Teaching English as a Second Language Quarterly (TESLQ)
(Formerly Journal of Teaching Language Skills)
43(2), Spring 2024, pp. 1-30
https://doi.org/10.22099/tesl.2024.49255.3256

Online ISSN: 2981-1546

Research Paper

Exploring the Effects of Semantic and Orthographic/Phonologic Priming on Reading and Listening Comprehension of EFL Learners

Mohsen Veisi [*] **Mohammad Saber Khaghaninezhad** [**]

Abstract

This study examined the possible effects of orthographic/phonologic priming techniques on the receptive language skills of Iranian EFL learners with different proficiency levels. From an initial pool of 700 EFL learners from a language learning institute, two hundred and seventy learners from both genders were selected based on their performance on an English proficiency test and classified into six experimental and three control groups. After gaining certitude about the participants' English proficiency levels, the semantic and orthographic/phonologic priming phase was conducted, and consequently, the participants' contextualized comprehension of the primed words was assessed via a set of reading and listening comprehension tasks. The performances of the participants on the designed tasks indicated that semantic primes were more efficient for improving both comprehension skills compared with the orthographic-phonologic primes. Moreover, based on the results, language proficiency affected the success of the primes on both reading and listening comprehension tasks; advanced learners showed a greater improvement than the beginners and the intermediates under the influence of the priming techniques. Orthographic-phonologic primes were found to be more efficient for beginners, whereas the advanced learners showed an enhanced performance with regard to semantic primes. Overall, semantic primes showed more facilitative effects across various comprehension tasks due to their activation of deeper cognitive processing. Orthographic-phonologic primes were also successful. However, they were more efficient in the early stages of language learning, where visual recognition played a more critical role.

Keywords: Semantic Priming, Orthographic/Phonologic Priming, Reading and Listening Comprehension, Language Proficiency

[*] Received: 20/01/2024 Accepted: 16/03/2024

[*] PhD Candidate, Department of Foreign Language and Linguistics, Shiraz University, Shiraz, Iran. mohsen98veisi@gmail.com

[**] Assoicate Professor, Department of Foreign Language and Linguistics, Shiraz University, Shiraz, Iran. (Corresponding author), mskhaghni@shirazu.ac.ir

How to cite this article:

Veisi, M., & Khaghaninezhad, M. (2024). Exploring the Effects of Semantic and Orthographic/Phonologic Priming on Reading and Listening Comprehension of EFL Learners. *Teaching English as a Second Language Quarterly (Formerly Journal of Teaching Language Skills), 43*(2), 1-30. doi: 10.22099/tesl.2024.49255.3256

One's stored knowledge of how lexical items are spelled, pronounced, and meant plays an integral role in comprehending a text (Cunningham et al., 2001; Nation & Snowling, 2004). The orthographic/phonologic and semantic knowledge are so intrinsically tied to comprehension skills that they cannot be separated (Deacon et al., 2012). However, there is an ongoing debate about whether this existing knowledge alone explains the differences in reading and listening ability between learners or if the facility with which learners can acquire knowledge also affects reading and listening comprehension (Deacon et al., 2012).

Comprehension of both written and spoken language is an intricate cognitive process that relies heavily on the ability to retrieve words from the mental lexicon and to understand their meaning within a given context (Nobre & Salles, 2016). In other words, the ability to recognize words is considered to be a fundamental aspect of reading and listening comprehension. Therefore, insufficient word recognition skills can lead to several negative consequences, such as impaired reading comprehension, difficulties in listening comprehension, and limited vocabulary knowledge (Soler et al., 2015).

The priming paradigm is a widely used method that investigates how words are recognized quickly and automatically. According to McDonough and Trofimovich (2008), priming, as an implicit cognitive process, occurs without consciousness on the part of language users. In fact, the speakers' use of language can be influenced by the language forms and meanings they have previously encountered (Nkrumah & Neumann, 2018). While the majority of studies agree that priming facilitates language processing, the nature of priming has been subject to a passionate discussion (Ouellette & Beers, 2010). Most of the studies on the priming effect have focused on language production tasks; moreover, they mostly investigated priming in isolated and de-contextualized sentences (Altarriba & Knickerbocker, 2011; Landi & Ryherd, 2017). Hence, adequate attention to the possible facilitation of priming in comprehension skills in richer contexts seems to be lacking, especially for foreign language learners. Although priming could act as a powerful tool for improving language skills by facilitating word recognition and aiding in meaning construction (Zeguers et al., 2017), the findings about the most efficient primes for different language skills are inconsistent, particularly when the language proficiency of the learners is concerned (Mulder et al., 2019). By understanding how priming works and how it can be useful for EFL learners of different proficiency levels, educators and learners can develop effective techniques and strategies for accommodating class activities.

This study aimed to delve deeper into the possible roles and extents of these awareness types in language comprehension skills among EFL learners of different proficiency levels. Consequently, the following research questions are formed to investigate:

- Do semantic and orthographic/phonologic priming techniques significantly affect the performance of EFL learners of different proficiency levels on reading comprehension tasks? If yes, which one of these priming techniques is more facilitative?
- Do semantic and orthographic/phonologic priming techniques significantly affect the performance of EFL learners of different proficiency levels on listening comprehension tasks? If yes, which one of these priming techniques is more facilitative?

Literature Review

Priming

Priming is a fundamental concept in cognitive psychology that refers to increased sensitivity or responsiveness to a stimulus due to prior exposure to related stimuli (Tulving & Schacter, 1990). The observation of priming effects in language dates back to 1886 when Cattell discovered that reading a meaningful sentence is faster than reading unrelated words, suggesting contextual facilitation in word processing. Priming effects on comprehension tasks refer to the facilitative influence of a prime on the understanding of the upcoming oral or written text. For example, suppose a participant reads a prime sentence that sets up a particular context. In that case, the participant is more likely to interpret a subsequent sentence in a way that is consistent with the prime context (McNamara, 2005).

The primes' facilitative roles can be justified by Collins and Loftus' (1995) *Activation Theory,* which asserts that when a word is encountered, its meaning activates the related concepts in memory, creating a network of associations. These activated concepts then facilitate the processing of subsequent words that are semantically related. This spreading activation allows for the efficient retrieval and integration of relevant information, ultimately leading to improved comprehension (Perfetti et al., 2008). Moreover, the efficiency of primes for comprehension tasks can be argued based on the *Dual Route model* (Coltheart et al., 2001) and *Connectionist model*s (Gonnerman et al., 2007), which posit that accurate comprehension and fluent reading is dependent on the simultaneous use of phonological, orthographic and semantic information (Harm & Seidenberg, 2004).

Priming effects on reading and listening comprehension can be manifested at different levels of syntactic, semantic, discourse, and prosodic processing (Graesser et al.,

1994). In effect, when someone is exposed to a prime, he or she is more likely to comprehend the subsequent sentence, which contains the primed word, both in oral and written form (Pickering & Ferreira, 2008).

Semantic versus orthographic/phonological priming

According to McNamara (2005), semantic priming refers to a phenomenon in which language users process words more quickly and more accurately due to a previous encounter with related words in meaning. This kind of priming is described as mental operations that focus on conceptual or meaning-related details of a language (McDonough & Trofimovich, 2008). Depending on the relationships between the primes and the target words, semantic priming can be categorized as *associative priming* and *category priming (*McDonough & Trofimovich 2008). In associative priming, the primes and the target words are associatively connected to each other while they are not members of the same semantic category. On the other hand, category priming is a type of semantic priming in which the prime and the target words belong to the same semantic category.

In the last three decades, semantic priming has captured the attention of several generations of cognitive scientists and SLA researchers (Devitto & Burgess, 2004). One likely and important reason is that semantic priming is used as a tool to investigate some aspects of perception and cognition, such as word recognition, sentence comprehension, reading comprehension, and knowledge representation (Madden & Zwaan, 2006). For instance, Heyman et al. (2015) found that working memory can be affected by semantic priming, with high-load patterns being more difficult to remember. The study also revealed the significant effects of load, relatedness, type of association, and stimulus-onset asynchrony on reaction times in the lexical decision tasks.

Orthographic/phonologic priming, on the other hand, is a type of priming in which two orthographic-phonologically similar words are presented to participants believing that the first word (the prime) may facilitate the recognition and speed of responses to the second (the target) (Gor, 2018). According to Dufour (2008), the excitatory/inhibitory effects of orthographic-phonologic primes rely on a number of factors, such as the task being used, the ratio of related prime-target pairs, and the amount of overlap between the prime and the target word. The main feature of orthographic priming is the reliance on the visual properties of the word. The main logic of this kind of priming is that if two words share an overlap in their written forms, they can prime each other (Gulan & Valerjev, 2010).

An important line of research has compared two crucial aspects of visual word recognition - the phonological and orthographic properties of words- in order to determine

which factor has a greater influence on lexical access and processing. Although these studies demonstrated the robustness and versatility of orthographic-phonologic priming as a tool for word recognition, the findings were inconsistent (Norris et al., 2010). However, most of the studies suggested that the recognition of words primarily relied on phonological processes, with visual word recognition being secondary or dependent on the phonological process (e.g., Kiefer & Martens, 2010; Kouider & Dehaene, 2007).

Priming effect has been studied in the EFL context mostly for word recognition and has been shown to be an implicit, facilitative process that affects the subsequent language processing (e.g., Khaghaninejad & Farrokhiyekta, 2019; Khodadady et al., 2012; Shojayee et al., 2018); however, to date, few studies have investigated the priming effect on the EFL learners' performance on reading and listening comprehension tasks _ two demanding skills that require several abilities such as word recognition to be executed.

Priming and reading/listening comprehension tasks

Language learners need to be able to read the words and understand their meanings to perceive a text. In this way, automatic word recognition is a prerequisite to the comprehension process because it provides the interface between the perceptual processing of stimulus and the conceptual comprehension of an utterance. Therefore, it is highly important to understand how the activation of word concepts, word reading, and reading comprehension are interrelated (Ouellette, 2006).

Although investigating the relationship between priming and reading comprehension is suggested by some authors, very few studies have actually investigated this relationship (e.g., Fukkink et al., 2005; Ouellette, 2006). For instance, Fukkink et al. (2005) used a computer-based training program to improve vocabulary acquisition and, consequently, language comprehension in a second language. The results revealed that prior exposure to the target words in a classroom setting facilitated the speed of the tasks involving L2 reading comprehension. Furthermore, the relationship between semantic processing and reading difficulties has been a topic of interest in the literature (Nation et al., 1999). For example, Vellutino et al. (1995) documented that meager semantic processing is indirectly related to poor reading that emanates from poor phonological processing.

In another study, Larkin et al. (1998) investigated the relationship between children's reading ability and two forms of memory priming, semantic priming and repetition priming, in order to check the evidence for the role of semantic priming in reading ability. The results showed a stronger association between semantic priming and reading ability compared to repetition priming, providing further support for the notion that implicit memory processes, particularly semantic priming, play a significant role in reading

ability. Moreover, in a study done by Betjemann and Keenan (2008), it was documented that participants with reading disability performed below the level of normal readers on lexical decision tasks. In the same vein, Goodrich and Leiva (2020) found stronger semantic priming effects for the more proficient children in vocabulary and reading comprehension than the less proficient ones.

It has also been assumed that reading fluency results from the integration of orthography and phonology (González et al., 2015; Hahn et al., 2014). Brain imaging studies supported this notion by showing that reading fluency is highly related to the integration of orthography-phonology at the level of individual letters (Blau et al., 2010). In this way, fluency is not limited to the reading rate; rather, it is the combination of both reading rate and comprehension (Celce-Murcia et al., 2014). However, it is widely recognized that both spelling (orthography) and pronunciation (phonology) play important roles in lexical retrieval and, consequently, in reading comprehension. To date, and to the researchers' best knowledge, very few studies have been conducted to see if orthographic-phonologic priming affects reading comprehension. For instance, in 2017, Zeguers et al. conducted a study on the reaction-time analyses of orthographic-phonological priming effects in skilled readers at different levels of reading development. The results revealed that orthographic priming had a positive effect during the early stages of reading development, while phonologic priming effects were absent. They concluded that as readers become more proficient, they begin to automatically activate the orthographic representations, which help them read more fluently, but they cannot activate phonologic codes unconsciously. According to Friederici et al. (2002), three complex cognitive processes are involved in listening comprehension, namely, word recognition, parsing, and semantic integration. Word recognition involves locating the words in the mental lexicon by analyzing the auditory input. Parsing, on the other hand, creates a syntactic structure that shows the relationships among the words. The third process refers to the process of combining lexical, syntactic, and pragmatic knowledge to comprehend the sentence. Thus, like reading comprehension, word recognition is an integral part of listening comprehension.

Relatively, little research has examined the effect of priming on listening comprehension, and most of the conducted studies have focused on the impact of syntactic and auditory priming (e.g., Tooley & Traxler, 2010). As one of the few studies that focused on other types of priming, Sheldon et al. (2007) investigated the predictability of a word from the sentential context under the repetition priming among younger and older adults. The authors found that both younger and older adults benefited

from each type of supportive context, but the greatest benefit was observed when both types were used. Yuan et al. (2010) also conducted a study to see if L1 priming of L2 words could help overcome the difficulty of meaning retrieval in L2 production and comprehension skills. The results indicated that when participants were briefly primed with English translation of Mandarin words, their response time and accuracy in comprehending Mandarin sentences improved significantly. It was reported that early and late word priming reduced response times, and priming both words resulted in a slightly greater facilitation effect than single-word priming. In another study, Hu and Jiang (2010) used cross-modal priming to investigate listening comprehension by Chinese L2 learners and native English speakers. The findings revealed that native speakers showed a priming effect for both congruent and neutral conditions, but Chinese speakers only showed a priming effect for the congruent condition.

As the reviewed studies suggest, priming techniques have been found reasonably efficient, mostly in word recognition studies and typically in second language contexts. Regarding the undeniable salience of receptive skills for foreign language development and considering the inconsistent findings about the most efficient priming techniques for different language skills, particularly when EFL learners of different proficiency levels are involved, this study attempted to empirically demonstrate how priming the meaning (semantic priming), spelling (orthographic priming) and pronunciation (phonologic priming) of target words can influence the performance of language learners on reading and listening comprehension tasks in a foreign language learning context. Believing in the fact that true social interactions and information transactions happen in contexts (and not via a single word), this study empirically evaluated the success of semantic and orthographic/phonologic primes for the contextualized comprehension of the primed words in reading and listening tasks.

Method

Participants

This study employed two hundred and seventy male and female Iranian EFL learners with the age range of 15 to 30 years. They were selected based on their performance on an English proficiency test from an initial population of 700 learners of different proficiency levels from a language learning institute in Shahrekord. To evaluate the efficiency of different priming types for the reading and listening comprehension of beginner, intermediate, and advanced participants, they were assigned into six experimental groups: semantic/advanced, semantic/intermediate, semantic/elementary,

orthographic-phonologic/advanced, orthographic-phonologic/intermediate, orthographic-phonologic/elementary in addition to three control groups of elementary, intermediate and advanced learners. In order to make the statistical comparisons more reasonable, each group consisted of an equal number of learners (i.e., 30 participants). The research was conducted with the participants' informed consent, and their personal information was kept confidential according to ethical guidelines.

Materials and instruments

To determine the language proficiency of the participants and assign them into three proficiency groups, the Syndicate's (2001) proficiency test was employed. This is a standardized 45-minute test comprised of 60 items of vocabulary, grammar and comprehension that provide a measurement of a test taker's English proficiency on the basis of the CEFR scale. Based on the official classification, learners would be classified as having basic proficiency if they score between 1 and 27 (A1 and A2), intermediate by scoring 28 to 47 points (B1 and B2), and proficient or advanced if their score is above 48 (equivalent to C1 and C2). This test, which is universally used to homogenize the participants, enjoys an acceptable reliability index (.93), as reported by Green (2017) and Ricketts et al. (2008).

This study attempted to scrutinize the effects of two priming techniques on reading and listening comprehension; hence, a list of 120 words (60 targets and 60 primes) was prepared considering the methodology of some related studies (e.g., Nobre & Salles, 2016; Zeguers et al., 2017). First, participants at each proficiency level were given a list of 100 words, randomly selected from Oxford Word Skills (Gairns & Redman, 2020) and Top-Notch series (Saslow & Ascher, 2006). They were instructed to carefully read each word and circle those that they were familiar with. This initial screening process allowed for the identification of words that were within the participants' current vocabulary range. The words that the participants did not circle were considered to be out of the participants' current vocabulary range and, therefore, suitable for use in the priming phase of the study. Second, the chosen words were presented to 10 experienced teachers, who were asked to rate the appropriateness of the words based on their difficulty level, frequency, and real-world application via a 4-point Likert scale that ranged from "non-appropriate" to "strongly appropriate." This process allowed for the validation and sustainability of the selected words, ensuring that they were relevant and suitable for use in the present study. Finally, from the pool of words rated by all the teachers as "strongly appropriate," 20 words were selected for each proficiency level. A total of 60 words were chosen as the

target words of the study, with an equal distribution of words across the different proficiency levels.

For semantic priming, a total of sixty semantically related words were selected from the Word Norms (Nelson et al., 1998) and the Word-Net databases (Fellbaum, 1998). These two databases provide extensive lists of words and important information about each word's properties, such as how strongly these words are semantically related to other words. For orthographic/phonologic priming, the related pseudo-words were selected from the pool of selected words. For instance, pseudo-words *kase* and *paje* were derived by modifying one letter in the real English words (case and page). Additionally, researchers had the option to employ specialized software like Word-Generator (Duyck et al., 2004) to generate vast quantities of orthographic-phonologic primes with particular characteristics, such as specific lengths, syllable structures, linguistic variations, or inclusion of certain vowels or consonants (McDonough & Trofimovich 2008).

The process of selecting and designing reading and listening comprehension test items was highly meticulous and took into account the guidelines and procedures from multiple sources such as Celce-Murcia et al. (2014), Green (2017), and Nation and Newton (2009). Three different texts were selected and slightly modified by the researchers for each language proficiency level. Most of the primed words (about 80%) were accommodated in the texts to see how priming could help the learners comprehend the text. Each text was followed by 6 to 8 inferential, referential, factual, and evaluative comprehension items, which were created by the researchers based on the contents of the texts and considering the necessities of reading comprehension test items' construction (Green, 2017). The reading comprehension tests were also piloted and underwent some minor revisions.

With respect to the proficiency level of the participants, different listening comprehension tasks were designed by the researchers. For elementary groups, the task included 10 short dialogues, and each dialogue contained 3 to 5 of the primed words (each word was used only once in each dialogue). Participants listened to the dialogues and chose the picture that was described or discussed from a set of slightly different pictures. For participants in intermediate and advanced groups, the tasks were composed of three dialogues followed by some items to assess their listening comprehension. Similar to the reading comprehension test, about 80% of the target words were employed in the dialogues in such a way that the true understanding of the dialogues necessitates the exact perception of the primed words. After the piloting of the constructed tests by three groups

of 4 to 7 learners of the same proficiency level, some minor revisions were done regarding a few of the comprehension items.

Data collection and analysis procedure

After the administration of the proficiency test, participants were randomly categorized into different experimental and control categories. The priming phase happened in groups of 10, with each sitting at an individual desk with a computer and a set of headphones to prevent ambient noise distractions. At the beginning of each priming phase, the participants were given general instructions for the procedures. Following the priming phase, the participants sat for the reading and listening comprehension tests.

Semantic Priming. This priming phase was initiated by presenting the prime for 3000 ms on the screen (e.g., table); while the prime remained on the screen, the target word appeared directly below the prime (e.g., chair). While the words were presented in a PowerPoint slide show, the Persian equivalents of both words were provided on the screen. The participants were also provided with the auditory presentation of the prime/target word pairs. Each pair remained on screen for 10000 ms. Participants viewed 20-word pairs in two blocks of 10-word pairs.

Orthographic-Phonological Priming. Like semantic priming, in this priming technique, experimental participants of each proficiency level were primed and tested for 20-word pairs. The orthographic-phonologic priming phase began with the presentation of a prime for 3000 ms on the screen (e.g., kostly). While the prime remained on the screen, the target word, which was orthographically related to the prime, appeared directly below it (e.g., costly). While both words remained on the screen, the Persian equivalent and an image (related to the target) appeared below them for 5000ms. Simultaneously, an auditory presentation of the prime/target word pair was also given to the participants. Each trial was linked to a sound file of a female speaker fluently reading the word pairs. Like semantic priming, the 20-word pairs were presented into two blocks of 10 pairs. The prime words for this phase were as follows: (a) a phonologic prime, which was pseudo-homophones of the target words, and (b) an orthographic prime with the same number of shared letters with the target words. For this priming technique, the primes and the target words were harmonized in the number of letters, sounds, and syllables.

After completing the priming phase, the participants took part in listening and reading comprehension tasks to see how different priming techniques had affected their performance in a real context. For the reading comprehension task, elementary participants were given three passages with 20 factual comprehension items. The intermediate participants were given three passages with 10 factual questions and 10

referential comprehension questions, and the advanced learners were asked to read three passages and answer 7 factual, 6 referential, and 7 inferential comprehension items. Most of the primed words were accommodated in the reading passages.

After the reading comprehension test, a listening comprehension test was administered based on the participants' proficiency levels. For the elementary learners, the task included 10 short dialogues (each dialogue contained 3 to 5 of the target words). They were asked to listen to the constructed dialogues one by one and match them with the appropriate pictures (the pictures were selected based on the target words and were different from those used in the orthographic-phonologic priming phase). Intermediate and advanced participants were asked to listen to a set of dialogues and were asked to answer 20 multiple-choice factual, referential, and inferential items. Most of the primed words (about 80%) were accommodated in the dialogues to see how priming affected listening comprehension.

The control participants, on the other hand, experienced explicit instruction for the same target words; the target words were checked in the bilingual dictionaries, and their Persian equivalents were presented on a piece of paper to memorize. Then, their perception was assessed via the same listening and reading comprehension tests of the experimental participants.

After accomplishing the priming phase and conducting the constructed reading and listening comprehension tests, the participants' performance was analyzed both descriptively and inferentially; more than the descriptive statistics, Levene's test was run to check for the homogeneity of the error variance across the experimental and the control groups, and subsequently, two-way ANOVAs were run to check if the observed differences were statistically significant. Furthermore, the effect sizes for the mean differences were calculated.

Results and Discussion

Results

To deal with the first research question, the reading comprehension scores of different classes of the study's participants were compared. The descriptive statistics associated with participants' performance on the reading comprehension test across different language proficiency levels are reported in Table 1.

Table 1.

Descriptive statistics of Reading Comprehension for all Groups across Different Proficiency Levels

group	level	Mean	Std. Deviation	N
semantic	elementary	4.47	.973	30
	intermediate	5.00	.910	30
	advanced	7.83	1.147	30
	Total	5.77	1.793	90
Ortho-phono	elementary	3.63	.615	30
	intermediate	3.77	.935	30
	advanced	5.13	1.008	30
	Total	4.18	1.097	90
control	elementary	2.37	.999	30
	intermediate	2.20	.961	30
	advanced	3.33	1.184	30
	Total	2.63	1.156	90
Total	elementary	3.49	1.229	90
	intermediate	3.66	1.478	90
	advanced	5.43	2.162	90
	Total	4.19	1.883	270

As it is discernible in the table, the semantic priming group had the numerically highest mean score (M = 5.77, SD = 1.793) and the advanced learners (M = 5.43, SD = 2.162) outperformed the intermediate (M = 3.66, SD = 1.478) and the elementary participants (M = 3.49, SD = 1.2297). Levene's test was run to check the homogeneity of the error variance across groups; moreover, the factorial assumptions of the ANOVA were checked. Subsequently, to check if the differences across the mean scores were statistically significant, a two-way ANOVA was employed.

Table 2.

Levene's Test for Reading Comprehension for all Groups across Different Proficiency Levels

		Levene's Statistic	df1	df2	Sig.
Reading	Based on Mean	1.499	8	261	.158
	Based on Median	1.006	8	261	.432
	Based on Median and with adjusted df	1.006	8	232.88	.432
	Based on trimmed mean	1.321	8	261	.233

Table 3.
Tests of Between-Subjects Effects for Reading Comprehension

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	702.119[a]	8	87.765	90.947	.000
Intercept	4746.015	1	4746.015	4918.118	.000
group	441.830	2	220.915	228.926	.000
level	209.074	2	104.537	108.328	.000
group * level	51.215	4	12.804	13.268	.000
Error	251.867	261	.965		
Total	5700.000	270			
Corrected Total	953.985	269			

The test of between-subjects effects reveals that the priming techniques accounted for 63.7% of the variance in the reading comprehension test and it had a significant main effect on the dependent variable (F (2,269) = 228.92, P =.000). The findings also indicated a significant difference across different levels of proficiency in reading comprehension, with the level of proficiency explaining 45.4% of the variance in reading comprehension performance of the participants (F (2,269) = 108.32, P = .000). There was also a statistically meaningful interaction between the priming techniques and the level of proficiency (F (4, 269) = 13.26, P = .000). This interaction explained 16.9% of the variance in reading comprehension scores. In order to see where exactly the differences existed, a post hoc test was run.

Table 4.
Pair-wise Comparisons of All Groups for Reading Comprehension across

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
semantic	orthographic	1.589*	.146	.000	1.236	1.942
	control	3.133*	.146	.000	2.780	3.486
Ortho-phono	semantic	-1.589*	.146	.000	-1.942	-1.236
	control	1.544*	.146	.000	1.192	1.897
control	semantic	-3.133*	.146	.000	-3.486	-2.780
	orthographic	-1.544*	.146	.000	-1.897	-1.192

The first post hoc test revealed that there were statistically significant differences among the experimental and the control participants and the priming types. As the mean differences suggest, the semantic group outperformed both the orthographic-phonologic

and the control groups, while the orthographic-phonologic group performed better than the control group. In order to see which priming technique had a more facilitative effect on reading comprehension, their effect sizes were measured.

Table 5.
The Results of Effect Sizes for all Groups

group		Sum of Squares	df	Mean Square	F	Sig.
semantic	Contrast	196.46	2	98.23	101.796	.000
	Error	251.86	261	.96		
Ortho-phono	Contrast	41.35	2	20.67	21.428	.000
	Error	251.86	261	.96		
control	Contrast	22.46	2	11.23	11.641	.000
	Error	251.86	261	.96		

As shown in Table 5, semantic priming (accounted for 43.8% of the variance of the test's scores) had a more facilitative effect than orthographic-phonologic priming. However, orthographic-phonologic priming also revealed a significant difference in reading comprehension and accounted for 14.1% of the variance of the test scores. To investigate the possible effect of language proficiency level, another post hoc test was run.

Table 6.
Pair-wise Comparisons for Reading Comprehension across Proficiency Levels

(I) level	(J) level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
elementary	intermediate	-.167	.146	.768	-.520	.186
	advanced	-1.944*	.146	.000	-2.297	-1.592
intermediate	elementary	.167	.146	.768	-.186	.520
	advanced	-1.778*	.146	.000	-2.131	-1.425
advanced	elementary	1.944*	.146	.000	1.592	2.297
	intermediate	1.778*	.146	.000	1.425	2.131

As it is detectable in Table 6, there was not a significant difference between the elementary and the intermediate participants in reading comprehension (P = .768). However, there was a significant difference between the elementary and the advanced learners (P = .000). There was also a significant difference between the intermediate and

the advanced participants (P = .000). The mean differences indicated that the advanced participants outperformed the elementary and intermediate participants and the intermediates performed noticeably better than the elementary learners.

Table 7.
The Effects of Different Proficiency Groups

level		Sum of Squares	df	Mean Square	F	Sig.
elementary	Contrast	67.089	2	33.544	34.761	.000
	Error	251.867	261	.965		
intermediate	Contrast	118.156	2	59.078	61.220	.000
	Error	251.867	261	.965		
advanced	Contrast	307.800	2	153.900	159.481	.000
	Error	251.867	261	.965		

As shown in Table 7, all the language proficiency levels had significant effects on reading comprehension; the elementary level accounted for 21%, the intermediate level accounted for 31.9%, and the advanced level accounted for 55% of the variance of the reading comprehension scores. For the interaction between the priming techniques and levels of proficiency, other post hoc tests were run, which compared the performance of elementary, intermediate, and advanced participants within each priming type.

Table 8.
Pair-wise Comparisons of Proficiency Levels in each Experimental group in Reading Comprehension

group	(I) level	(J) level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
semantic	elementary	intermediate	-.533*	.254	.036	-1.033	-.034
		advanced	-3.367*	.254	.000	-3.866	-2.867
	intermediate	elementary	.533*	.254	.036	.034	1.033
		advanced	-2.833*	.254	.000	-3.333	-2.334
	advanced	elementary	3.367*	.254	.000	2.867	3.866
		intermediate	2.833*	.254	.000	2.334	3.333
Ortho-phono	elementary	intermediate	-.133	.254	.600	-.633	.366
		advanced	-1.500*	.254	.000	-1.999	-1.001
	intermediate	elementary	.133	.254	.600	-.366	.633
		advanced	-1.367*	.254	.000	-1.866	-.867
	advanced	elementary	1.500*	.254	.000	1.001	1.999
		intermediate	1.367*	.254	.000	.867	1.866
control	elementary	intermediate	.167	.254	.512	-.333	.666

group	(I) level	(J) level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
		advanced	-.967*	.254	.000	-1.466	-.467
	intermediate	elementary	-.167	.254	.512	-.666	.333
		advanced	-1.133*	.254	.000	-1.633	-.634
	advanced	elementary	.967*	.254	.000	.467	1.466
		intermediate	1.133*	.254	.000	.634	1.633

As indicated in Table 8, the advanced learners outperformed two other proficiency levels under the influence of semantic priming. Although there was not a significant difference between the elementary and the intermediate participants for the orthographic-phonologic priming, under this priming technique, the advanced learners performed remarkably better than the beginners. There was also a significant distinction between intermediate level and advanced level in this priming group. Considering the mean differences, the advanced learners outperformed the elementary and the intermediate participants, and the intermediates performed better than the beginners under orthographic-phonologic priming for the reading comprehension test. Overall, the findings revealed that both the priming type and the level of language proficiency had significant effects on reading comprehension; the semantic priming had a more facilitative effect than the orthographic-phonologic priming on reading comprehension, and the advanced participants outperformed the other two proficiency levels under the both priming conditions.

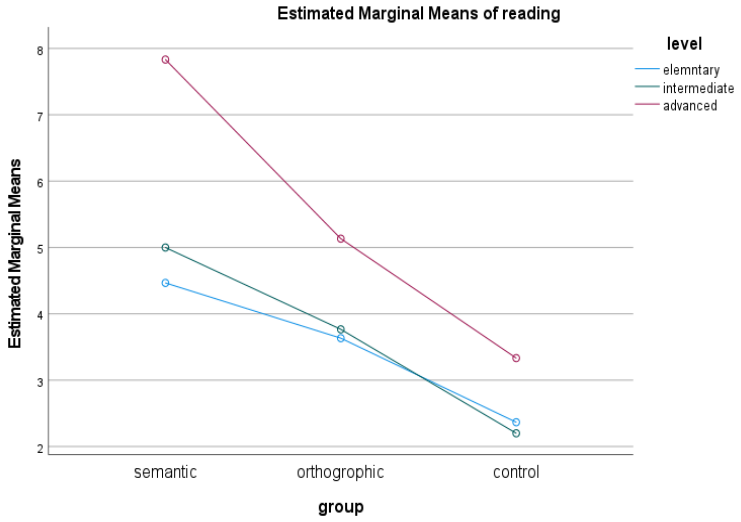

Figure 1.*Reading Comprehension Groups Mean across Different Proficiency Levels*

Regarding the second research question, the experimental and the control participants' scores on the listening comprehension tasks were analyzed. The descriptive statistics for priming techniques and different levels of proficiency are reported in the following table.

Table 9.

Descriptive statistics of Listening Comprehension for all Groups across Different Proficiency Levels

group	level	Mean	Std. Deviation	N
semantic	elementary	4.40	.894	30
	intermediate	4.97	.928	30
	advanced	7.23	.817	30
	Total	5.53	1.508	90
Ortho-phono	elementary	3.80	.551	30
	intermediate	4.93	.868	30
	advanced	4.03	.765	30
	Total	4.26	.881	90
control	elementary	2.47	.776	30
	intermediate	2.30	.794	30
	advanced	3.20	.925	30
	Total	2.66	.914	90
Total	elementary	3.56	1.103	90
	intermediate	4.07	1.520	90
	advanced	4.82	1.935	90
	Total	4.15	1.636	270

As Table 9 indicates, the mean scores for the participants in semantic priming (M = 5.53, SD = 1.50) was higher than the orthographic-phonologic priming (M = 4.26, SD = .881) and the control groups (M = 2.26, SD = .914). Regarding the level of proficiency, the advanced learners in the semantic group (M = 7.23, SD = .817) numerically performed better than the elementary (M = 4.40, SD = .894) and intermediate participants (M = 4.97, SD = 928) and the intermediate participants under the orthographic-phonologic priming (M = 4.93, SD = .868) outperformed two other groups. The statistical significance of these differences was checked through inferential statistical analyses. Before that, to check the homogeneity of error variance across groups, Levene's test was run, and then a two-way ANOVA followed.

Table 10.

Levene's Test of Equality of Error Variances for Listening Comprehension

		Levene's Statistic	df1	df2	Sig.
Listening	Based on Mean	1.884	8	261	.063
	Based on Median	1.634	8	261	.115
	Based on Median and with adjusted df	1.634	8	244.87	.116
	Based on trimmed mean	1.912	8	261	.059

Table 11.

Tests of Between-Subjects Effects for Listening Comprehension

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	544.31	8	68.04	101.05	.000
Intercept	4645.92	1	4645.92	6900.15	.000
group	374.23	2	187.11	277.90	.000
level	73.09	2	36.54	54.21	.000
group * level	97.01	4	24.25	36.02	.000
Error	175.73	261	.67		
Total	5366.00	270			
Corrected Total	720.07	269			

As shown in Table 11, the main effect for priming techniques indicated a significant difference in listening comprehension across different groups, explaining 68% of the variance (F (2, 269) = 277.9, P = .000). As for the main effect for levels of proficiency, the results also indicated a significant difference in listening comprehension, with level of proficiency explaining 29.4% of the variance (F (2, 269) = 54.281, P = .000). Finally, the results revealed that there was a statistically meaningful interaction between priming techniques and the levels of proficiency, with the interaction explaining the 35.6% of the variance (F (4, 269) = 36.022, P = .000).

Table 12.

Pair-wise Comparisons of all Groups for Listening Comprehension

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
semantic	orthographic	1.278*	.122	.000	.983	1.573
	control	2.878*	.122	.000	2.583	3.173
Ortho-phono	semantic	-1.278*	.122	.000	-1.573	-.983
	control	1.600*	.122	.000	1.305	1.895

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
control	semantic	-2.878*	.122	.000	-3.173	-2.583
	orthographic	-1.600*	.122	.000	-1.895	-1.305

As Table 12 presents, there was a significant distinction between semantic priming and orthographic-phonologic priming groups (P = .000). Considering the mean differences, semantic priming participants outperformed both the orthographic-phonologic priming and the control participants. Furthermore, the results revealed that both priming groups outperformed the control group; consequently, both priming types significantly affected the participants' listening comprehension.

Table 13.
The Results of Effect Sizes for Different Groups in Listening Comprehension

group		Sum of Squares	df	Mean Square	F	Sig.
semantic	Contrast	134.86	2	67.43	100.152	.000
	Error	175.73	261	.67		
orthographic	Contrast	21.48	2	10.74	15.958	.000
	Error	175.73	261	.67		
control	Contrast	13.75	2	6.87	10.215	.000
	Error	175.73	261	.67		

As shown in Table 13, semantic priming accounted for 43.4% while orthographic-phonologic priming accounted for 10.9% of the variance of the listening comprehension scores. This also suggested that the semantic primes were more facilitative than the orthographic-phonologic primes for the listening comprehension of the participants.

Table 14.
Pair-wise Comparisons of Different Proficiency Levels for Listening Comprehension

Level	Level	Mean Difference	Std. Error	Sig	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
elementary	intermediate	-.511	.122	.000	-.806	-.216
	advanced	-1.267	.122	.000	-1.561	-.972
intermediate	elementary	.511	.122	.000	.216	.806
	advanced	-.756	.122	.000	-1.050	-.461
advanced	elementary	1.267	.122	.000	.972	1.561
	intermediate	.756	.122	.000	.461	1.050

A second post hoc test was run to compare the effects of different levels of proficiency. As is discernible in Table 14, there were statistically significant distinctions among the elementary, the intermediate, and the advanced participants. Considering the mean differences, the advanced learners outperformed both the intermediate and elementary learners, while the intermediates outperformed the beginners on listening comprehension tasks. The effect sizes were also measured and presented in Table 15.

Table 15.
The Results of Effect Sizes for Different Proficiency Levels in Listening Comprehension

level		Sum of Squares	df	Mean Square	F	Sig.
elementary	Contrast	58.756	2	29.38	43.62	.000
	Error	175.733	261	.67		
intermediate	Contrast	140.467	2	70.23	104.31	.000
	Error	175.733	261	.67		
advanced	Contrast	272.022	2	136.01	202.00	.000
	Error	175.733	261	.67		

As shown in Table 15, the elementary level accounted for 25.1%, the intermediate level accounted for 44.4%, and the advanced level accounted for 60.8% of the variance of the listening comprehension scores. To compare the performance of participants with different levels of proficiency within a single group, the third post hoc test was run.

Table 16.
Pair-wise Comparisons of Proficiency Levels in each Experimental group for Listening Comprehension

group	(I) level	(J) level	Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
semantic	elementary	intermediate	-.567*	.212	.008	-.984	-.149
		advanced	-2.833*	.212	.000	-3.251	-2.416
	intermediate	elementary	.567*	.212	.008	.149	.984
		advanced	-2.267*	.212	.000	-2.684	-1.849
	advanced	elementary	2.833*	.212	.000	2.416	3.251
		intermediate	2.267*	.212	.000	1.849	2.684
Ortho-phono	elementary	intermediate	-1.133*	.212	.000	-1.551	-.716
		advanced	-.233	.212	.272	-.651	.184
	intermediate	elementary	1.133*	.212	.000	.716	1.551
		advanced	.900*	.212	.000	.483	1.317
	advanced	elementary	.233	.212	.272	-.184	.651

group	(I) level	(J) level	Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
		intermediate	-.900*	.212	.000	-1.317	-.483
control	elementary	intermediate	.167	.212	.432	-.251	.584
		advanced	-.733*	.212	.001	-1.151	-.316
	intermediate	elementary	-.167	.212	.432	-.584	.251
		advanced	-.900*	.212	.000	-1.317	-.483
	advanced	elementary	.733*	.212	.001	.316	1.151
		intermediate	.900*	.212	.000	.483	1.317

As Table 16 suggests, there were significant distinctions among elementary, intermediate, and advanced levels for the semantic priming group; the advanced learners outperformed both the intermediates and beginners under this priming type. Under the influence of orthographic-phonologic priming, the results revealed that there were significant differences among the elementary and intermediate participants; however, there was not a significant difference between elementary and advanced participants under this priming technique. Moreover, there was a significant difference between intermediate and advanced learners in the orthographic-phonologic priming group.

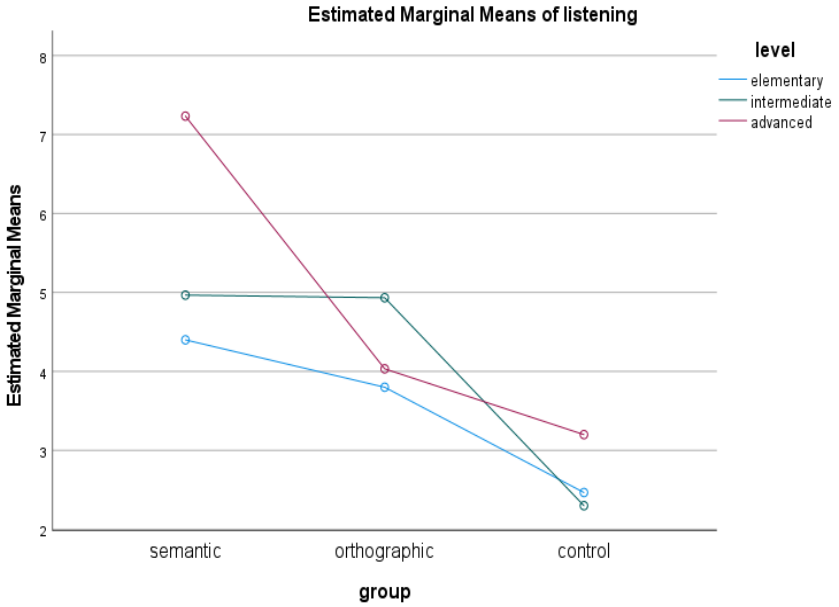

Figure 2. *Listening Comprehension Groups Mean across Different Proficiency Levels*

To recapitulate, it was found that the priming techniques had significant effects on the listening comprehension of the participants, whereas the semantic priming had a more significant effect. It was also found that the advanced participants outperformed two other levels in the semantic priming group. The results also revealed that the intermediate participants outperformed the beginners under the orthographic-phonologic priming technique. Moreover, it was also indicated that under both priming types, the advanced participants had performed remarkably better than the other two proficiency levels for the listening comprehension test.

Discussion

This study documented that both priming types and the level of language proficiency significantly affected the participants' reading comprehension performance; the priming techniques accounted for 63.7%, and the level of proficiency explained 45.4% of the variances for reading comprehension scores. Comparing the effect sizes of priming types and the proficiency levels indicated that the type of priming had a more significant effect on participants' reading comprehension than the level of proficiency. Furthermore, there was a significant interaction between priming methods and levels of proficiency; this interaction explained 16.9% of the variance for reading comprehension scores. This implies that the influence of priming on reading comprehension may be different for individuals with different levels of proficiency.

The findings indicated that both semantic and orthographic-phonologic priming positively affected reading comprehension. The findings also revealed that semantic priming accounted for a larger variance in reading comprehension (43.8%) compared to orthographic-phonologic priming (14.1%). One possible explanation for the difference in effects is the nature of the priming stimuli. Semantic priming involves activating related concepts or meanings, while orthographic-phonologic priming involves activating related letter sequences or word forms (Fernandino & Conant, 2023). Another possible justification can be in line with Collins and Loftus' (1995) *Activation Theory*, which claims that the activated concepts facilitate the processing of subsequent words that are semantically related. The findings also suggested that although orthographic-phonologic priming may facilitate certain aspects of reading comprehension, such as word recognition or accuracy, it may not have the same effect on comprehension as semantic priming does by tapping the networks and facilitating the word retrieval.

Regarding the role of language proficiency in priming facilitation, it was found that the advanced level of proficiency accounted for a significant 55% of the variance in

reading comprehension, indicating the strongest effect among the three proficiency levels. Therefore, the effect of priming on reading comprehension varies across proficiency levels, with a more pronounced effect at higher proficiency levels. This finding supported the idea of Goodrich and Leiva (2020), who suggested that learners' cognitive development during the early stages of learning to read is characterized by word recognition and identification processes, which, in turn, limit reading comprehension. This is because learners are not yet able to extract meaning from the text they are reading. These findings align with *Dual Route* (Coltheart et al., 2001) and *Connectionist models* (Gonnerman et al., 2007), which posit that individuals with different levels of proficiency employ semantic levels differentially in word reading. It is believed that at an advanced level, the semantic component plays a more significant role compared to the intermediate and elementary levels (Harm & Seidenberg, 2004).

The study also documented that both priming techniques and levels of language proficiency had significantly affected the participants' listening comprehension. It was also found that semantic priming had a more facilitative effect than orthographic-phonologic priming for listening comprehension. This result may be explained by the fact that semantic integration, as an important aspect of language comprehension, directly affects individuals' comprehension of sentences and of larger discourse (Madden & Zwaan, 2006). The results also indicated a statistically significant interactive effect between priming and level of proficiency on listening comprehension. Within the semantic priming group, significant effects were observed across all three levels of proficiency. This contradicts previous research by Perfetti et al. (2008), which proposed that less-competent language learners may struggle with a deficient semantic integration process, leading to difficulties in language comprehension. Another important finding was that the participants in the advanced level group performed better than those two other proficiency levels in the semantic priming group. This result aligns with existing evidence supporting the presence of a context effect in word recognition, which can be extended to listening comprehension.

The study's findings regarding orthographic-phonologic priming and its effect on listening comprehension revealed some interesting patterns. The results indicated a significant difference in listening comprehension between the beginners and intermediates, as well as between the intermediates and advanced learners. However, surprisingly, no significant difference was observed between the elementary and advanced levels within the orthographic priming group. The finding that orthography

plays a significant role in speech perception challenges previous research that primarily focused on the phonological aspects of visual word recognition (Ziegler et al., 1997).

Overall, the study's findings provided worthy insights into the effects of priming on listening comprehension across different proficiency levels. The results indicated that both priming types and levels of proficiency had a significant effect on listening comprehension. Semantic priming was more efficient than then orthographic-phonologic priming. Moreover, the advanced participants outperformed the elementary and intermediate participants on listening comprehension tasks. Additionally, the interaction effect between the priming types and levels of proficiency was significant, indicating that the effectiveness of the priming type depends on the participants' proficiency level.

Conclusion

This study aimed to investigate how priming techniques may affect the comprehension of the contextualized target words across different levels of proficiency. The results revealed that both priming types facilitated the comprehension of the primed words both in the listening and reading tasks. The findings also demonstrated that semantic priming had a more facilitative effect than orthographic-phonologic priming in all comprehension tasks. This result can be attributed to the nature of how words are processed and stored in memory, emphasizing meaning-related associations and semantic networks. Additionally, semantic processing is associated with deeper cognitive processing, leading to a more enduring and influential effect on word retrieval. Moreover, it was revealed that the advanced participants had the highest degree of benefit from semantic primes, while the orthographic-phonologic primes were found to be more influential for beginners on comprehension tasks. This aligns with established research and theories, indicating that advanced learners possess more developed and interconnected semantic networks, which enhances their ability to utilize semantic information.

The findings challenged the previous assumptions about the limitations of less-proficient learners in utilizing semantic cues and called for a more differentiated approach to language instruction that accounts for individual differences in proficiency. The study also invites a reevaluation of the relationship between orthographic and phonological processing in listening comprehension, emphasizing the potential for orthographic information to play a more significant role than previously acknowledged. The results also highlighted that semantic primes have a more consistent impact across various language tasks due to their activation of deeper cognitive processing and broader semantic

networks. This suggests that semantic associations play a crucial role in language processing and should be emphasized in educational settings.

The pedagogical implications of this study encompass several vital aspects of language learning and instruction. Firstly, the findings on lexical retrieval and priming techniques would provide educators with a deeper understanding of how to enhance vocabulary acquisition and retrieval. The superior performance of learners who underwent semantic priming implies that teaching strategies that emphasize meaning and context, such as using synonyms, antonyms, and thematically related words, can be more effective in improving lexical access than those focusing merely on word forms (Dijkstra et al., 2023). This suggests that curricula should incorporate semantic mapping and contextual activities to bolster word memory and retrieval. Secondly, the differential effects of priming techniques on learners at various proficiency levels have significant implications for differentiated instruction. As the study indicates, learners at the elementary level may benefit more from orthographic-phonological priming, which supports the use of strategies that focus on the visual similarities of words. In contrast, advanced learners, with their more intricate semantic networks, benefit more from semantic priming, which suggests that instruction for higher proficiency learners should involve more complex, meaning-based tasks such as referencing and paraphrasing (Bernabeu, 2022). This differentiation in teaching methods can optimize learning outcomes by catering to the cognitive development and linguistic capabilities of students at different stages of language acquisition.

In the domain of comprehension skills, since semantic priming has shown a stronger effect, educators might consider pre-teaching vocabulary and concepts that are crucial to the texts students will encounter, thus activating their prior knowledge and facilitating a deeper understanding of the material. Activities that encourage prediction using semantic cues can also help students prepare for and engage more effectively with reading tasks, ultimately enhancing comprehension. The significant effects of semantic priming highlight the importance of developing learners' abilities to make connections between spoken words and their underlying concepts (Bernabeu, 2022). Teachers can use semantic priming techniques, such as discussing thematically related topics before listening activities, to improve students' ability to comprehend spoken language. Additionally, the study's findings encouraged the exploration of the role of orthographic-phonological priming in listening comprehension, suggesting that visual aids and written transcripts might aid learners in processing spoken language, even at lower proficiency levels.

The present study has several limitations that should be taken into consideration. First, the study focused solely on Iranian EFL learners, which may limit the generalizability of the findings to other linguistic and cultural contexts. Future research could include a more diverse sample to increase the external validity of the results. Second, participant selection from English language institutes may not capture the diversity of the wider EFL learner population, including individuals in less formal educational settings. This could skew the study's findings, as these learners might have different motivational profiles, learning strategies, or exposure to English. Third, the study did not consider psycholinguistic variables such as working memory capacity, attentive control, or cognitive flexibility, which could influence performance on priming and comprehension tasks.

Acknowledgments

We would like to thank the editorial team of TESL Quarterly for granting us the opportunity to submit and publish the current synthesis. We would also like to express our appreciation to the anonymous reviewers for their careful, detailed reading of our manuscript and their many insightful comments and suggestions.

Declaration of conflicting interests

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for this article's research, authorship, and/or publication.

References

Altarriba, J. & Knickerbocker, H. (2011). Acquiring second language vocabulary through the use of images and words. In K. M. P. Trofimovich (Ed.), *Applying priming methods to L2 learning, teaching and research* (pp. 21-48). John Benjamins.

Bernabeu, P. (2022). *Language and sensorimotor simulation in conceptual processing: Multilevel analysis and statistical power.* Lancaster University Press.

Betjemann, R. S., & Keenan, J. M. (2008). Phonological and semantic priming in children with reading disability. *Child Development*,79,1086–1102. http://dx.doi.org/10.1111/j.1467 8624.2008.01177.x

Blau, V., Reithler, J., van Atteveldt, N., Seitz, J., Gerretsen, P., Goebel, R., & Blomert, L. (2010). Deviant processing of letters and speech sounds as proximate cause of reading failure: A

functional magnetic resonance imaging study of dyslexic children. *Brain,* 133, 868–879. http://dx.doi.org/10.1093/brain/ awp308

Cattell, J. M. (1886). The time taken up by cerebral operations. *Mind, 11*(3), 377-399.

Celce-Murcia, M., Brinton, D., Snow, A. M. (2014). *Teaching English as a second or foreign language.* Cengage publishing House.

Collins, A. M., & Loftus, E. F. (1995). A spreading-activation theory of semantic processing. *Psychological Review, 82*(6), 407–428. https://doi.org/10.1037/0033-295X.82.6.407

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review,* 108,204–256. http://dx.doi.org/10.1037/0033-295X.108.1.204

Cunningham, A. E., Perry, K. E., & Stanovich, A. E. (2001). Converging evidence for the concept of orthographic processing. *Reading and Writing: an Interdisciplinary Journal,* 14, 549–568.

Deacon, S. H., Benere, J., & Castles, A. (2012). Chicken or egg? Untangling the relationship between orthographic processing skill and reading accuracy. *Cognition*, 122,110–117. http://dx.doi.org/10.1016/j.cognition.2011.09.003

Devitto, Z., & Burgess, C. (2004). Theoretical and methodological implications of language experience and vocabulary skill: Priming of strongly and weakly associated words. *Brainand Cognition,* 55, 295–299.

Dijkstra, T., Peeters, D., Hieselaar, W. & van Geffen A. (2023). Orthographic and semantic priming effects in neighbour cognates: Experiments and simulations. *Bilingualism: Language and Cognition. 26*(2), 371-383. http://dx.doi.org/10.1017/S1366728922000591

Dufour, S. (2008). Phonological priming in auditory word recognition: When both controlled and automatic processes are responsible for the effects. *Canadian Journal of Experimental Psychology,* 62, 33–41.

Duyck, W., Desmet, T., Verbeke, L., & Brysbaert, M. (2004). WordGen: A tool for word selection and non-word generation in Dutch, German, English, and French. *Behavior Research Methods Instruments, & Computers,* 36, 488–499.

Fellbaum, C. (1998). *WordNet: An electronic lexical database*. MIT Press.

Fernandino, L. & Conant L. (2023). The Primacy of Experience in Language Processing: Semantic Priming Is Driven Primarily by Experiential Similarity. *bioRxiv,* 3, 2023 http://dx.doi.org/10.1101/2023.03.21.533703.

Friederici, A. D., Steinhauer, K., & Pfeifer, E. (2002). Brain signatures of artificial language processing: Evidence challenging the 'critical period' hypothesis. *Proceedings of the National Academy of Science,* 99, 529–534.

Fukkink, R. G., Hulstijn, J., & Simis, A. (2005). Does training in second-language word recognition skills affect reading comprehension? An experimental study. The Modern Language Journal, 89, 54–75.

Gairns, R., Redman, S. (2020). *Oxford Word Skills Intermediate Student's Book and CD-ROM Pack*. Oxford University Press.

Gonnerman, L. M., Seidenberg, M. S., & Andersen, E. S. (2007). Graded semantic and phonologicalsimilarity effects in priming: Evidence for a distributed connectionist approach to morphology. *Journal of Experimental Psychology*, 136, 323–345. http://dx.doi.org/10.1037/0096-3445.136.2.323

González, G. F., Žarić, G., Tijms, J., Bonte, M., Blomert, L., & van der Molen, M. W. (2015). A randomized controlled trial on the beneficial effects of training letter-speech sound

integration on reading fluency in children with dyslexia. *PLoS ONE,* 10, http://dx.doi.org/10.1371/journal.pone.0143914

Goodrich, M. J., & Leiva, S. (2020). Semantic priming and reading skills among Spanish- speakingdual language learners. *International Journal of Bilingual Education and Bilingualism,*1-19. http://dx.doi.org/10.1080/13670050.2020.1835810

Gor, K. (2018). Phonological priming and the role of phonology in nonnative word recognition. *Bilingualism: Language and Cognition, 21*(3), 437-442. http://dx.doi.org/10.1017/S1366728918000056

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing Inferences during Narrative Text Comprehension. *Psychological Review,* 101, 371-395. http://dx.doi.org/10.1037/0033-295X.101.3.371

Green, R. (2017). *Designing Listening Tests: A Practical Approach.* Macmillan publications.

Gulan, T. & Valerjev, P. (2010). Semantic and related types of priming as a context in word recognition. *Review of Psychology, 17*(1), 53-58.

Hahn, N., Foxe, J. J., & Molholm, S. (2014). Impairments of multisensory integration and cross- sensory learning as pathways to dyslexia. *Neuroscience & Biobehavioral Reviews,* 47, 384–392. http://dx.doi.org/10.1016/j.neubiorev.2014.09.007

Harm, M. W., & Seidenberg, M. S. (2004). Computing the meanings of words in reading: Cooperative division of labor between visual and phonological processes. *Psychological Review*, 111, 662–720. doi:10.1037/0033-295X.111.3.662

Heyman, T., Van Rensbergen, B., Storms, G., Hutchison, K. A., & De Deyne, S. (2015). The influence of working memory load on semantic priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 41*(3), 911–920. https://doi.org/10.1037/xlm0000050

Hu, G., & Jiang, N. (2011). Semantic integration in listening comprehension in a second language. In K. M. P. Trofimovich (Ed.), *Applying priming methods to L2 learning, teaching and research* (pp. 199-218). John Benjamins.

Khaghaninejad, M. S., & Farrokhiyekta, B. (2020). The effect of visual priming on the lexical retrieval on implicit memory tasks for advanced foreign language learners. *Revista Signos, 53*(102), 104–122. https://doi.org/10.4067/s0718-09342020000100104

Khodadady, E., alavi, M., Pishghadam, R. & Khaghaninezhad, M. S. (2012). Teaching general English in academic context: Schema-based or translation-based approach? *International journal of linguistics, 4*(1), 56-76. http://dx.doi.org/10.5296/ijl.v4i1.1213

Kodadady, E., Alavi, M. & Khaghaninejad, M. S. (2012). Schema-based instruction: A novel approach of teaching English to Iranian university students. *Ferdowsi review,* 5, 3-21.

Kiefer, M., & Martens, U. (2010). Attentional sensitization of unconscious cognition: Task sets modulate subsequent masked semantic priming. *Journal of Experimental Psychology,* 139, 464–489.

Kouider, S., & Dehaene, S. (2007) Levels of processing during non-conscious perception: a critical review of visual masking. *Cognition,* 362, 857–875.

Landi, N., & K. Ryherd. (2017). Understanding Specific Reading Comprehension Deficit: A Review. *Language and Linguistics,* 11, 67-90. http://dx.doi.org/10.1111/lnc3.12234

Larkin, A. A., Wolts, J. D., Reynolds, E. P., & Clark, E. A. (1998). Conceptual priming differences and reading ability. *Contemporary Educational Psychology*, 21, 279–303.

Madden, C. J., & Zwaan, R. A. (2006). Perceptual representation as a mechanism of lexical ambiguity resolution: An investigation of span and processing time. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 32, 1291–1303.

McDonough, K., & Trofimovich, P. (2008). Using priming methods in second language research. Routledge.

McNamara, T. P. (2005). *Semantic priming: Perspectives from memory and word recognition*. Psychology Press.

Mulder, E., Ven, M. D., Segers, E. & Verhoeven, L. (2019). Context word, and student predictors in second language vocabulary learning. *Applied Psycholinguistics*, *40*(1), 137-166. https://doi.org/10.1017/S0142716418000504

Nation, I. S. P., & Newton, J. (2009). Teaching ESL/EFL listening and speaking. Routtledge.

Nation, K., & Snowling, M.J. (2004). Beyond phonological skills: Broader language skills contribute to the development of reading. *Journal of Research in Reading, 27*(4), 342-356.

Nation, K., Adams, J. W., Bowyer-Crane, C. A., & Snowling, M. J. (1999). Working memory deficits in poor comprehenders reflect underlying language impairments. *Journal of Experimental Child Psychology,* 73, 139–158.

Nelson, D. L., McEvoy, C. L., & Schreiber, T. A. (1998). The University of South Florida word associations, rhyme, and word fragment norms. http://w3.usf.edu/FreeAssociation/.

Nkrumah, I., & Neumann, E. (2018). Cross-language negative priming remains intact, while positive priming disappears: evidence for two sources of selective inhibition. *Journal of Cognitive Psychology, 30*(3), 361-384. http://dx.doi.org/10.1080/20445911.2017.1417311

Nobre, A. D. P., & Salles, J. F. D. (2016). Lexical-semantic processing and reading: Relations between semantic priming, visual word recognition and reading comprehension. *Educational Psychology, 36*(4), 753-770.

Norris, D., Kinoshita, S., & van Casteren, M. (2010). A stimulus sampling theory of letter identity and order. *Journal of Memory and Language*, 62, 254–271. http://dx.doi.org/10.1016/j.jml.2009.11.002

Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology*, 98, 554–566. http://dx.doi.org/10.1037/0022-0663.98.3.554

Ouellette, G., & Beers, A. (2010). A not-so-simple view of reading: How oral vocabulary and visual-word recognition complicate the story. *Reading and Writing*, 23, 189–208. http://dx.doi.org/10.1007/s11145-008-9159

Perfetti, C. A., Landi, N., & Oakhill, J. (2008). The acquisition of reading comprehension skill. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 227–247).Oxford. http://dx.doi.org/ 10.1002/9780470757642.ch13

Pickering, M. J., & Ferreira, V. S. (2008). Integration and interaction in language comprehension. *Trends in Cognitive Sciences, 12*(7), 234-241.

Saslow, J. and Ascher, A. (2006). *Top Notch series: English for today's world.* Pearson Education.

Shojayee, S., Khaghaninejad, M. S., Najafi, M. (2018). Family communication patterns of individuals with and without learning disabilities. *Health psychology research*, 6, 16-21.

Soler, M., Dasí, C., & Ruiz, J. (2015). Priming in word stem completion: Comparison with previous results in word fragment completion tasks. *Frontiers in Psychology*, 6, 11-72.

Tooley, K., & Traxler, M. J. (2010). Syntactic priming effects in comprehension: A critical review. *Language and Linguistics Compass, 4*(10), 925–937. http://dx.doi.org/10.1111/j.1749-818X.2010.00249.x

Tulving, E., & Schacter, D. L. (1990). Priming and human memory systems. *Science,* 247, 301–306.

Vellutino, F. R., Scanlon, D. M., & Spearing, D. (1995). Semantic and phonological coding in poor and normal readers. *Journal of Experimental Child Psychology,* 59, 76-82.

Yuan, Y., Woltz, D., & Zheng, R. (2010). Cross-language priming of word meaning during second language sentence comprehension. *Language Learning, 60*(2), 446-469. https://doi.org/10.1111/j.1467-9922.2010.00564.x

Zeguers, M. H. T., Snellings, P., Huizenga, H. M., & Van der Molen, M. W. (2017). Time course analyses of orthographic and phonological priming effects in developing readers. *The Quarterly Journal of Experimental Psychology, 71*(8), 1672–1686. http://dx.doi.org/10.1080/17470218.2017.1345958

Ziegler, J. C., Montant, M., & Jacobs, A. M. (1997). The feedback consistency effect in lexical decision and naming. *Journal of Memory and Language, 37*(4), 533–554. https://doi.org/10.1006/jmla.1997.2525