

Please cite this paper as follows: Hayatbakhsh Abbasi, B., Haddad Narafshan, M., & Seifadidni, P. (2023). Relationship Between Vocabulary Learning Strategy Use and Learning Styles Using Structural Equation Modelling across Age and Gender. *International Journal of Foreign Language Teaching and Research*, 11 (47), 139-154. <http://doi.org/10.30495/IJFL.2023.707752>

Research Paper

## Relationship Between Vocabulary Learning Strategy Use and Learning Styles Using Structural Equation Modelling across Age and Gender

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Received: July 27, 2023

Accepted: September 06, 2023

### Abstract

This study investigated Iranian English-as-a-foreign-language (EFL) learners' use of vocabulary learning strategies (VLSs) and its interrelationship with the breadth of vocabulary knowledge (VK), depth of vocabulary knowledge and learning styles, especially in relation to gender and age. Structural equation models (SEM) were established. Two hundred students' vocabulary strategy use frequency, vocabulary size test scores (indicative of breadth of VK), word associates test (indicative of depth of VK) and learning styles questionnaire results were used as data. The priority of strategies that were used is as follows from the most used to the least used respectively: Memory, Cognitive, Determination, Social & Metacognitive. Furthermore, the learning style questionnaire categorized the participants in the four groups of: activists, reflectors, theorists & pragmatists. There was a significant relationship between determination VLS and depth of VK. Learning styles of theorist, reflector and activist provided the basis for increasing and improving breadth of VK. Also, there was a significant and incremental (direct) relationship between theorist, reflector & activist learning styles with depth of VK. In three groups of theorist, reflector, and activist learning styles, social VLS provided the basis for increasing and improving breadth of VK. Also, in three groups of pragmatists, theorist & reflector learning styles, there is a significant and direct relationship between memory VLS and breadth of VK. In males' group, there was a significant and direct effect between determination VLS and breadth of VK. Furthermore, in females' group, there was a significant and direct relationship between social VLS and depth of VK. Considering the age of participants, in the age group of 20-24 years, there was a significant and direct relationship between metacognitive VLS and breadth of VK. However, in the age group of 25-30 years, there was a significant and direct relationship between cognitive VLS and breadth of VK. Given the important mediating effects of gender and age, it is proposed that vocabulary learning be strategically and stylistically integrated into the accumulative process of English learning.

**Keywords:** Breadth and Depth of Vocabulary Knowledge; Learning Styles; Structural Equation Modelling; Vocabulary Learning Strategies

رابطه بین استفاده از استراتژی یادگیری واژگان و سبک های یادگیری با استفاده از مدل سازی معادلات ساختاری در سن و جنس این مطالعه به بررسی استفاده زبان آموزان ایرانی انگلیسی انگلیسی به عنوان یک زبان خارجی (EFL) از راهبردهای یادگیری واژگان (VLS) و ارتباط متقابل آن با وسعت دانش واژگان (VK)، عمق دانش واژگان و سبک های یادگیری به ویژه در رابطه با جنسیت پرداخته است. و سن مدل های معادلات ساختاری (SEM) ایجاد شد. فراوانی استفاده از راهبرد واژگان دویست دانش آموز، نمرات آزمون اندازه واژگان (VK)، آزمون همکاران کلمه) نشان دهنده عمق (VK) و نتایج پرسشنامه سبک های یادگیری به عنوان داده استفاده شد. اولویت راهبردهای مورد استفاده به ترتیب از پرکاربردترین تا کم استفاده ترین است: حافظه، شناختی، تعیین، اجتماعی و فرآشناختی. همچنین پرسشنامه سبک یادگیری شرکت کنندگان را در چهار گروه کنشگران، بازتابگران، نظریه پردازان و عمل گرایان دسته بندی کرد. بین تعیین VLS و عمق VK رابطه معنی داری وجود داشت. سبک های یادگیری نظریه پرداز، بازتاب دهنده و کنشگر زمینه را برای افزایش و بهبود وسعت VK فراهم کرد. همچنین بین سبک های یادگیری نظریه پرداز، بازتاب دهنده و فعال با عمق VK رابطه معنادار و افزایشی (مستقیم) وجود داشت. در سه گروه سبک های یادگیری نظریه پرداز، بازتاب دهنده و فعال، VLS اجتماعی مبنایی برای افزایش و بهبود وسعت VK فراهم کرد. همچنین در سه گروه سبک های یادگیری عملگر، نظریه پرداز و بازتاب دهنده، بین VLS حافظه و وسعت VK رابطه معنادار و مستقیم وجود دارد. در گروه مردان، بین تعیین VLS و وسعت VK اثر معنی دار و مستقیم وجود داشت. همچنین در گروه دختران بین VLS اجتماعی و عمق VK رابطه معنادار و مستقیم وجود داشت. با توجه به سن شرکت کنندگان، در گروه سنی ۲۰ تا ۲۴ سال، بین VLS فرآشناختی و وسعت VK رابطه معنادار و مستقیم وجود داشت. اما در گروه سنی ۲۵-۳۰ سال، بین VLS شناختی و وسعت VK رابطه معنادار و مستقیم وجود داشت. با توجه به تأثیرات میانجی مهم جنسیت و سن، پیشنهاد می شود که یادگیری واژگان از نظر استراتژیک و سبک در فرآیند انباشته یادگیری انگلیسی ادغام شود.

**کلمات کلیدی:** وسعت و عمق دانش واژگان، سبک های یادگیری، مدل سازی معادلات ساختاری، راهبردهای یادگیری واژگان

## Introduction

The utilization of language learning strategies (LLS) by students to enhance their own skills in acquiring a second or foreign language is a well-established phenomenon, as stated by Oxford (1999). The investigation into this crucial construct regarding individual differences (Cohen & Macaro, 2007) dates to the 1970s, when the focus was on recording the types of learning strategies that successful second language (L2) learners employed (Rubin, 1975). In addition to the classification and documentation of LLS employed by language learners, another significant area of LLS research is dedicated to exploring the correlation between LLS and L2 performance (Zhang & Lu, 2015).

Scholarly endeavors in the realm of language acquisition strategies (LLSs) (see O'Malley and Chamot, 1990; Oxford, 1990) have been pivotal to the formation of compilations of vocabulary acquisition strategies (VLSs). Researchers have utilized VLS inventories to scrutinize a multitude of topics, such as the VLSs that are adopted by prosperous and unsuccessful language learners (Fan, 2003; Gu, 2003), the factors that may influence the utilization of VLSs (Gu, 2002; Catalán, 2003), and the correlation between this utilization and the extent of vocabulary knowledge (VK) (Kojic-Sabo and Lightbown, 1999) along with its comprehensiveness (e.g., Nassaji, 2006; Zhang and Lu, 2015). Further research is necessary to examine the relationships between Vocabulary Learning Strategies (VLSs) and the breadth and depth of Vocabulary Knowledge (VK).

Na Fan's (2020) and Zhang and Lu's (2015) investigations represent the sole known instances of utilizing structural equation modeling to identify the correlation between the implementation of vocabulary learning strategies and the breadth and depth of vocabulary knowledge among learners, based on Schmitt's (1997) questionnaire. SEM can incorporate a diverse range of strategy categories for study by utilizing varied questionnaires for data elicitation. Furthermore, the impact of learner variables on such relationships, specifically the moderating and mediating effects of learners' age and gender remains unexplored. The moderating effect pertains to the differentiation of relationships with respect to individual differences, while the mediating effect determines whether a third-party factor significantly and indirectly contributes to the relationship (e.g., Mackinnon, 2011). There is now a widespread recognition that the utilization of learning strategies is influenced by various individual and context-dependent factors, such as gender, age, level of motivation, learning styles and other related variables. Therefore, it is imperative to conduct an in-depth investigation into the impact of each of these variables on vocabulary acquisition (Ehrman et al., 2003). An in-depth examination of the scholarly literature on learning styles reveals a wide range of models that categorize learners into various types. Although there are variances among these models (as evidenced by Pashler et al., 2008; Romanelli et al., 2009; Kaminska, 2014), they share a fundamental premise: not all individuals acquire knowledge and skills in identical ways.

Vocabulary proficiency constitutes a salient attribute for English as a Foreign Language learners, ascertaining requisite cognition of the lexical items to effectively comprehend textual or auditory material (Zhang & Lu, 2015). Furthermore, it is an indispensable skill in both written and aural comprehension (Na Fan, 2020; Tian, 2019; Zhang & Lu, 2015; Feng Teng, 2019; Tu & Tham, 2023; My, 2022). Siriwan (2007) posited that the acquisition of vocabulary entails the acquisition of a collection of subsets of words, along with the acquisition of strategies to navigate unfamiliar words. In recent times, the instruction of vocabulary has piqued the interest of researchers, prompting them to explore vocabulary learning strategies that can aid both researchers and EFL teachers in enhancing learners' vocabulary size (Nation, 2001). According to Nation (2001), a vast vocabulary can be attained through the utilization of vocabulary learning strategies that have been shown to be effective for learners of varying proficiency levels (Ramzan, 2021). Indeed, the primary advantage of vocabulary learning strategies is that they



enable EFL learners to take charge of their own learning and attain autonomy (Nation, 2001; Petra, 2018). The utilization of vocabulary learning strategies by learners may be subject to influence from their perception of the efficacy of such strategies. In line with this premise, the present study endeavors to investigate the correlation between diverse categories of vocabulary learning strategies, as gauged by Schmitt's (1997) vocabulary learning strategies survey (VLSS), and the depth and breadth of vocabulary knowledge, while concurrently considering learners' learning style. Furthermore, it seeks to assess the mediating roles played by learners' age and gender.

### Literature Review

Vocabulary breadth knowledge is defined as the quantity of words that an individual possesses at least a surface-level understanding of their meanings. On the other hand, depth of vocabulary knowledge pertains to an individual's level of proficiency in each lexical item, as stated by Qian (2002). While it has been established that depth and breadth of vocabulary knowledge are positively correlated, they are deemed to be separate dimensions of vocabulary knowledge (e.g., Qian, 2002; Schmitt, 2014).

The phrase "vocabulary learning strategies" denotes an extensive range of strategies utilized in a continuous process of vocabulary acquisition (Gu & Johnson, 1996, p. 669). Consonant with the classifications of LLSs proposed by O'Malley and Chamot (1990), Gu and Johnson (1996) have compiled a comprehensive list of metacognitive and cognitive strategies that can be employed from the initial encounter with words to their practical utilization. This list includes classifications such as selective attention, self-initiation, guessing, dictionary use, note-taking, memorization strategies, and activation. In addition, Schmitt (1997) and Fan (2003) have developed VLS questionnaires based on the frameworks of O'Malley and Chamot (1990) and Oxford (1990).

Studies conducted on the utilization of Vocabulary Learning Strategies (VLSs) by Alahmadi and Foltz (2020), Behforouz and Al Ghaithi (2022), Fan (2003), Fan (2020), Gu (2003), and Zhang and Lu (2015) have concluded that proficient learners exhibit a diverse range of VLSs, which they employ in a well-coordinated manner, while also being characterized by their unique features. Additionally, research has revealed that the selection and application of VLSs is influenced by individual dissimilarities and learning settings. Notably, female students have been observed to utilize a greater number of VLSs (e.g., Gu, 2002; Catalán, 2003) and exhibit an increased eagerness to experiment with new ones (e.g., Young and Oxford, 1997) relative to their male counterparts.

Behforouz and Al Ghaithi (2022) undertook an investigation into the strategies employed by 42 Omani EFL learners in vocabulary learning and analyzed the influence of gender on the choice of strategy. The data was collected using a questionnaire, and the results of the study indicated an insignificant correlation between gender and the selection of vocabulary learning strategies. However, among all the strategies employed, determination strategies were ranked highest by the users, while social strategies were found to be at the bottom of the list.

In their study, Alahmadi and Foltz (2020) explored the extent to which the utilization of vocabulary learning strategies across four language domains impacted the growth of learners' vocabulary. A total of sixty-one Arabic learners of English were tasked with reading target words in semi-authentic reading materials, utilizing either the strategy of guessing meaning from context or consulting a dictionary. The researchers administered tests to estimate both vocabulary size and meaning. The results demonstrated that successful learning through inferencing, as opposed to learning through dictionary use, was contingent upon learners' familiarity with the particular learning strategy.



A study conducted by Fan (2020) examined the utilization of vocabulary learning strategies among Chinese EFL learners and its association with vocabulary knowledge, particularly in terms of proficiency level, gender, and discipline. The findings indicate that proficiency level is a significant positive predictor of Attention and Guessing strategies, but a negative predictor of Socializing strategy (i.e., seeking assistance from others). Attention and Guessing strategies were significantly positively associated with Vocabulary Size Test (VST) and Word Association Test (WAT), while Socializing strategy was significantly negatively associated with the breadth and depth of Vocabulary Knowledge (VK). However, the predictive power of Attention, Guessing, and Socializing strategies was primarily achieved through the mediating or indirect effects of proficiency level. Gender moderated the predictive power of Attention, Socializing, and DictNote strategies, particularly among male students, whereas discipline moderated the relationship between Guessing strategy and WAT, particularly among students majoring in the arts.

Zhang and Lu (2015) conducted a study with the aim of investigating the potential relationship between the Vocabulary Learning Strategies (VLSs) of EFL learners and their knowledge of vocabulary breadth and depth. One hundred and fifty first-year university students were selected as the subjects of the study. In order to collect the data, three instruments were employed, namely, the Vocabulary Levels Test, a meaning recall task, and the Depth of Vocabulary Knowledge Test. Additionally, participants were required to complete a vocabulary learning strategies survey (Schmitt, 1997). To determine the extent to which vocabulary learning strategies can predict the breadth and depth of vocabulary knowledge, structural equation modeling was utilized. The results of the study indicated that those strategies which are focused on the learning of the forms and associative meanings of words are significant predictors of both vocabulary breadth and depth knowledge.

It is noteworthy to acknowledge that a substantial amount of research has been conducted about vocabulary learning strategies and their association with vocabulary acquisition. However, a limited number of studies have endeavored to explore the interdependent relationship between the four variables of vocabulary learning strategies, learning styles, the breadth and depth of vocabulary learning via the implementation of structural equation modeling. Additionally, the categorization of vocabulary knowledge has frequently isolated the elements of vocabulary breadth and depth as separate entities. Furthermore, the variables of age and gender have not been considered in the investigation of such effects. Accordingly, the current study endeavors to investigate the correlation between diverse categories of vocabulary learning strategies, as gauged by Schmitt's (1997) vocabulary learning strategies survey (VLSS), and the depth and breadth of vocabulary knowledge, while concurrently considering learners' learning style. Furthermore, it seeks to assess the mediating roles played by learners' age and gender.

## Methodology

### Participants

Two hundred participants, ranging in age from 20 to 30, were enlisted to partake in the present study. The participants' English proficiency was gauged via a practice test from the esteemed International English Language Testing System (IELTS), with a mean score of 5.35 points ( $SD = 1.12$  points). All participants were first-year students at a university situated in Kerman. Of the 200 participants, 120 (60%) were identified as female and 80 (40%) as male, with their majors spanning three distinct fields: teaching, literature, and translation. Of the participants, 134 were aged between 20-24 years, while the remaining 66 were aged between 25-30 years. Notably, all participants had completed English courses during their secondary education, having acquired a minimum of 6 years of English language instruction prior to enrolling at the university. Through a comparative and analytical assessment of the vocabulary proficiency of the study's participants,



utilizing both breadth and depth questionnaires, it was determined that said participants demonstrated a congruent level of aptitude, rendering them qualified for inclusion in the study at hand.

### **Instruments**

To gather the necessary data, a total of four instruments were utilized. Firstly, a questionnaire pertaining to vocabulary learning strategies was employed with the aim of investigating the strategies employed in the acquisition of vocabulary. This instrument was developed by Schmitt in 1997 and was adopted for the purpose of evaluating the employment of vocabulary learning strategies by learners. Comprising 58 items and utilizing a 6-point Likert scale ranging from never to always, the questionnaire demonstrated a high level of reliability, with an Alfa Cronbach of .89. Furthermore, the questionnaire was deemed to be valid, given its successful utilization in previous studies focusing on the estimation of vocabulary learning strategies.

The second phase entailed administering a learning styles questionnaire to explore the learning styles of the participants. The Honey and Mumford's learning style (1989) questionnaire was employed for this purpose, comprising 80 items that probed whether the participants concurred or dissented with each item. The resultant data was subsequently classified into four categories, namely Reflectors, Activists, Theorists, and Pragmatists. The term learning styles connotes the attitudes and conducts that dictate an individual's favored approach to learning. The questionnaire's reliability was assessed using Alfa Cronbach, which was found to be .92, signifying its suitability for the study.

Furthermore, in order to evaluate the breadth and depth of lexical knowledge, two assessments of vocabulary were employed. The initial examination, created by Read (1993, 2000), gauged the depth of receptive vocabulary knowledge with a high degree of consistency. The examination comprised of 40 segments, each containing a single target term and two boxes. The left box displayed four potential synonyms of the target word, while the right box exhibited four potential collocates of the target word. The greater the total score of the exam, the greater the depth of vocabulary knowledge. Additionally, Schmitt, Schmitt, and Clapham's (2001) adaptation of the Vocabulary Levels Test (VLT) were utilized to appraise recognition of meaning and therefore, estimate the breadth of vocabulary knowledge. The validity of the VLT as a tool for assessing the lexicon of English language learners across varying frequency levels has been demonstrated in prior studies (Schmitt et al., 2010). Moreover, it is widely regarded as the preeminent assessment instrument for measuring the extent of learners' vocabulary knowledge (Schmitt, 2010). Comprising five distinct sections, the VLT evaluates passive mastery of 30 target words in each section, with a cumulative total of 150 target words. These words are selected based on their frequency level or academic relevance.

### **Procedure**

The current study, conducted as a cross-sectional survey, aimed to investigate the correlation between vocabulary learning strategies and breadth and depth of vocabulary knowledge regarding the learners' learning styles at a distinct point in time (i.e., February-June 2023). Following the introduction of the research project during staff meetings at participating university, interested instructors were scheduled for appointments to receive further information regarding the technicalities and procedures of the study. The ethical guidelines established by the ministry of higher education were adhered to in obtaining prior approval from university officials. The administration of the questionnaires and the test, either in person or electronically through email or a pre-existing Google Doc link, was extended to more than 220 EFL learners, including those geographically distant from the researchers. Regrettably, some learners evinced reluctance in sharing their responses and refused to complete the questionnaires and the tests, though a



considerable number of 200 EFL learners ultimately filled out the questionnaire. As a member of the research society, establishing a bond of trust between the researchers and the participants was facilitated by direct contact with most students. Before participation, the objectives, procedure, and limitations of the study were outlined to the participants, who were then asked to participate voluntarily. To ensure the confidentiality of the participants' information, all identifications were removed, and pseudonyms were employed instead. The questionnaires were treated with anonymity.

## Results

The data were analyzed utilizing the statistical software programs SPSS 26 and AMOS 25. Through the administration of the questionnaire on vocabulary learning strategies, regarding the first research question (What are the vocabulary learning strategies that Iranian EFL learners use most and least frequently?), the prioritization of strategies utilized by the participants were identified, with Memory (MEM), Cognitive (COG), Determination (DET), Social (SOC), and Metacognitive (MET) being ranked from most to least utilized respectively. Additionally, based on the learning style questionnaire, the participants were categorized into four distinct groups: Activists, Reflectors, Theorists, and Pragmatists. Numerical results for the two variables were obtained from two tests measuring breadth and depth of vocabulary knowledge. Table 1 shows acceptable fit indices. All factors were then used in further analyses.

**Table 1**  
*Model fit indices*

Index	Acceptable	Model
CMIN/DF	$5 \leq$	3.372
GFI	$0.9 \geq$	0.950
AGFI	$0.9 \geq$	0.853
NFI	$0.9 \geq$	0.920
IFI	$0.9 \geq$	0.930
TLI	$0.9 \geq$	0.835
CFI	$0.9 \geq$	0.927
RMSEA	$0.08 \leq$	0.077

With regards to the second research question, what are the relationships between the vocabulary learning styles and the breadth and depth of VK?, the findings, as illustrated in Table 2 and Figure 1, revealed a positive correlation between the Theorist learning style and the Breadth of vocabulary knowledge ( $\beta=0.226$ ,  $p<0.05$ ), Reflector learning style and Breadth of vocabulary knowledge ( $\beta=0.368$ ,  $p<0.05$ ) and Activist learning style with Breadth of vocabulary knowledge ( $\beta=0.209$ ,  $p>0.05$ ). This suggests that the characteristics of the Theorist, Reflector, and Activist learning styles act as a foundation for enhancing and improving the Breadth of vocabulary knowledge and the results also evinced a significant negative relationship between the Pragmatist learning style and Breadth of vocabulary knowledge ( $\beta= -0.329$ ,  $p<0.05$ ).

Moreover, the findings indicated a positive correlation between the Theorist learning style and the Depth of Vocabulary Knowledge ( $\beta=0.298$ ,  $p<0.05$ ), the Reflector learning style and the Depth of Vocabulary Knowledge ( $\beta=0.330$ ,  $p<0.05$ ), as well as the Activist learning style and the Depth of Vocabulary Knowledge ( $\beta=0.118$ ,  $p<0.05$ ) But the results of the study revealed a significant negative correlation between the Pragmatist learning style and the Depth of Vocabulary Knowledge ( $\beta=-0.551$ ,  $p<0.05$ ).

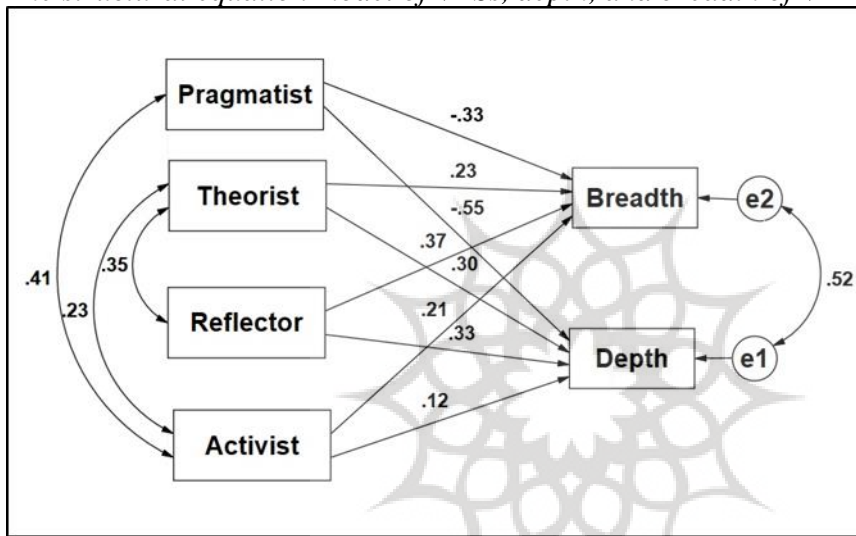


**Table 2**  
the Relationship between VLSs and depth and breadth of VK

Hypothesis	Path	t statistic	P-value
Pragmatist → Breadth	-0.329	-5.278	0.001
Theorist → Breadth	0.226	3.595	0.001
Reflector → Breadth	0.368	6.048	0.001
Activist → Breadth	0.209	3.241	0.001
Pragmatist → Depth	-0.551	-10.490	0.001
Theorist → Depth	0.298	5.620	0.001
Reflector → Depth	0.330	6.442	0.001
Activist → Depth	0.118	2.178	0.029

**Figure 1**

The structural equation model of VLSs, depth, and breadth of VK Relationship



Regarding the third research question, what is the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge they possess based on their learning style category?

The results presented in Table 3 and Figures 2-6 showed:

There was not a significant relationship between DETERMINATION vocabulary learning strategy and Breadth of vocabulary knowledge in Pragmatist ( $\beta = -0.103$ ,  $p > 0.05$ ), Theorist ( $\beta = -0.032$ ,  $p > 0.05$ ), Reflector ( $\beta = 0.159$ ,  $p > 0.05$ ) and Activist ( $\beta = -0.030$ ,  $p > 0.05$ ) learning style group.

There was not a significant relationship between SOCIAL vocabulary learning strategy and Breadth of vocabulary knowledge in Pragmatist learning style group ( $\beta = -0.196$ ,  $p > 0.05$ ) and There was a significant and positive relationship between SOCIAL vocabulary learning strategy and Breadth of vocabulary knowledge in Theorist learning style group ( $\beta = 0.127$ ,  $p < 0.05$ ), Reflector learning style group ( $\beta = 0.291$ ,  $p < 0.05$ ) and Activist learning style group ( $\beta = 0.538$ ,  $p < 0.05$ ).

The results also showed a positive relationship between MEMORY vocabulary learning strategy and Breadth of vocabulary knowledge in learning styles groups of Pragmatist ( $\beta = 0.516$ ,  $p < 0.05$ ), Theorist ( $\beta = 0.677$ ,  $p < 0.05$ ) and Reflector ( $\beta = 0.264$ ,  $p < 0.05$ ) and the results presented a significant negative relationship between MEMORY vocabulary learning strategy and Breadth of vocabulary knowledge in Activist learning style group ( $\beta = -0.112$ ,  $p < 0.05$ ).



There was not a significant relationship between COGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge in Pragmatist ( $\beta=-0.097$ ,  $p > 0.05$ ) and Reflector ( $\beta=0.134$ ,  $p > 0.05$ ) learning style group. The results also showed a positive relationship between COGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge in learning styles groups of Theorist ( $\beta=0.618$ ,  $p<0.05$ ,) and Activist ( $\beta=0.773$ ,  $p<0.05$ ).

There was not a significant relationship between METACOGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge in Pragmatist ( $\beta=-0.109$ ,  $p > 0.05$ ) learning style group. the relationship between METACOGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge in Theorist ( $\beta= -0.165$ ,  $p<0.05$ ) and Reflector ( $\beta= -0.413$ ,  $p<0.05$ ) learning styles groups was meaningful and negative and There was a positive relationship between METACOGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge in Activist learning style group ( $\beta=0.143$ ,  $p<0.05$ ).

The results presented a significant negative relationship between DETERMINATION vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta = -0.190$ ,  $p < 0.05$ ) in Pragmatist learning styles group. There was not a significant relationship between DETERMINATION vocabulary learning strategy and Depth of vocabulary knowledge in Theorist ( $\beta=0.009$ ,  $p > 0.05$ ) and Activist ( $\beta=0.051$ ,  $p > 0.05$ ) learning style group and the results revealed a positive relationship between DETERMINATION vocabulary learning strategy and Depth of vocabulary knowledge in Reflector learning styles group ( $\beta=0.276$ ,  $p < 0.05$ ).

There was also a negative relationship between SOCIAL vocabulary learning strategy and Depth of vocabulary knowledge in Pragmatist ( $\beta= -0.331$ ,  $p>0.05$ ) and Activist ( $\beta= -0.368$ ,  $p>0.05$ ) learning styles groups. Also, there was a positive relationship between SOCIAL vocabulary learning strategy and Depth of vocabulary knowledge in Theorist learning styles group ( $\beta = 0.280$ ,  $p < 0.05$ ) and Reflector learning styles group ( $\beta = 0.487$ ,  $p < 0.05$ ).

There was not a significant relationship between MEMORY vocabulary learning strategy and Depth of vocabulary knowledge in Pragmatist ( $\beta=0.101$ ,  $p > 0.05$ ) and Reflector ( $\beta=-0.135$ ,  $p > 0.05$ ) learning style group. The results show a significant negative relationship between MEMORY vocabulary learning strategy and Depth of vocabulary knowledge in Theorist ( $\beta= -0.792$ ,  $p < 0.05$ ) learning styles group and a positive relationship in Activist learning styles group ( $\beta=0.667$ ,  $p < 0.05$ ) between MEMORY vocabulary learning strategy and Depth of vocabulary knowledge.

The results showed a significant negative relationship between COGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Pragmatist ( $\beta= -0.341$ ,  $p<0.05$ ) and Theorist ( $\beta= -0.664$ ,  $p<0.05$ ) learning styles groups. There was not a significant relationship between COGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Reflector ( $\beta=-0.114$ ,  $p > 0.05$ ) learning style group. Moreover, there was a positive relationship between COGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Activist learning styles group ( $\beta=0.546$ ,  $p<0.05$ ).

There was also a positive relationship between METACOGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Pragmatist learning styles group ( $\beta=0.601$ ,  $p<0.05$ ). There was a significant negative relationship between METACOGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Theorist ( $\beta= -0.137$ ,  $p<0.05$ ) and Activist ( $\beta= -0.255$ ,  $p>0.05$ ) learning styles groups and There was not a significant relationship between METACOGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge in Reflector ( $\beta=-0.056$ ,  $p > 0.05$ ) learning style group.





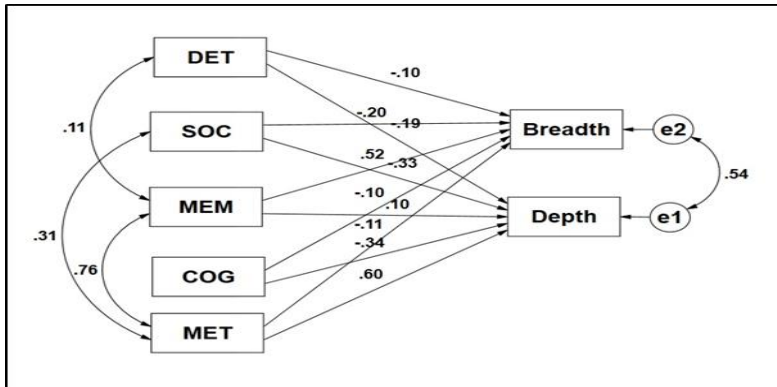
**Table 3**

*The relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge they possess based on their learning style category*

Hypothesis	Learning Style	Path	t statistic	P-value
DET→Breadth	P	-.103	-.942	.346
	T	-.032	-.871	.384
	R	.159	1.673	.094
	A	-.030	-1.306	.191
SOC→ Breadth	P	-.196	-1.584	.113
	T	.127	2.164	.030
	R	.291	2.526	.012
	A	.538	19.982	.001
MEM→ Breadth	P	.516	2.794	.005
	T	.677	12.579	.001
	R	.264	2.638	.008
	A	-.112	-4.612	.001
COG→ Breadth	P	-.097	-.898	.369
	T	.618	16.839	.001
	R	.134	1.554	.120
	A	.773	33.453	.001
MET→ Breadth	P	-.109	-.565	.572
	T	-.165	-2.349	.019
	R	-.413	-3.470	.001
	A	.143	5.115	.001
DET→Depth	P	-.190	-2.364	.018
	T	.009	.537	.591
	R	.276	2.866	.004
	A	.051	1.013	.311
SOC→ Depth	P	-.331	-3.653	.001
	T	.280	10.821	.001
	R	.487	4.177	.001
	A	-.368	-6.289	.001
MEM→ Depth	P	.101	.744	.457
	T	-.792	-33.309	.001
	R	-.135	-1.329	.184
	A	.667	12.599	.001
COG→ Depth	P	-.341	-4.315	.001
	T	-.664	-40.967	.001
	R	-.114	-1.310	.190
	A	.546	10.879	.001
MET→ Depth	P	.601	4.241	.001
	T	-.137	-4.413	.001
	R	-.056	-.463	.643
	A	-.255	-4.192	.001

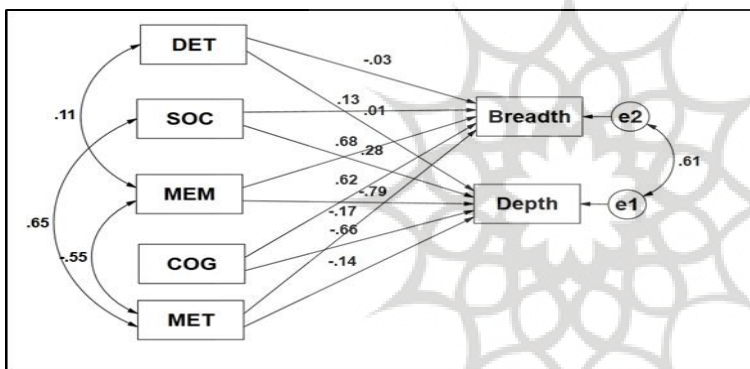
**Figure 2**

*The structural equation model of the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge in Pragmatist Group*



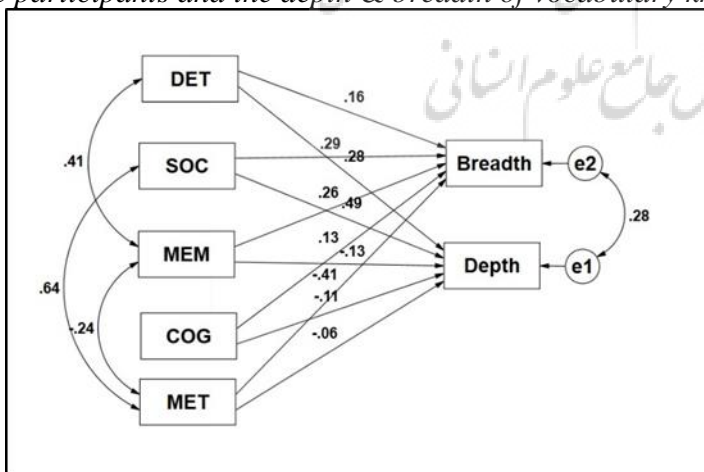
**Figure 3**

*The structural equation model of the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge in Theorist Group*



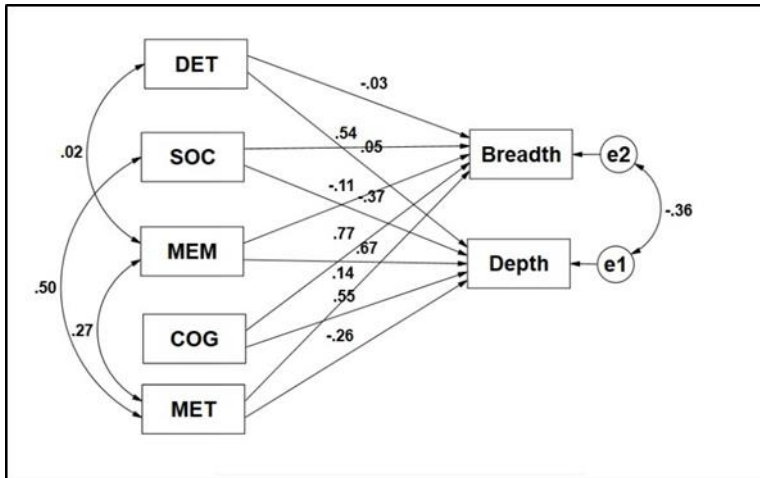
**Figure 4**

*The structural equation model of the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge in Reflector Group*



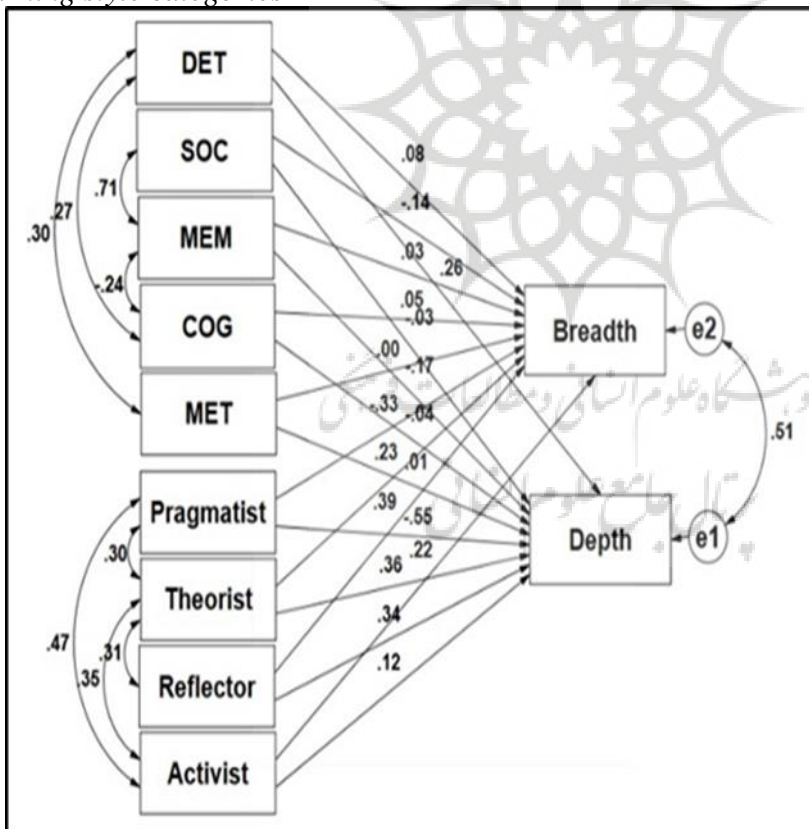
**Figure 5**

*The structural equation model of the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge in Activist Group*



**Figure 6**

*The structural equation model of the relationship between the learning strategies employed by the participants and the depth & breadth of vocabulary knowledge they possess based on their learning style categories*



Regarding the fourth research question, what is the relationship between the vocabulary learning strategy employed by learners and the depth and breadth of their vocabulary knowledge, with respect to their gender?

The results presented in Table 4 and Figure 8 (males) showed that there was a positive relationship between DETERMINATION vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta=0.278$ ,  $p < 0.05$ ) and METACOGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta= 0.388$ ,  $p < 0.05$ ). But there was a significant negative relationship between SOCIAL vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta= -0.484$ ,  $p<0.05$ ) and COGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta= -0.233$ ,  $p<0.05$ ) and there was not a relationship between MEMORY vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta= 0.137$ ,  $p > 0.05$ ).

The results also showed a positive relationship between DETERMINATION vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta=0.431$ ,  $p<0.05$ ) and METACOGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta=0.233$ ,  $p<0.05$ ). The results indicated a significant negative relationship between SOCIAL vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta= -0.461$ ,  $p<0.05$ ) and COGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta= -0.257$ ,  $p<0.05$ ) and there was not a relationship between MEMORY vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta= 0.067$ ,  $p > 0.05$ ).

The results presented in Table 4 and Figure 7 (females) showed there was not a relationship between DETERMINATION ( $\beta= -0.001$ ,  $p > 0.05$ ), SOCIAL ( $\beta= 0.208$ ,  $p > 0.05$ ), MEMORY ( $\beta= -0.048$ ,  $p > 0.05$ ) vocabulary learning strategy and Breadth of vocabulary knowledge. there was a positive relationship between COGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta=0.252$ ,  $p<0.05$ ) and there was a significant negative relationship between METACOGNITIVE vocabulary learning strategy and Breadth of vocabulary knowledge ( $\beta= -0.341$ ,  $p<0.05$ ).

there was not a relationship between DETERMINATION ( $\beta= 0.040$ ,  $p > 0.05$ ), METACOGNITIVE ( $\beta= -0.104$ ,  $p > 0.05$ ) vocabulary learning strategy and Depth of vocabulary knowledge. There was a positive relationship between SOCIAL vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta=0.337$ ,  $p<0.05$ ) and COGNITIVE vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta=0.183$ ,  $p<0.05$ ). But in this group, the relationship between MEMORY vocabulary learning strategy and Depth of vocabulary knowledge ( $\beta= -0.423$ ,  $p<0.05$ ) was significant and negative.

**Table 4**

*The relationship between the vocabulary learning strategy employed by learners and the depth and breadth of their vocabulary knowledge, with respect to their gender*

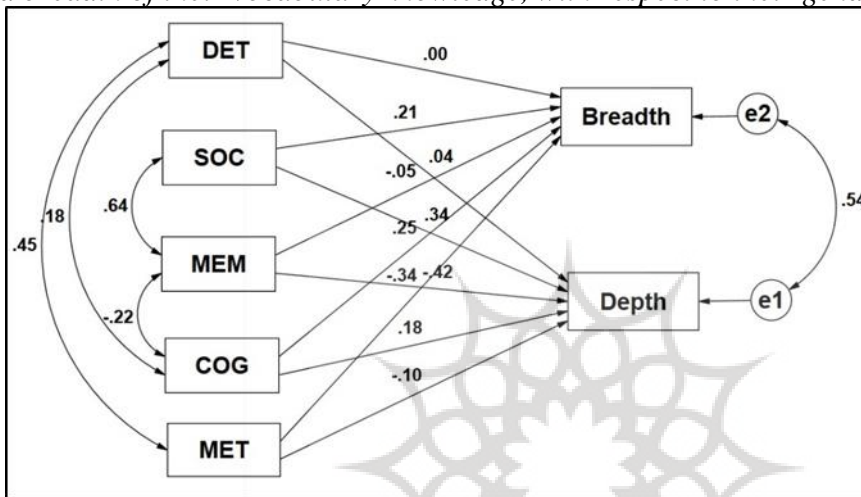
Hypothesis	Gender	Path	t statistic	P-value
DET→Breadth	Female	-0.001	-0.006	0.996
	Male	0.278	2.804	0.005
SOC→ Breadth	Female	0.208	1.943	0.052
	Male	-0.484	-2.902	0.004
MEM→ Breadth	Female	-0.048	-0.441	0.659
	Male	0.137	0.783	0.433
CoG→ Breadth	Female	0.252	2.920	0.003
	Male	-0.233	-2.091	0.037
MET→ Breadth	Female	-0.341	-3.743	0.001
	Male	0.388	4.473	0.001
DET→Depth	Female	0.040	0.427	0.670
	Male	0.431	4.331	0.001
SOC→ Depth	Female	0.337	3.096	0.002



Hypothesis	Gender	Path	t statistic	P-value
	Male	-0.461	-2.753	0.006
MEM→ Depth	Female	-0.423	-3.789	0.001
	Male	0.067	0.385	0.700
CoG→ Depth	Female	0.183	2.080	0.038
	Male	-0.257	-2.297	0.022
MET→ Depth	Female	-0.104	-1.122	0.262
	Male	0.233	2.676	0.007

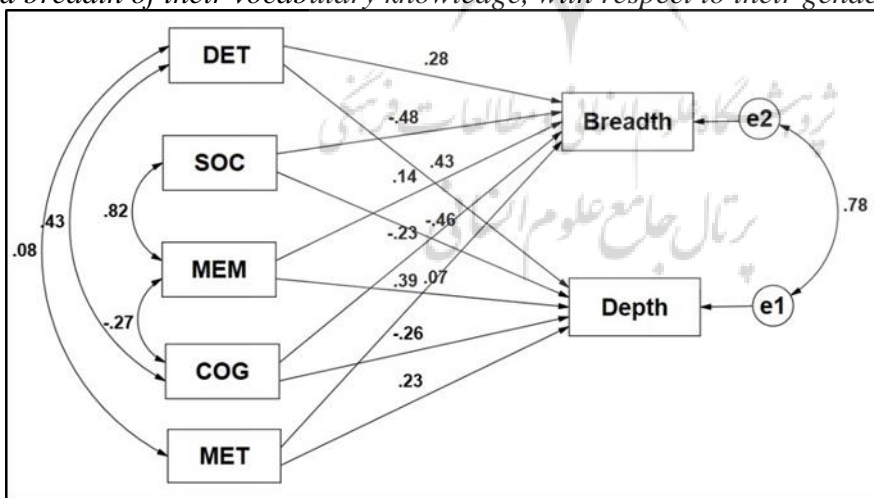
**Figure 7**

*the relationship between the vocabulary learning strategy employed by learners and the depth and breadth of their vocabulary knowledge, with respect to their gender (Females)*



**Figure 8**

*the relationship between the vocabulary learning strategy employed by learners and the depth and breadth of their vocabulary knowledge, with respect to their gender (Males)*



**Discussion**

An overview of the data helps understand current vocabulary learning behaviors in an EFL context. The memory vls was the most used following by the determination vls. By prioritizing the strategy statements it was found that strategies such as: part of speech, affixes and roots, finding an L1 cognate, picture or gesture, guessing, using monolingual or bilingual dictionaries,

English-Persian word lists and flashcards have the highest frequency. This is consistent with Na Fan's study in which using dictionaries and guessing have been found popular among Chinese students because Chinese EFL learners do not have a good mastery of English and meet new words frequently. They use English-Chinese dictionaries much more often because bilingual dictionaries offer word information in friendly local languages. This confirms our findings however, in this study due to intermediate level of students and English being their major, they used more monolingual dictionaries. Zhang and Lu's study found that mnemonic strategies were first in priority and after them were cognitive strategies. Although their findings do not match exactly with our findings, they are some similarities in strategies taken.

In Na Fan's study, gender difference occurred only in DictNote and Socializing, with female students reporting significantly more use. However, in our study, gender differences were more studied and it was found that the strength of the relationship between determination vls and breadth of vocabulary knowledge, social vocabulary learning strategy and breadth of vocabulary knowledge, and determination vocabulary learning strategy and depth of vocabulary knowledge was higher in the male group than in the female group. Also, in the female group, the intensity of the relationship between memory vocabulary learning strategy and depth of vocabulary knowledge was higher than in the male group. This last statement confirms with Na Fan's study. Zhang & Lu did not consider gender in their study. Some studies in this strand such as Na Fan's study, reported that female students used more strategies than did their male counterparts. The results of the present study indicated that the variables of gender and vocabulary learning strategy are independent from each other. In other words, gender does not affect the strategy of vocabulary learning.

This study put further the issue of age groups that was not mentioned in similar studies. It has been revealed that the intensity of the relationship among the variables of social vls and breadth of vk, cognitive vls and breadth of vk, metacognitive vls and breadth of vk, determination vls and depth of vk, social vls and depth of vk, memory vls and depth of vk and metacognitive vls and depth of vk in the age groups of 20-24 and 25-30 years is different. Examining the coefficients of the path, regardless of the direction of the relationship, shows that the intensity of the relationship between all the mentioned cases was higher in the age group of 25-30 years than in the age group of 20-24 years.

Na Fan's study showed that vocabulary learning strategies have effect both on vocabulary breadth and depth. In this study this finding is confirmed. Determination vls had asignificant relationship with depth of vk. This means that by increasing and improving determination vls features, the ground for increasing and improving the depth of vocabulary knowledge score is provided. Also, a significant and decreasing relationship was between memory vls and depth of vk. Moreover, in Zhang & Lu's study, there were five factors of vocabulary learning strategies: repetition, word list, association, form, and picture/image. In that study, Meaning Recognition, Depth, and Meaning Recall represent the three types of vocabulary knowledge examined in the study. In their study form has significant effect over both vocabulary breadth (meaning recognition and recall) and vocabulary depth. Association also plays an important role as it has significant relationship with meaning recognition and vocabulary depth. Both picture/image and word list have negative relationship with vocabulary depth. Repetition does not seem to be significantly related to either vocabulary breadth or depth.

### Conclusion

Amongst a plethora of publications on language learning strategies within the last 20 years, the present study provides substantiation for the substantial influence of language learning strategies on language learning in general, and specifically on vocabulary acquisition. The present study



solely focuses on the breadth and depth of vocabulary, however, it would be advantageous to explore how vocabulary learning strategies relate to other significant aspects of vocabulary knowledge, such as automaticity and lexical organization. Furthermore, we aspire that this study inspires further interest and discourse in empirical research regarding language learning strategies, thus promoting strategic learning, and advancing the comprehension of language learning strategies.

The present study's findings have the potential to enhance existing research in this field, however, it is essential to acknowledge the study's limitations. The first limitation pertains to the relatively small sample size. Despite the researcher's efforts to recruit a substantial number of EFL learners in Kerman, a larger sample size is necessary to increase the study's generalizability. Secondly, the utilization of questionnaires in the current study may not have fully reflected the English language learners' strategies and styles. Thirdly, the study's convenience sampling design impedes establishing temporal relationships between the variables. It is important to note that the sampling design was not random nor representative, as producing an exhaustive list of all learners for random sampling was impractical. Therefore, caution should be exercised when generalizing the findings of this study to a broader population due to the limitations of the employed sampling method. It is crucial to note that a correlation does not necessarily indicate causation, particularly direct causation. Therefore, it is essential to conduct further studies that experimentally investigate the effects of VLSs on VK.

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