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English Spelling Knowledge and Word Reading Skills of Arabic and Japanese ESL Learners

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Abstract

Previous research has demonstrated that L1 orthographic features and literacy experiences may influence some lower-level processing skills in L2 literacy development. The goal of this study is to expand understanding of this influence on the development of ESL word reading and spelling skills among a group of 49 intermediate-level Arabic learners of English as a Second Language (ESL) and a corresponding comparison group of 50 Japanese ESL learners. Data were collected on a spelling test, a reading comprehension test, and a series of word reading tasks which include reading words with a missing vowel, reading words with a missing consonant, reading a regular wordlist, and reading pseudo-words. The results indicated that at the same level of reading comprehension, the Japanese ESL group performed significantly better than the Arabic group on spelling and all the word reading measures except the accuracy and speed in reading words with a missing vowel. The study also found that the Arabic ESL learners were more adversely affected in both accuracy and speed of reading words with a missing consonant compared with reading words with a missing vowel. Furthermore, accuracy in reading words with a missing consonant was found to be the best predictor of reading comprehension for the Arabic group but for the Japanese group, spelling and accuracy in reading words with a missing consonant were both significant predictors of ESL reading comprehension. The findings were discussed in relation to previous research. Pedagogical implications were also addressed.

Keywords

ESL reading comprehension, spelling knowledge, word reading skills, L1 orthography

1. Introduction

The development of literacy skills is a long and complex process, which involves the development of literacy-related precursor skills, word-level skills, and text-level skills. Literacy-related precursor skills include skills such as print awareness, phonemic awareness, and knowledge of basic representational units in the writing system, for example, letters in the alphabet. Word-level skills include skills in word reading and spelling, while text-level skills include fluency, reading comprehension, and writing skills. Among the three types of skills, word-level skills are considered as foundational lower-level skills in literacy development (Grabe, 2009). Without well-developed lower-level word reading and spelling skills, the achievement of high-level reading fluency or comprehension skills will be difficult.

Skilled word reading involves a combination of orthographic and phonological processes. Orthographic knowledge is "the general ability to learn, store, and use information about the orthographic form of words" (Martin, 2017, p. 279) and is the conscious and unconscious knowledge of spelling patterns and writing conventions (Stanovich & West, 1989), while phonological knowledge is "the ability to segment and manipulate phonological units" (Martin, 2017, p. 280). With both orthographic and phonological knowledge, English speakers know that *rain*, *reign*, and *rein* are different English words even though they sound the same, and can tell which letter combinations may indicate a possible English word, for example, *boudel* makes a possible English word based on English phonological rules but *ebdluo* does not. Similarly, spelling involves both phonological and orthographic processing skills. While both skills demonstrate the correspondence between graphemes and phonemes, word recognition is often seen as a decoding process, which transfers graphemes into phonemes. Spelling, on the other hand, is an encoding process, which transfers phonemes into graphemes (i.e., letters). In addition to phonological and orthographic knowledge, visual memory plays an important role in spelling, which is closely related to orthographic skills.

Previous research evidence demonstrates that L1 orthographic features may influence some lower-level processing skills in L2 literacy development. Eye movements and strategies in visual/text search in L2 vary by L1 (e.g., Green et al., 1996; Green & Meara, 1987; Ktori & Pitchford, 2008; Randall & Meara, 1988). Language learners with various L1 backgrounds have different sensitivity to sub-lexical characteristics (letter frequency, sequence legality), whole-word spellings and orthographic shapes (e.g., Akamatsu, 1999, 2003; Fender, 2003; Haynes & Carr, 1990; Koda, 1999; Wang & Koda, 2005) and different sensitivity to different types of graphemes. Understanding variations in learners' orthographic knowledge and processing strategies in word reading is important because we need to understand development of this crucial skill in L2. If ability varies by L1 background, understanding these differences will help us understand cognitive underpinnings of text processing and find promising areas for pedagogical development and differentiated instruction. Therefore, the goal of the current study is to expand understanding of the possible influence of L1 orthographic knowledge on the development of ESL word reading and spelling skills through a cross-linguistic study with two ESL groups, Arabic and Japanese native speakers.

2. Literature Review

2.1 Word Reading Efficiency

Word reading efficiency refers to the ability of readers to recognize individual words accurately and rapidly (Adams, 1990). Word reading efficiency is composed of two skills, phonemic decoding and word recognition, with the former referring to the process of sounding out words quickly and accurately and the latter the process of recognizing familiar combinations of letters (words) as whole units (Torgesen, Wagner, & Rashotte, 1999). Word reading efficiency contributes significantly to reading comprehension and predicts reading abilities in later years. Fluent reading comprehension relies on rapid and automatic recognition of a large vocabulary. Both orthographic and phonological processing skills are important in word recognition. Orthographic processing is responsible for the visual recognition of word forms from the text, for example, letters, letter groups, visual word shapes, and morphological complex words with prefixes and suffixes (e.g., un-event-ful). Words read by sight (not completely processed phonologically before the word meaning is accessed) demonstrate that readers make strong use of orthographic information. Meanwhile, phonological processing is important especially for the recognition of non-sight words, of which the process of lexical access starts with the activation of their phonological information. Therefore, phonological activation of the form plays a major role for the large majority of words. Phonological processing skills are also early predictors of later reading development.

Previous L2 reading studies showed that variation in word reading efficiency contributes significantly to variation in reading comprehension even among fluent bilinguals (e.g., Favreau & Segalowitz, 1982; Koda, 1996, 1999; Muljani, Koda, & Moates, 1998; Segalowitz, 1986; Segalowitz, Poulsen, & Komoda, 1991). These research findings showed that skilled use of phonological and orthographic knowledge in word recognition was the foundation of successful reading comprehension, and any deficiency in word recognition would be directly reflected in and linked to learners' comprehension performance.

Traditionally, a major objective in English reading education at the primary school level (K-3) has been to foster phonemic decoding skills and word recognition accuracy. Accuracy alone, however, is insufficient because word recognition and phonemic decoding can be accurate but slow and effortful. In addition to accuracy in word reading, readers must achieve a certain speed (e.g., reading a certain number of words per minute). Due to the limited capacity of our working memory and the complex nature of the reading comprehension process, which involves multiple component skills, inefficiency in word recognition places extra burden on readers' cognitive resources, which consequently leaves less resources for other skills in reading comprehension (Adams, 1990; Perfetti, 1985, 1999). In this study, instead of accuracy and speed as indicators of word reading efficiency, number of words read correctly per minute (wcpm) is used to indicate word recognition and phonemic decoding efficiency.

2.2 Spelling Knowledge

Like word recognition and phonemic decoding, spelling also relies on grapho-phonemic knowledge of

the language (Robbins, Hosp, J. L., Hosp, M. K., & Flynn, 2010). Ehri (2000) states that accurate spelling relies on the coordination of phonological, orthographic, and morphological knowledge. According to the lexical quality hypothesis (Perfetti & Hart, 2001), words are composed of three constituents, an orthographic one, a phonological one, and a semantic one. When readers build efficient connections between well-learned orthographic forms or spelling representations and their corresponding phonological and semantic forms, word recognition efficiency emerges (Ehri, 2005; Perfetti & Hart, 2001). In other words, spelling knowledge or orthographic representation indicates that not only the orthographic forms of words are activated via visual input during reading but also its corresponding phonological and semantic forms. Therefore, spelling knowledge underpins word recognition efficiency (Berninger, Abbott, R., & Abbott, S., 2002; Burt & Tate, 2002; Caravolas, Hulme, & Snowling, 2001; Ehri, 1997; Perfetti, 1992; Perfetti & Hart, 2001; Templeton & Morris, 2000).

A research synthesis by Weiser and Mathes (2011) indicated that instruction in decoding and spelling had a significant effect in the development of phonemic awareness, alphabetic decoding, word reading, fluency, and comprehension; in addition, spelling instruction can foster readers' attention to the orthographic details of words in the lower elementary grades in L1 English. As children become highly familiar with a word's orthographic form or spelling, they are able to recognize the word as an entire graphic unit without paying attention to its component parts (e.g., letters, syllables, or word parts). These well-learned word spellings are established in children's sight vocabulary and can be automatically recognized during reading.

In the field of ESL reading research, English spelling knowledge and English word reading skills are found to be closely related with young ESL learners (Chiappe, Glaeser, & Ferko, 2007; Geva & Zadeh, 2006; Wade-Woolley & Siegel, 1997). However, very little research has been conducted with adult ESL learners on the relationship between spelling knowledge, reading comprehension, and other reading skills (Chiappe et al., 2007; Fender, 2008; Holm & Dodd, 1996; Wade-Woolley & Siegel, 1997).

2.3 L1 Transfer Effects on Orthography-Related Processing Skills

A few studies have investigated the importance of L1 phonological and orthographic processing skills in adult ESL reading comprehension. Nassaji and Geva (1999) found that skills in phonological and orthographic processing in learners' L1 contributed significantly to ESL reading differences among a group of native speakers of Farsi. Fender (2003) compared the English word recognition and word integration skills among native Arabic and Japanese L1 learners. He found that Japanese ESL learners read English words more accurately and faster than the Arabic ESL learners did, though the latter were better at integrating words into larger phrases and comprehending them. Akamatsu (2003) studied L2 text reading abilities among nonalphabetic L1 groups (Chinese and Japanese) and an alphabetic L1 group (Persian). The study found that compared with learners with an alphabetic L1 background, L2 readers with a nonalphabetic L1 background were less efficient in processing English words.

Learners' L1 orthographic and phonological processing skills might also have an influence on ESL spelling skills. Wang and Geva (2003) found that compared to native English-speaking children, L1

Chinese children learning English did not perform differently in spelling English words but did significantly worse in spelling pseudo words. The researchers suggested that the L1 Chinese children were able to acquire English word spellings as entire lexical units or visual-orthographic forms (due to their strong orthographic processing skills) but were less able to sound out pseudo words by applying phoneme-level decoding and mapping skills (for weaker phonological processing skills). Holm and Dodd (1996) reported similar results based on data from a group of adult ESL learners from Hong Kong. Fender (2008) found that intermediate-level Arabic adult ESL learners were significantly weaker on spelling and reading comprehension compared with non-Arab ESL students but not listening comprehension, which suggests a link between spelling and reading comprehension skills. Martin (2017) examined English spelling knowledge of ESL learners from three L1 backgrounds (French, Hebrew, and Mandarin Chinese) and found that the L1 Chinese speakers ranked the first in spelling accuracy, Hebrew speakers the second, and then French speakers. This was consistent with previous research findings (e.g., McBride-Chang, Bialystok, Chong, & Li, 2004).

2.4 Research on L1 Effects among Arabic ESL Learners

Modern Standard Arabic uses an alphabetic orthography. Native speakers of Arabic develop their early literacy and reading skills through two stages. At the early stage of literacy development, usually during the first few years in primary school, native speakers of Arabic learn to read Arabic with a phonologically transparent orthography, in which there are highly consistent grapheme-phoneme correspondences (Abu-Rabia, 1997, 1999; Fender, 2008; Wagner, 1993). As their literacy skills develop, they switch to a less transparent orthography, in which short vowels are not represented in spelling in print. In other words, only the consonants and three long vowels are spelled out. Due to the lack of diacritic marks, which signal vowel information in word spellings, Arabic readers have to fill in the vowels appropriate to the context when reading. Some of the contextual information that readers rely on includes the consonant spelling, the graphic display of phonological information, in addition to readers' morphological, syntactic, and discourse knowledge (Abu-Rabia, 2002; Fender, 2008). For that reason, Abu-Rabia (1997) states that "Arabic is perhaps the only language in the world in which readers must first understand the sentence in order to recognize the word" (p. 76).

Due to the unique orthographic features and literacy practices of the Arabic language, researchers in the area of ESL literacy development have been interested in how Arabic ESL learners might differ in the processes of ESL literacy development compared to learners with other L1 orthographic backgrounds. One of the earliest studies, Ryan and Meara (1991) aimed to test the hypothesis that Arabic-speaking learners of English relied heavily on consonants in English word recognition. They used a word matching task to test the participants' accuracy and speed in identifying whether two presentations of the word are identical. The task involved a one-second presentation of a 10-letter word (e.g., department), a two-second blank screen, and then the word again, but this time it can either be in correct spelling as in its original form or incorrect spelling with a vowel missing (e.g., *dpartment*). The missing vowel occurs in the second (e.g., dpartment), fourth (e.g., expriment), sixth (e.g., revoltion), or

eighth (e.g., photogrph) position. The results of the study indicated that Arabic speakers were less accurate and slower than non-Arabic speaking leaners of English and native speakers of English. The researchers argue that native Arabic ESL leaners lack accurate vowel spellings because they put more emphasis on consonants when reading in their native language, which serves as evidence that Arabic ESL learners carried over their L1 reading habits, specifically word recognition skills, to English. However, the researchers were not able to fully confirm their hypothesis without data from items with missing consonants. The researchers "expected Arabic speakers to perform much better" on the missing consonant task than on the missing vowels task (p. 539). Considering their heavier reliance on consonants, it is also reasonable to predict that recognizing a word with a missing consonant will be more challenging for these ESL learners compared to recognizing a word with a missing vowel. Therefore, a further experiment is needed to examine how Arabic ESL learners will be affected when reading words with missing consonants.

Fender (2003) examined how ESL learners' word-level reading skills in their L1 might affect the development of the same skills in ESL with a cross-linguistic analysis of Arabic and Japanese learners of English. Data on a lexical decision task and a sentence reading task were collected from a group of 20 native Japanese-speaking and a group of 19 native Arabic-speaking ESL participants who are proficiency-matched. In the lexical decision task, the participants read 60 English words and 60 pronounceable nonwords and indicated whether or not they are real English words. Data from the lexical decision task showed significant differences between the two groups. Japanese ESL learners were faster and more accurate compared to the Arabic ESL group. In the sentence-reading task, the participants read 60 12-word sentences to measure their word-integration skills. In contrast, the results demonstrated that the Arabic ESL learners were significantly more accurate but not faster than the Japanese ESL group in reading the sentences. The higher accuracy in the sentence-reading task indicated stronger ability in parsing and integrating words into larger phrases and clause units. The study indicates that learners of Arabic and Japanese L1 backgrounds have different strengths in ESL word-level reading and may encounter different difficulties. It also suggests that Arabic ESL learners benefit more from the context in word reading than Japanese ESL learners do.

Hayes-Harb (2006) aimed to test the hypothesis that "native Arabic speakers' pattern of attention to vowel and consonant letters will differ from the other native language groups and that the difference will reflect the relative prominence of consonants compared to vowels in native Arabic speakers' written word identification strategies" (p. 325). The study reported two experiments. The first experiment was a close replication of Ryan and Meara (1991) with some revisions. The participants in the experiment were 10 L1 Arabic speakers, 10 non-Arabic ESL learners, and 10 native English speakers. The task used for data collection was an identity judgement task, which included both words with a missing vowel and words with a missing consonant. The stimuli for the identity judgement task were carefully chosen, frequently used, 6- to 10-letter English nouns familiar to the participants. Like in Ryan and Meara (1991), the first stimulus on each trial was the original form of the word, but the

second stimulus represented three conditions: it can be the identical form, the form with a missing vowel, or the form with a missing consonant. A total of 72 target items were used in the task, with 24 items for each condition. Analysis of response times data showed that the Arabic group was significantly slower than the non-Arabic ESL group, which was again significantly slower than the native English group. Furthermore, response times were slower to the identical condition than to the deleted consonant condition, which were again slower than to the deleted vowel condition. However, the interaction between participant group and stimulus condition was not significant, which means, the Arabic ESL group was not different compared with the other two groups. For that reason, the researcher called for a follow-up study with a larger sample size. Analysis of the response accuracy data did not show any significant main effects of either participant group or stimulus condition; neither was there significant interaction between the two. The researcher was intrigued by the lack of differential results and was not sure whether there was truly a lack of an effect, or this result was due to problems with the task's validity, or small sample size. As a result, she designed a second experiment "to overcome the methodological problem by investigating the allotment of visual attention while reading passages in English" (p. 331).

In the second experiment, Hayes-Harb (2006) used a letter detection task, which required the participants to circle all instances of a designated target letter while reading a text for comprehension. The participants were 15 Arabic ESL learners, 15 non-Arabic ESL learners, and 15 native English speakers. Each participant read four texts, each with a length of 87 words. The participants were told to read as quickly as possible and circle the letter *t* in two of the texts and the letter *o* in the other two texts. Each text was followed by two comprehension questions. Results of ANOVA and follow-up analyses based on accuracy rates of letter detection showed significantly lower accuracy rate for the Arabic group compared to the native English and non-Arabic ESL group, but no difference was found between the native English speakers and the non-Arabic ESL learners. The Arabic group did not differ in the accuracy rates on circling vowels or consonants, while both the native English group and the non-Arabic ESL group performed significantly more accurately on vowels than on consonants. The interaction between group and letter type further indicated that the Arabic ESL learners were significantly less accurate in detecting vowels compared to the other two groups. "Given that vowels are less prominent than consonants in Arabic writing", the researcher claims that "native Arabic speakers transfer visual word-processing strategies from Arabic to reading in English" (p. 335). However, it is worth noting that the results on the interaction between group and letter type were only marginally significant. In addition, the sample size is still quite small for such analysis. Therefore, these findings should be taken with caution.

Fender (2008) compared spelling knowledge, listening and reading comprehension skills between a group of 16 intermediate-level Arabic ESL leaners and a proficiency-matched comparison group of 21 non-Arabic ESL learners. The spelling test included 58 items which targeted three types of spelling skills: within-word spelling skills (22 items), syllable-juncture-pattern spelling skills (18 items), and

derivational spelling skills (18 items). The listening and reading comprehension tests were from the corresponding sections (the listening section and the reading comprehension section) of a paper-based TOEFL test. Analyses of the data showed no significant difference in listening comprehension between the Arabic and non-Arabic ESL groups, but the Arabic ESL learners performed significantly worse on the spelling test (all three types of subskills) and the reading comprehension test. The researcher claimed that the difficulties Arabic ESL learners experienced in processing English word forms (as shown in their weaker orthographic and spelling knowledge) might have affected their reading comprehension skills.

2.5 Japanese and English Orthographic Features

Japanese orthography often serves as an example of syllabary. In fact, Japanese writing system is more than syllabary. Japanese *kana* is considered syllabic and Japanese *kanji* is logographic. Although native speakers of Japanese may lack phonological processing skills compared to speakers of an alphabetic language, their "sophisticated" "L1-based orthographic processing skills" may be used to their advantage in acquiring "a well-developed set of graphic ESL word representations that facilitate English word processing fluency and accuracy" (Fender, 2003, p. 294). According to Fender (2003), Japanese ESL learners encounter more difficulties in word integration processes than in word recognition and spelling but Arabic ESL learners were the opposite.

The English orthography is alphabetic but has many inconsistencies in terms of grapheme-phoneme correspondence; hence, it is considered opaque or deep, compared to other alphabetic languages such as Spanish, which has very consistent grapheme-phoneme mappings (i.e., transparent or shallow orthography). In addition to phonological processing skills, "the development of fluent English word recognition skills involves the acquisition of highly specified orthographic representations of words and spelling patterns that occur across the English orthography" (Fender, 2003, p. 293).

Previous research has demonstrated that efficient word recognition in English reading requires both orthographic and phonological processing skills (Gough & Walsh, 1991; Perfetti, 1991; Seidenberg, 1992; Stanovich, 1991). However, due to the potential influence of L1 orthography, ESL learners with different L1 orthographic backgrounds make resort to different strengths originated from their L1 literacy experiences. For example, Japanese ESL learners may benefit from their strong orthographic processing skills that they have developed in their L1 to facilitate English word processing. In contrast, Arabic ESL learners may over-rely on their stronger phonological processing skills in English word recognition. It will be interesting to show how ESL learners with different orthographic backgrounds utilize orthographic and phonological processing skills to their advantage in ESL word recognition and whether their performances in ESL word recognition fluency and accuracy can serve as evidence of L1 influence.

Therefore, the current study aims to investigate the possible differences between Arabic and Japanese ESL learners in English word reading and spelling abilities and their relationship with ESL reading comprehension. The findings of the study may indicate evidence or lack of evidence of L1 orthographic

influence in ESL reading and literacy development. Specifically, the following research questions will be answered.

a) How do Arabic ESL learners compare with Japanese ESL learners in word reading and spelling abilities?

b) Do Arabic ESL learners show any differences in the accuracy and speed of reading words with a missing vowel and reading words with a missing consonant?

c) What are the relationships between these skills (word reading and spelling) and reading comprehension for Arabic and Japanese ESL learners?

3. Methods

3.1 Participants

The participants of the study are 99 ESL learners at varying proficiency levels. Among them 49 were Arabic native speakers and 50 were Japanese native speakers. About half of these participants were students in an Intensive English Program (IEP) while the rest are undergraduate or graduate students at a comprehensive university in the United States (see Table 1). Although the participants represent various levels of proficiency within each language group, the composition of IEP and non-IEP students is comparable between the two groups.

Table 1. *Participants*

L1	IEP	Non-IEP	Total
Arabic	23	26	49
Japanese	21	29	50

3.2 Instruments

The spelling test. Thirty-six items were selected from a total of 58 words in Fender (2008) to represent three types of spelling skills (12 words each): 1) words for within-word spelling skills, which involve short vowels, long vowels, and complex vowels in single-syllable words; 2) words for basic syllable pattern spelling skills, which involve consonant doubling, long-vowel with open syllables and short-vowel with closed syllables; and 3) words for multi-syllable spelling pattern skills with unstressed syllables and derivational spellings. According to Fender (2008), these words were familiar and known by intermediate-level ESL students.

The spelling test was read and recorded by a native speaker of English and accessed by the participants through a link on a website. The target words were first read, then used in a sentence, and then read again. The recording of the spelling test was approximately 9 minutes long including directions and two examples. The spelling test was scored as correct/wrong with a maximum of 36 points. The Cronbach alpha reliability estimate was .94 for the test.

Word recognition efficiency (wcpm). Word recognition was measured by wordlist reading. A list of 80 words generated by Akamatsu (1999) was used in the reading of wordlists. According to Akamatsu (1999), the list "consisted of 40 high-frequency and 40 low-frequency monosyllabic words. For each frequency-type, there were 20 regular and 20 exception words" (p. 387).

The scoring of accuracy for wordlist reading was mainly based on native English pronunciation rules, but consistent foreign accent and dialectal variations were also taken into consideration. Approximately 40% of the samples was double scored to check inter-rater reliability. Inter-rater agreement (Pearson *r*) for wordlist reading was .91. For comparison purpose, the number of words read correctly per minute (wcpm) was computed as a measure of word recognition efficiency.

Phonemic decoding efficiency (wcpm). The Test of Word Reading Efficiency (TOWRE) (Torgesen, Wagner, & Rashotte, 1999) Subtest II was used to measure phonemic decoding skills. The subtest included a list of 63 pronounceable nonwords ordered from the easiest to the most difficult. The participants were asked to read the nonwords aloud as if they were real English words. They were told to read as quickly and accurately as possible within 45 seconds. Participants' voice responses were recorded.

The Phonemic Decoding task was scored following the guidelines provided by the test. Approximately 40% of the samples were double scored to check inter-rater reliability. Inter-rater agreement (Pearson *r*) for Phonemic Decoding was .90. For comparison purpose, the number of nonwords read correctly per minute (wcpm) was computed as a measure of phonemic decoding efficiency.

Reading comprehension test. The reading comprehension section of a retired paper-based TOEFL test. The participants had 55 minutes to read 5 passages and answer a total of 50 multiple-choice comprehension items. The items were scored as right/wrong, 1 point for each correct answer; the reliability of the test (Cronbach's alpha) was .87.

Reading words with a missing vowel or consonant. This task was inspired by the computer-based word matching test (Ryan & Meara, 1991) and identity judgment task (Hayes-Harb, 2006). In both tasks, the participants were first presented the original form of the word, and then they had to decide whether the second presentation was identical to the first presentation. The second presentation represented two conditions (identical or words with a missing vowel) in Ryan and Meara (1991) and three conditions (identical, words with a missing vowel, or with a missing consonant) in Hayes-Harb (2006). The validity of the task was questioned by Hayes-Harb (2006) with the concern that "participants may have developed strategies of comparing word length because the deleted vowel and deleted consonant conditions contained fewer letters than the stimuli in the identical condition" (p. 336). Hayes-Harb (2006) further questions the validity of the task by saying that "it is possible in principle for participants to complete the identity judgment task without achieving lexical access for any of the words, as the task involved o comprehension checks" (p. 336). For these same considerations, this study requires the participants to read two lists of words, one list consisting of words with a missing vowel and the other consisting of words with a missing consonant. The experiment used 40 frequent

10-letter words in English. The words were all highly frequent items from the Thorndike and Lorge AA to 20 per million categories (Thorndike & Lorge, 1944). Like Ryan and Meara (1991), one vowel was removed from each word, with the removed vowel in the second, fourth, sixth, or eighth position, for example, *dpartment*, *autmobile*, *especally*, and *expresson*. Similarly, the removed consonant was also in the second, fourth, sixth, or eighth position, for example, *poduction*, *foudation*, *suffiient*, and *themseles*. There was a total of 20 words in each list, with five words representing each removed position. The participants were asked to read the words aloud. The number of words read correctly was used as measure of accuracy and the time spent reading the words was used as measure of speed.

3.3 Data Collection Procedures

Data collection took place in two sessions. In the first session, the participants took the TOEFL reading comprehension test under a proctored condition for 55 minutes and had 5 extra minutes to respond to a brief background survey. The second session took place in a computer lab. Each participant had a headset so they listened to the previously recorded spelling dictation file for the spelling task. For the word reading tasks, the participants were asked to read aloud into a microphone as quickly and as accurately as possible and record their voices and send them directly via *wimba* voice mails.

3.4 Analyses

To answer the research questions, multiple statistical procedures were carried out. For Research Questions 1, one-way ANOVA was carried out to compare the differences between Arabic and Japanese ESL learners in all the measures. For Research Questions 2, paired-samples t tests were conducted for Arabic ESL learners to compare their performances on reading words with a missing vowel and reading words with a missing consonant. For Research Question 3, *Pearson* correlations and stepwise regression analyses were conducted separately for the Arabic and Japanese ESL groups.

4. Results

The first research question aims to compare the performances of the Arabic and Japanese ESL groups on all the measures. Table 2 shows the descriptive statistics and one-way ANOVA results. No significant difference was found between the two groups on L2 reading comprehension, which means, the two groups are at similar level of reading comprehension ability. Neither were there significant differences on the accuracy and speed in reading words with a missing vowel between the two groups. The Arabic ESL learners performed significantly worse in spelling, word recognition efficiency, phonemic decoding efficiency, and accuracy and speed in reading words with a missing consonant.

Table 2. ***Descriptive Statistics and Results of One-Way ANOVA***

	Arabic (N = 49)	**Japanese (N = 50)**	**F**	**Sig.**
L2 Reading Comprehension	23.86 (11.34)	24.57 (9.76)	0.18	n.s.
Spelling	22.79 (9.29)	30.38 (3.9)	22.55	$p < .001$
Reading Words with a Missing Vowel—Accuracy	17.54 (2.35)	18.38 (1.53)	3.53	n.s.
Reading Words with a Missing Vowel—Speed (seconds)	29.59 (11.74)	26.50 (5.32)	2.29	n.s.
Reading Words with a Missing Consonant—Accuracy	15.13 (3.77)	17.05 (1.97)	8.11	$p < .01$
Reading Words with a Missing Consonant—Speed (seconds)	38.08 (17.67)	30.53 (6.35)	6.46	$p < .05$
Reading a Regular Wordlist (wcpm)	79.18 (17.15)	90.56 (15.17)	7.98	$p < .01$
Reading Pseudowords—Phonemic Decoding (wcpm)	52.07 (15.19)	58.13 (10.14)	4.38	$p < .05$

The second research question examines whether Arabic ESL learners are more affected when reading English words with missing vowels or missing consonants. Table 3 shows the results of paired-samples t tests, which indicate that the Arabic ESL learners made significantly more errors and were significantly slower in reading words with a missing consonant compared with reading words with a missing vowel.

Table 3. ***Arabic ESL Learners: Results of Paired-Samples t Tests***

Pairs	**Comparisons**	***t***	**Sig.**
1	Reading words with a missing vowel vs. reading words with a missing consonant: Accuracy	6.41	$p < .001$
2	Reading words with a missing vowel vs. reading words with a missing consonant: Speed	-5.33	$p < .001$

The third research question investigates the relationship between these word reading and spelling skills and reading comprehension for the Arabic and Japanese groups separately. Table 4 shows the correlation matrix between pairs of the assessed variables for the Arabic group. A few things are noteworthy. First, the highest correlation with ESL reading comprehension is the accuracy in reading words with a missing consonant ($r = .71$, $p < .01$). Second, the highest correlations with spelling are accuracy in reading words with a missing vowel ($r = .78$, $p < .01$) and accuracy in reading words with a missing consonant ($r = .76$, $p < .01$). Third, accuracy in reading words with a missing vowel correlates most highly with accuracy in reading words with a missing consonant ($r = .80$, $p < .01$); so is the speed in reading these two types of incomplete words highly correlated ($r = .85$, $p < .01$). Finally, efficiency (wcpm) in reading regular words correlates most highly with efficiency (wcpm) in reading pseudo-words ($r = .80$, $p < .01$).

Table 4. ***Correlations—Arabic ESL Learners***

	1	2	3	4	5	6	7
1. L2 reading comprehension							
2. Spelling	.57**						
3. Missing vowel accuracy	.48**	.78**					
4. Missing vowel speed	-.40*	-.61**	-.58**				
5. Missing consonant accuracy	.71**	.76**	.80**	-.64**			
6. Missing consonant speed	-.48**	-.58**	-.47**	.85**	-.65**		
7. Regular word (wcpm)	.39*	.58**	.58**	-.75**	.63**	-.70**	
8. Pseudoword (wcpm)	.33*	.66**	.58**	-.64**	.56**	-.65**	.80**

Note. * $p < .05$; ** $p < 0.01$.

In order to further demonstrate the relative importance of these word reading skills to ESL reading comprehension, or how they predict Arabic ESL learners' performance in reading comprehension, step-wise regression analysis was conducted. The results in Table 5 indicate that, for Arabic ESL learners, the only significant predictor of ESL reading comprehension is accuracy in reading words with a missing consonant; it alone accounts for 49% of variance in their reading comprehension performance.

Table 5. ***Regression—Arabic ESL Learners***

Model	R	R^2	Adjusted R^2	F	Sig.
1. Reading words with a missing consonant—accuracy	.71	.50	.49	37.38	$p < .001$

The same statistical procedures were carried out for the Japanese group. The correlation indexes between pairs of the measured variables are shown in Table 6. For the Japanese group, the highest correlation with ESL reading comprehension is spelling ($r = .62$, $p < .01$), which also correlates most highly with accuracy in reading words with a missing consonant ($r = .59$, $p < .01$). Unlike the Arabic ESL learner group, there is no significant correlation between reading comprehension and word reading efficiency or phonemic decoding efficiency for the Japanese group. Accuracy in reading words with a missing vowel has a significant but relatively small correlation with accuracy in reading words with a missing consonant ($r = .44$, $p < .01$); on the other hand, speed in reading words with a missing vowel has a moderately high correlation with speed in reading words with a missing consonant ($r = .72$, $p < .01$). Like the Arabic ESL learner group, efficiency (wcpm) in reading regular words correlated most highly with efficiency (wcpm) in reading pseudo-words, although at a moderate level ($r = .63$, $p < .01$).

Table 6. ***Correlations—Japanese ESL Learners***

	1	2	3	4	5	6	7
1. L2 reading comprehension							
2. Spelling	.62**						
3. Missing vowel accuracy	.41**	.38*					
4. Missing vowel speed	-.55**	-.58**	-.37*				
5. Missing consonant accuracy	.58**	.59**	.44**	-.41**			
6. Missing consonant speed	-.48**	-.49**	-.24	.72**	-.44**		
7. Regular word (wcpm)	.09	.26	.07	-.54**	.15	-.42**	
8. Pseudoword (wcpm)	.28	.52**	.12	-.59**	.35*	-.53**	.63**

Similarly, to further demonstrate the relative importance of these word reading skills to ESL reading comprehension, or how they predict Japanese ESL learners' performance in reading comprehension, step-wise regression analysis was conducted. The results in Table 7 demonstrate a two-model solution. For the Japanese ESL learner group, spelling alone shared 37% of the variance in ESL reading comprehension. Together with accuracy in reading words with a missing consonant, the two variables accounted for 43% of variance in ESL reading comprehension.

Table 7. ***Regression—Japanese ESL Learners***

Model	R	R^2	Adjusted R^2	F	Sig.
1. Spelling	.62	.38	.37	24.05	$p < .001$
2. Spelling; Reading words with a missing consonant—accuracy	.68	.46	.43	15.54	$p < .001$

5. Discussion

The Arabic and Japanese ESL groups were at the same level of reading comprehension but the Japanese group performed significantly better than the Arabic group on spelling, word recognition efficiency, phonemic decoding efficiency, and accuracy and speed in reading words with a missing consonant. The findings confirm those of Fender (2003) that Japanese ESL learners were significantly faster and more accurate compared to the Arabic ESL group in the lexical decision task. In other words, the Japanese ESL learners have developed more fluency in word recognition than their Arabic counterparts have. These results are overall consistent with previous research on Chinese ESL learners whose L1 orthography is similar to Japanese (Hamada & Koda, 2008; McBride-Chang et al., 2005; Martin, 2017; Wang & Geva, 2003; Wang & Koda, 2005). A possible explanation is that Japanese ESL learners benefited from their strong L1visual and orthographic knowledge and were able to utilize this knowledge to build visual representations of English words. This ability may also be due to their

substantial amount of English print exposure and intensive practices in English writing at school, especially during their years in secondary school as they prepare for university entrance exams (Brown & Haynes, 1985; Fender, 2003). The English instructional practices and classroom learning experiences may have helped develop their phonological awareness to some extent in addition to strong orthographical sensitivity.

The findings are also consistent with previous studies on L1 Arabic speakers, who often have difficulties with ESL spelling and word recognition in general (Fender, 2003, 2008; Hayes-Harb, 2006; Ryan & Meara, 1991). As mentioned in the previous literature review, Ryan and Meara (1991) found that Arabic ESL learners were less accurate and slower than non-Arabic ESL learners in detecting spelling discrepancies in a matching test which involved words with a missing vowel. Hayes-Harb (2006) noted that Arabic ESL learners were slower than non-Arabic ESL learners in detecting spelling discrepancies in an identity judgment test which involved words with a missing vowel or a missing consonant. Fender (2003) found that the Arabic ESL learners were significantly slower and less accurate than the Japanese ESL group in the lexical decision task. Finally, Fender (2008) found that with the same level of listening comprehension, the Arabic ESL learners were significantly weaker on spelling and reading comprehension. These results, along with the findings of the present study, suggest that Arabic ESL learners have less detailed knowledge of the orthographic representations of the English words, which has been reflected in a range of tasks related to spelling and word reading. It is possibly true that Arabic ESL learners relied mainly on their phonological knowledge in reading English words but unfortunately, due to the lack of consistency in grapheme-phoneme correspondence in English orthography, they were less accurate and slower in reading English words and recognizing English spelling patterns.

The lack of significant differences between the Arabic and Japanese ESL learners in the accuracy and speed of reading words with a missing vowel does not agree to the findings of Ryan and Meara (1991), which reported significantly higher number of errors and significantly slower reaction times for the Arabic ESL learners compared with the non-Arabic ESL learners. It is only partially supportive of Hayes-Harb (2006) that the Arabic ESL learners were significantly slower than non-Arabic ESL learners but the two groups were not different in accuracy. Because of their weaker performances than the Japanese ESL learners in spelling, reading a regular wordlist, reading pseudo-words, and reading words with a missing consonant, the lack of significant differences in reading words with a missing vowel points to the direction that the Arabic ESL learners were not as much affected as the Japanese ESL learners when reading words with a missing vowel. One possible explanation is that readers of Arabic are accustomed to filling in vowels in their L1 reading and this decoding skill has been transferred into a similar task in ESL word reading, i.e., reading words with a missing vowel.

Compared with reading words with a missing vowel, the Arabic ESL learners were more adversely affected in both accuracy and speed of reading words with a missing consonant. This confirms our early prediction that recognizing words with a missing consonant would be more challenging for these

Arabic ESL learners than recognizing words with a missing vowel, which is opposite to what Ryan and Meara (1991) has expected (p. 539). The result also provides evidence for possible transfer of L1 decoding experiences into L2 decoding. In reading their native language, Arabic speakers rely mainly on consonant structures and put more emphasis on consonants. In fact, as shown in the answer to the third research question, the relationship between accuracy in reading words with a missing consonant indicated the highest correlation with reading comprehension (r = .71) and it shared 49% of the variance in ESL reading comprehension. This finding means that learners with higher reading comprehension ability tended to be more accurate in reading words with a missing consonant or the other way around. In future research, it would be informative to collect data from participants with different levels of ESL proficiency to pinpoint this relationship. More detailed cross-sectional or longitudinal work would help to clarify the developmental path of orthographic knowledge and specify the relative importance of word reading skills in ESL reading comprehension.

The study also shows that, for the Japanese group, spelling had the highest correlation with reading comprehension (r = .62), followed by accuracy in reading words with a missing consonant (r = .58). Spelling and accuracy in reading words with a missing vowel are both significant predictors of ESL reading comprehension for the Japanese group. Spelling alone accounted for 37% of variance in ESL reading comprehension; together with accuracy in reading words with a missing consonant, it raised the shared variance to 43%. Spelling requires close attention to the orthographic representations of words; more accuracy in spelling indicates a better-learned sight word vocabulary, which is a pre-requisite for efficiency in word recognition and reading comprehension.

The correlation between spelling knowledge and reading comprehension for the Arabic group was found to be moderate (r = .57) in this study, which is typical based on previous findings (Chiappe et al., 2007; Geva & Zadeh, 2006). Fender (2008), however, found no correlation between the spelling and reading comprehension scores of the Arabic ESL group (r = -.15, *ns*). We agree with the author that the lack of relationship was “quite unusual” (Fender, 2008, p. 35). Whether or not Arabic ESL learners “rely on partial spelling information and extra-lexical information (e.g., sentence and discourse context) to identify English words during reading” will warrant further research so that we can better understand the relationship between spelling knowledge, specific word reading skills, and reading comprehension of the Arabic ESL learners.

To conclude, the current findings further demonstrate the influence that L1 literacy experiences and orthographic backgrounds can have in the developmental processes of L2 literacy skills. The findings are consistent with previous reports that Arabic ESL learners face more difficulty in spelling and other word reading skills (Fender, 2003, 2008; Hayes-Harb, 2006; Ryan & Meara, 1991). The study provides further evidence that these lower-level processing skills (e.g., spelling, word recognition, and phonemic decoding) play different roles in ESL learners’ reading comprehension for groups of learners with different first language backgrounds (cf. Jiang, Sawaki, & Sabatini, 2011; Jiang, 2017). Due to the differences in first language backgrounds, learners may have to resort to different strategies to achieve

the same level of reading comprehension. The different strategies in spelling, word recognition, and phonemic decoding may have important implications for the development of reading fluency and reading comprehension among ESL readers of various first language backgrounds. Specifically, Arabic ESL learners can benefit from regular spelling exercises and tests. They could also benefit from different types of word identification games or tasks. More importantly, they should be encouraged to read more English texts because after all, the amount of print exposure and reading experience matters the most in developing ESL orthographic knowledge.

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