34	134.56	52.05	134.16

Recall Test

As can be seen in Table 7, the participants on average recalled 16.88 propositions in the high-frequency text, and 15.72 propositions in the low-frequency text; note the small difference between the two means and the measurement unit in the scale (only 1.16 propositions difference between the means). However, incorporating this data of the fully vowelized and diacriticized reading condition with the previous reading conditions and reanalyzing the data show the following results: no significant main effects were found for text type, $F(1, 156) = 0.03, p = 0.87$, or for reading condition, $F(5, 156) = 0.29, p = 0.92$, nor there was a significant interaction between text type and reading condition, $F(5, 156) = 0.40, p = 0.85$. Subsequently, their recalling was not affected by the type of text they read or the reading condition they were in; their performances on average were the same.

The marginal means (Table 7) show that the groups in general scored the same (marginal means: 14.87 and 14.77 for HF and LF, respectively; these values are after summing up the values for all reading conditions), with a 0.09 difference, which means a 0.09 unit difference equivalent to a difference of 0.09 propositions. However, the data analysis shows that the participants in group 6 recalled, to some degree, more propositions in both texts than the participants in the other reading conditions (16.88 in the high-frequency text and 15.72 in the low-frequency text); this was particularly noticeable with the low-frequency text. However, there was only a 1.16 unit difference between the two marginal means for the LF and HF texts, which equals a 1.16 unit difference.

Table 7. Cell and marginal means on the recall test by reading condition and text for group 6

Reading Condition	Text				Marginal
	High Freq.		Low Freq.		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6	16.88	9.31	15.72	9.43	16.30

The Multiple-Choice Test

The mean values of correct answers showed that the participants on average scored higher on the HF text than on the LF text (6.84 for the HF text and 6.48 for the low frequency text); note the very small difference between the two means (the 0.36 difference is equivalent to a difference of 0.36 correct answer points). However, incorporating this data of the fully vowelized and diacriticized reading condition with the previous reading conditions and reanalyzing the data show the following results: a significant main effect was found for text type, $F(1, 159) = 19.91, p = .000, \eta^2 = 0.111$, but not for reading condition $F(5, 159) = 0.59, p = .71$. Further, there was no significant interaction between text type and reading condition, $F(5, 159) = 0.76, p = .58$. Examining the means shows that the participants on average scored higher on the HF text than on the LF text (marginal means: 6.51 and 5.72, respectively; these values are after summing up the values for all reading conditions). Note that there was only a 0.79 unit difference between the marginal means for the LF and HF texts, and that the measurement scale involved one point for each correct answer; therefore, a 0.79 unit difference was equivalent to a difference of 0.79 correct answer points. However, conducting a post hoc analysis on every pair using both Scheffe and Tukey tests did not show any significant differences between the compared pairs. That is, the participants did well on the high-frequency text, regardless of the reading condition they were in and which text they read first. Further, generally speaking, the participants in group 6—the reading condition in which the participants read a fully vowelized and diacriticized text—scored higher, to some degree. This was particularly noticeable with the low-frequency text, compared with the other groups (6.84 and 6.48 for the HF and LF texts, respectively), but still with very close means, given the measurement unit of the scale, in which each correct answer was given one point (Table 8).

The reported partial eta squared value, η^2 , is considered to be a value of a medium effect size (Kotrlík & Williams, 2003), and indicates that 11 % of the total variance in the dependent variable, number of correct answers, is attributed to word frequency variable.

Table 8. Cell and marginal means on the multiple-choice test by reading condition and text for group 6

Reading Condition	Text				Marginal
	High Freq.		Low Freq.		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6	6.84	2.29	6.48	2.14	6.66

General Results

Despite the non-significant results observed over the reading time variable after adding group 6's data to the analysis, the marginal means between the text, and the pair of means for each group did show noticeable differences in the amount of reading time between the texts (see Tables 2 and 6). Fourth graders always took more time to read texts in which 10% of its words were of low-frequency. Thus, we could say that word frequency affects the reading process of the less experienced and skilled Arab readers (beginning readers), as reflected in the reading time it takes them to read a text. Further, the supplemented vowelization did not affect their reading process for comprehension, as was measured by the time it took the fourth grader to read the text, or by the number of propositions

recalled and the correct responses scored. The statistically nonsignificant effect of the reading condition variable on the three dependent variables, reading time, number of propositions recalled, and correct responses scored, was trivial. The Partial Eta Squared value, η^2 , was found to be between 0.011 and 0.008, which means that the reading condition variable accounts for 1% to 0.8 % of the variance of those dependent variables. Additionally, the only factor that played a role in the reading process of beginning readers was word frequency. Its role was observed with the reading time, and with the reading comprehension, as assessed by the correct responses scored. Although its effect might not be practically affected due to the observed sizeable difference between the means and the measurement scales employed in the study, a percentage proportion of 11 to 14 % of variance in the number of correct answers is explained by the manipulated word frequency factor.

However, giving beginning Arabic readers a plain text, with 10% percentage of its vocabulary of low frequency, did not affect their recalling of the text's propositions, nor did it affect severely their understanding of the text, as was observed from the close mean values.

Another observation worth mentioning is that it took the less experienced Arabic readers less time to read texts that were both vowelized and diacriticized, as can be observed in Group 6, which was asked to read the versions of texts with short vowels, *shaddah*, and *skun* together; this result is not in agreement with a previous study by Al-Fahid (2000), which claimed (from examining the reading rates of some individual participants in his study) that adding short vowels and diacritics to the consonants prolongs the reading process of Arab adults as they read fully diacriticized text. Further, it was noticed that Group 6 had smaller differences between the pairs of means (the high- and low-frequency texts) for each reading condition (133.76 for HF; 134.56 for LF). Can we say that the expected effect of the word frequency in processing a text diminishes when the orthography of the texts is transparent? Oppositely, when the orthography of the texts presented is plain or partially presented, does the effect of word frequency become larger?

Further, the reading process of the low-frequency texts becomes much longer when the orthographies of the texts only present consonants, have only short vowels presented, or have incorrect vowels presented (see Table 2). The readers took 173.32 seconds to read the only consonantly presented text; 169.64 seconds to read the texts with only short vowels presented; and 154.92 seconds to read the wrongly vowelized text. Therefore, can we say that children's Arabic reading learning and reading experience were accustomed to either plain or fully vowelized and diacriticized texts (sight words), and that they were affected by the experience of their reading exposition to print, which they brought to the reading conditions?

This finding is in accordance with a previous study (Seraye, 2004) conducted on Arab adult readers when reading connected texts, which showed that the only variable that played a role in their reading processing as reflected in the reading time it takes them to read a text was word frequency. However, in terms of reading comprehension, as can be realized by the products of their reading process, their performance in recalling more information from the text and getting the correct responses, showed, on the surface, conflicting results. However, examining the analysis closely resolves such a conflict. The analysis reveals that the reading comprehension of beginning Arabic readers was not affected by missing short vowels from text, nor it was affected by the low frequency: their performance, on average, was always the same. This conclusion is more obvious when the beginning Arabic readers were asked to recall as many propositions, as they could. However, this was not always the case. In the multiple choice test, the result showed that

beginning Arabic readers' reading comprehension was correlated with word frequency, and not with the presence or absence of short vowels. On average, they scored higher with the high-frequency texts. That is, they comprehended high-frequency texts better than the low-frequency ones. However, the differences between every pair of means for all groups were still very small. Further, the post hoc analyses conducted on those pairs of means did not reveal any significant differences between the pairs of means. Furthermore, even when accepting the small differences found between the means (bowing to the reported large effect size), the average scores of 6.51 for the high-frequency text and 5.72 for the low-frequency one are far from the maximum score of 10 in the multiple-choice test, which indicates that their performance is obviously average, if not quite weak.

In conclusion, the current data does not support attributing the high scores in the multiple choice data to the presence of short vowels (even to the short vowels and diacritics in combination). This finding is not in accordance with previous studies, such as Abu-Rabia's (1999) and (2001) studies, as well as Shimron and Sivan (1994) study, which all claimed—except with caution, as did Shimron and Sivan's study in their comments on the results—that short vowels have a positive effect on the reading comprehension of both adults and children (as represented by second graders), although they neither manipulated the short vowels to a degree that should isolate their effect, nor did they reinterpret, cautiously, the slight difference found between the means. Such a conflict can be explained in terms of the controlling procedures of the reading conditions and the reading texts used, which did not take into account that short vowels and diacritics are different forms that represent different aspects of the orthography, nor did it take into account the involvement of word frequency in text reading difficulty and thus the necessity of having similar texts (as can be achieved by using a matching procedure) in their experimental design. Further, even after accepting their experimental design, as mentioned before, the differences between the means reported for the groups that read the vowelized text versus those that read the unvowelized one are very small, once we take the measurement unit into account. In fact, some of the researchers (Shimron & Sivan, 1994) stated explicitly that the difference was nearly significant, since the $p = 0.05$.

On the other hand, Abu-Hamour's (2013) study showed that fifth-grade students, both poor and skilled, performed better with the vowelized text, and the benefit was higher for the skilled readers. The difference between the means was large enough to attribute such a difference to the dependent variable (24.19 for the vowelized text vs. 7.88 for the unvowelized one). However, there were still some questionable observations in the analysis. For example, the skilled students scored 24.19 on average, compared with 7.88; however, the score range was from 18 to 43, an indication that that 24.19 is still far from the maximum score; in fact, it is almost close to the minimum score (18). Second, the researchers manipulated the diacritics to be part of the short vowels and considered the fully vowelized text to be supplemented with short vowels and diacritics. In fact, they even considered the case markings to be part of this vowelization. Therefore, attributing the positive results to the presence of short vowels is neither accurate nor valid. The researchers did not isolate the role of short vowels accurately. Further, the authors used a within-subject design and different texts, and word frequency was not manipulated, despite the fact that word frequency is implicated in the text-reading process (Seraye, 2004).

General Discussion

The only variable implicated in the less experienced/skilled readers' reading process, as represented by fourth graders, was word frequency, which was obvious in the reading time and reading comprehension product data as measured by the number of correct answers. Indeed, the effect of word frequency was also found with the more experienced

readers, as represented by Arab adult readers at the graduate and postgraduate academic levels (Seraye, 2004). The opaqueness and depth of the texts, when presented without suitable short vowels and diacritics, did not affect the children's reading process, as reflected in the time load needed to process the texts, nor did it interact with the type of text they read, in terms of word frequency. Rahbari and Senechal (2009) arrived at the conclusion that "it is not the orthographic depth of a language, but it is the reading skills, or more precisely the experience with reading words, as well as a task demand that affect processes used to read" (p. 523).

Previous literature, in general, has demonstrated that sensitivity to word frequency was found in tasks such as word naming and word recognition. High-frequency words are read more quickly than low-frequency words, which has been a consistent finding for different orthographies that both differ from and resemble Arabic orthography (Seraye, 2004, for Arabic; Raman & Baluch for Turkish, 2001; Baluch, 1996, for Persian).

In fact, well-established research on eye movement has shown that the fixation durations for high-frequency words while reading a sentence or passage are shorter than the fixation durations for low-frequency words; this was documented for both adults and children readers (e.g., Joseph, Nation, & Liversedge, 2013; Rayner et al., 2006; Rayner & Duffy, 1986; Rayner, Sereno, & Raney, 1996; Sereno & Rayner, 2000). Similarly, predictable words take short duration times to fixate, compared to their non-predictable counterparts (e.g., Balota, Pollatsek, & Rayner, 1985; Mielle, Sparrow, & Sereno, 2007; Rayner & Well, 1996).

Thus, these higher time fixations for low-frequency words are assumed to add more time to the process of reading the text and subsequently prolong its reading time process. This effect was more salient due to the controlling procedure for word frequency as a variable adopted in the current study by intentionally inserting low-frequency counterpart words in one of the versions of the text. Therefore, we can say that reader's experience, as reflected in his/her lexical representation of the word—word familiarity, specifically—plays a major role in the reading process of the less experienced Arabic readers, as it did with the more experienced Arabic readers (e.g., Seraye, 2004).

Such an effect should not be surprising, since individual words and their characteristics were found to play a central role in the reading process of different orthographies (see for example the three experimental studies by Seraye, 2004, for Arabic; and Rahbari and Senechal, 2009, for Persian). The ease and speed in accessing the mental lexicon from memory during reading affects the reader's reading fluency and comprehension (Perfetti, 2007).

This finding can be justified by the explanation given by the so called restricted-interactive theory proposed by Perfetti (1994), which presents—in the researcher's opinion—a suitable framework for explaining the effects of the reader's experience, as reflected in word familiarity, on the reading processing of texts. Perfetti (1994) stated that "learning to read is the acquisition of increasing numbers of orthographically addressable words (quantity acquisition) and the alteration of individual representations along quality dimensions: specificity and redundancy" (p. 857). His theory is based on two principles: specificity (an increase in the number of position-correct specific letters in a representation) and redundancy (the increasing establishment of redundant phonemic representations), which would lead to a quality word representation in a reader's mind and subsequently to a resource-cheap reading. As noted by Perfetti (1994), "[A]s individual words become fully specified and redundant, they move from the functional lexicon, which allows reading, to the autonomous lexicon, which allows resource-cheap

reading” (p. 857). In Macleod and Kampe’s (1996) words, “automaticity is a direct function of experience” (p. 132).

However, the effect of word frequency on the reading process was found to be equally present, regardless of the boundary of exposure to print, whether limited, as was the case with fourth graders, versus unlimited, as was the case with skilled adult readers at the undergraduate and graduate academic levels.

For reading comprehension, as assessed by the two tests measuring the number of propositions and the correct answers, the absence and presence of short vowels and diacritics did not implicate the reading comprehension process of the less experienced readers, as represented by the fourth graders. Further, their reading comprehension, although found to be significantly correlated with word frequency, was not severely affected, as can be seen from the closeness of the mean values. Such a finding can be attributed to the fact that beginning Arabic readers use their knowledge of the morphological aspects of the language in comprehending the text; indeed, they exploit their knowledge of the *trilateral/quadrilateral* root of Arabic words that is needed to comprehend the text. A study by Badry (1982) arrived at the conclusion that Arab Moroccan children from ages 3 to 6 “are aware of the underlying morphological root in their spoken language, and this awareness was reflected in the production stage of their acquisition” (Seraye, 2004, p. 83). Further, in their comparison study between dyslexics and normal readers in sixth and eighth grades, Abu Rabia and Abu-Rahmoun (2012) reached to the conclusion that, while reading, both dyslexic and normal readers rely heavily on the morphological aspects of the Arabic language—particularly the root. This reliance on the roots of Arabic words appears more clearly with the reading materials that were presented unvowelized, particularly observed with the normal Arab readers (Abu Rabia & Abu-Rahmoun, 2012). Their conclusive statement is that, “[r]oots of words are the key to initial lexical access” (Abu Rabia & Abu-Rahmoun, 2012, p. 1265). Furthermore, well-documented research in languages with alphabetic-based writing systems revealed that children in fifth grade and up employ morphological information to infer the meanings of unfamiliar and low-frequency words while reading (McCutchen & Logan, 2011).

Therefore, by combining the findings in the current investigation with those from previous research, we can reach a conclusive statement: in the absence of short vowels and diacritics from print, beginning readers still can compensate for such an absence by relying on their linguistic knowledge, particularly the morphological roots of Arabic words, and the textual context to understand the text.

Limitations

The current study’s findings should be restricted to only fourth graders, particularly male fourth graders population, whose reading levels are at the fourth-grade instruction reading level, and should not be generalized to fourth graders in general. Further, the interpretation should be restricted to students who have mastered the reading skill and just started to read for learning across the curriculum. Therefore, the roles of vowelization (short vowels plus diacritics) and word frequency in the reading process of less-skilled fourth graders should be assessed for two reasons: to help determine the degree to which exposing such readers to plain reading materials would affect their reading comprehension, and subsequently, whether they would be able to compensate for such an effect by exploiting their knowledge of the morphological roots of Arabic language.

Additional caution should be taken into account, regarding the finding of no explicit additional benefits regarding the presence of short vowels and diacritics for the reading comprehension of Arabic readers, both experienced and less experienced readers. The

benefits should be interpreted in the context of silent-mode reading tasks and not be extended to other reading modes such as reading accuracy tasks.

Recommendations

The current study targeted beginning readers, as represented by skilled fourth-grade male students; thus, replicating the same procedure for non-skilled readers is recommended. Further, due to the segregated nature of the education system in Saudi Arabia, replicating the same procedure for female fourth graders of skilled and non-skilled reading levels is encouraged. Additionally, according to my aforementioned explanation, the small subscripts and superscripts in written Arabic words do not represent only short vowels, but also diacritics (such as *skun*, *shaddah*, *maddah*) as well as case ending markers that take the shape of short vowels and *skun*. Therefore, the term “fully vowelized”, as reported in the current and previous studies, needs to be given a new meaning when investigating its effect. That is, the role of short vowels needs not be investigated separately from the other diacritics included in the fully vowelized reading condition.



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