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Working Memory, Task Type, and Chinese High School Students' English Vocabulary Acquisition

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Abstract

Audiovisual learning is gaining increasing attention, with factors such as working memory and task type potentially influencing learning outcomes. This study examined English vocabulary acquisition among 110 Chinese high school English as a foreign language learners with varying levels of working memory (high and low) and different types of tasks (input-based and output-based). After engaging in an audiovisual activity, the learners were divided into six groups: a high capacity input group, a high capacity output group, a high capacity control group, a low capacity input group, a low capacity output group, and a low capacity control group. Two vocabulary tests were administered—one immediately after the tasks and the other two weeks later. Using repeated measures ANOVA, the findings revealed that (1) the high capacity learners significantly outperformed the low capacity learners on both the immediate and delayed tests; and (2) while the output groups showed better performance than the input groups on both tests, the differences were not statistically significant. These results add to the findings of existing research on second language (L2) vocabulary acquisition and provide valuable pedagogical insights aimed at improving L2 vocabulary instruction.

Keywords: working memory, task type, audiovisual activity, vocabulary acquisition

1. Introduction

Vocabulary serves as the essential element of effective communication, underpinning all facets of language proficiency. Consequently, vocabulary acquisition has long been a focus of research in the field of L2 acquisition. Scholars have explored a diverse array of strategies to optimize vocabulary acquisition, and this inquiry remains ongoing. Among the critical issues in vocabulary acquisition are the variables that mediate its effectiveness, which can inform the design of productive methods to enhance learning outcomes.

One significant variable influencing vocabulary acquisition is working memory. While it may seem intuitive that working memory plays a role in vocabulary acquisition, research indicates that the relationship between the two is complex and involves multiple dimensions rather than being merely binary. The degree to which working memory impacts vocabulary acquisition is contingent upon various factors, including the type of exercises employed (e.g., Teng, 2024), instructional conditions (e.g., Liang & Zhang, 2024), and other contextual elements. Thus, the interplay between working memory and vocabulary acquisition represents a domain ripe for further exploration.

Another critical factor that has emerged in the discourse on vocabulary acquisition is the nature of the tasks assigned to learners. Within this framework, input and output tasks have garnered considerable attention. Input is widely acknowledged as a necessary condition for L2 acquisition (Krashen, 1985), while output has been shown to serve multiple facilitative functions in language development (Swain, 2005). Consequently, both input and output tasks have the potential to significantly influence vocabulary acquisition. However, the relative effectiveness of these task types remains unclear, presenting a promising avenue for research.

In this context, the present study investigated the impact of working memory and task type on the vocabulary acquisition of Chinese high school English as a foreign language students, aiming to provide novel insights to

enhance vocabulary instruction and acquisition. While acquisition and learning are commonly viewed as two distinct constructs, our focus is not on the difference between the two; therefore, these terms will be used interchangeably in this paper. The subsequent sections will first review existing research on the influence of working memory and task type on vocabulary acquisition. Next, a detailed account of the methodology and results of the current study will be presented, followed by a discussion of the findings. Finally, the paper will address the pedagogical implications of the study while also acknowledging its limitations.

2. Literature Review

Working memory plays a vital role in how learners process and retain new information, and the type of tasks assigned to learners can shape the learning environment and influence engagement and retention. Investigating these two variables within the context of vocabulary acquisition can reveal their unique contributions and possible interactions, thereby enhancing our understanding of effective teaching and learning practices. Existing studies have provided valuable insights into the impact of working memory and task type on vocabulary acquisition; however, no consensus has been established.

2.1 Working Memory and Vocabulary Acquisition

Working memory is a crucial system for temporarily storing and processing information, playing a critical role in our cognitive functioning. According to Baddeley's multi-component model (Baddeley, 2021; Baddeley & Hitch, 1974), working memory comprises four interrelated components: the central executive, the phonological loop, the visuospatial sketchpad, and the episodic buffer. The central executive orchestrates cognitive processes and regulates attentional focus; the phonological loop retains auditory information; the visuospatial sketchpad manages visual and spatial data; and the episodic buffer integrates all forms of information from both long-term and short-term memory. These insights prompt a review of empirical studies on the relationship between working memory and vocabulary acquisition.

Numerous studies have indicated a significant correlation between working memory and vocabulary learning outcomes. For example, Lee, Warschauer, and Lee (2022) investigated the association between learners' working memory (also vocabulary proficiency and strategy use) and corpus-based L2 vocabulary learning, where learners analyzed and explored large, structured collections of authentic language data. The results of path analysis indicated that working memory significantly contributed to learners' vocabulary acquisition and retention. Teng and Zhang (2024) examined the effect of executive and phonological working memory on learners' L2 vocabulary learning in three input conditions: Definition + Word information + Video, Definition + Word information, and Definition. It was found that both types of working memory played a significant role in learners' vocabulary learning and retention across all three conditions. Zhou (2013) employed a 3×3 between-group factorial design to assess the influence of processing levels and working memory on Chinese English as a foreign language learners' lexical chunk acquisition. Participants learned 24 new English chunks under three conditions: semantic processing, formal processing, and no particular type of processing. The findings suggested that those with higher working memory capacities demonstrated better recall of both the semantic and formal aspects of the chunks.

Different from these studies, some studies found that working memory did not unequivocally affect vocabulary acquisition in all learning conditions. Behbahani and Razmjoo (2023) assigned participants with high and low working memory capacities to different reading tasks: reading-only, reading plus blank-fill, and reading-plus production. Significant differences were observed in the delayed test of receptive vocabulary knowledge but not in the immediate test or productive vocabulary tasks. Liang and Zhang (2024) investigated the impact of working memory, along with language aptitude, on Chinese L2 learners' acquisition of four Chinese classifiers. Participants were assigned to three instructional (or learning) conditions: processing instruction, meaning-based output instruction, and combined instruction. Multiple regression analysis of test results indicated that working memory did not predict the learning of any of the three groups. Additionally, Teng (2024) examined the effects of working memory as well as L2 proficiency level on Chinese English as a foreign language learners' vocabulary learning outcomes across three activities: reading comprehension plus marginal glosses, reading plus gap-fill, and reading plus sentence writing. It was found that working memory significantly predicted the immediate gain scores of the gap-fill and sentence writing groups but not those of the reading comprehension group.

In summary, although there is considerable evidence for the importance of working memory in L2 vocabulary learning, the results across various studies remain mixed and context-dependent. While some research consistently shows a correlation between working memory and vocabulary acquisition, other studies suggest that

the effect of working memory is not universally applicable across all learning contexts. This disparity underscores the need for further research into the impact of working memory on vocabulary acquisition.

2.2 Task Type and Vocabulary Acquisition

Vocabulary learning is often associated with different types of tasks. Based on how learners interact with language, vocabulary learning tasks can be broadly categorized into input tasks and output tasks. Input tasks prioritize comprehension, focusing on information comprehension and processing with minimal production demands, whereas output tasks involve both comprehension and production, placing a greater emphasis on production (Kaivanpanah, Alavi & Ravandpour, 2020). Input tasks include true or false questions or matching words with their meanings, while output tasks include activities like blank filling exercises and writing assignments (Huang, Willson & Eslami, 2012). By understanding these task categories, teachers can design vocabulary instruction that addresses different aspects of language learning. Consequently, a considerable amount of research has been conducted to explore the differential effects of various vocabulary exercises or activities that encompass both input and output tasks, and the findings are also inconsistent.

Some studies have substantiated the significant effect of task type on vocabulary acquisition. For instance, Kida (2022) compared the outcomes of semantic processing tasks with structural processing tasks for Japanese learners of English who read a text with 10 target words. Data analysis showed that structural processing tasks were more beneficial for L2 vocabulary learning as demonstrated in L1-L2 cued recall. Xin and Wang (2021) compared the effects of two tasks—multiple-choice questions and Chinese-English translation—on Chinese junior high students' incidental English vocabulary acquisition in listening activities with different input modes. Analysis of vocabulary test scores suggested that the translation task resulted in significantly greater learning gains. Zhang, Du, and Zhu (2022) compared Chinese-speaking Japanese learners' vocabulary learning in two types of tasks: reading plus continuation writing and reading plus continued cloze. It was found that the continuation writing group showed substantially better learning gains than the continued cloze group in a meaning recall test and an oral form recall test.

In contrast to these studies, other studies found no significant correlation between task type and vocabulary acquisition. Duong, Montero Perez, Desmet, and Peters (2021) compared the effects of spoken input- and output-based tasks on L2 vocabulary acquisition at three levels: oral spontaneous use, oral form recall, and meaning recall. It was found that although both input- and output-based tasks produced better learning gains than mere L2 exposure, the two types of tasks demonstrated no significant difference. Likewise, Namaziandost and colleagues (2019) compared the vocabulary learning gains of learners engaged in input-based activities versus those involved in output-based activities. Analysis of test results showed that while both groups outperformed the control group, there was no significant difference between the two. Controlling the involvement load variable, Silva and Otwinowska (2018) compared the effects of different tasks on young English as a foreign language learners' vocabulary learning in three conditions: reading with glosses plus sentence writing, reading with glosses plus comprehension questions and picture matching, and reading without glosses plus multiple glosses, comprehension questions, and association. Results of both immediate and delayed posttests showed that different treatment conditions yielded similar learning gains.

Vocabulary tasks are a pivotal component of vocabulary instruction. Understanding the effect of task type on vocabulary learning can help teachers refine their instructional strategies and create more effective learning environments. Nonetheless, the current body of research results in conflicting conclusions, with some studies reporting significant differences while others indicating minimal distinctions among various task types. Addressing these gaps will not only enhance our understanding of vocabulary learning processes but also provide practical guidance for language teachers seeking to optimize their vocabulary instruction methods, highlighting the need for further exploration into the impact of task type on vocabulary acquisition.

3. Research Questions

From the review above, it is evident that substantial controversy exists regarding the effects of working memory and task type on vocabulary learning, and most studies did not concurrently examine these factors or adequately control for them. Furthermore, with the advancements in educational technology and the emergence of novel instructional modes such as micro-lectures and massive open online courses, audiovisual methods of L2 instruction have become increasingly prevalent. However, reviews of existing studies (e.g., Chen & Wang, 2021; Jonathans, Widiati, Astutik & Ratri, 2021) indicate that current research primarily concentrates on vocabulary acquisition in reading contexts. Against this backdrop, this study investigated the impact of both working memory and post-audiovisual tasks on vocabulary acquisition, guided by two specific research questions:

1) How does working memory influence vocabulary acquisition when task type is held consistent?

2) How does task type affect vocabulary acquisition when working memory is held consistent?

4. Method

4.1 Participants

The participants in this study consisted of 110 second-year high school students from two parallel classes at a high school in southern China. Both classes were instructed by the same teacher, and the students' ages ranged from 15 to 17 years. Each participant had undergone formal English instruction for approximately seven years. An analysis of the final examination scores from the second semester of their first year revealed no statistically significant difference in English proficiency between the two classes ($t = 1.145$, $p = 0.255$).

4.2 Materials

To ensure that the audiovisual material employed was of moderate difficulty and contained an appropriate number of new vocabulary items, we selected a segment from the Netflix documentary series *Our Planet*, Season 1, titled "Frozen World." This selection was based on a collective assessment conducted by three experienced high school English teachers according to participating students' overall English proficiency, listening skills, and vocabulary breadth. The chosen segment, which describes the icy landscapes of Antarctica, has a duration of 4.65 minutes and includes English subtitles. It comprises a total of 246 words and is presented at an approximate speed of 50 words per minute.

4.3 Tests

Test of working memory. The study utilized Turner and Engle's (1989) operation span test to assess participants' working memory capacities. Prior to the formal testing, participants engaged in a series of practice exercises to familiarize themselves with the testing procedure. The formal test comprised 15 sets of questions, each containing 3 to 7 arithmetic problems followed by a letter. In each set, participants decided the correctness of the arithmetic solutions while simultaneously memorizing the subsequent letters. Later, they were required to recall all letters in the correct sequence on an answer sheet. The scoring for each set was based on the number of letters recalled, with each letter accounting for 1 point. The total number of letters included was 75, resulting in a maximum attainable score of 75 points.

Test of vocabulary knowledge. Wesche and Paribakht's (1996) Vocabulary Knowledge Scale (Table 1) is used to assess vocabulary proficiency across various contexts. The scale consists of five levels. Levels I and II measure receptive knowledge, requiring test-takers to recognize a word's form and meaning. In contrast, Levels III, IV, and V assess productive knowledge, asking test-takers to produce words and sentences. Given the relatively low English proficiency level of the participants, Lian and Huang's (2010) Chinese version of the scale (Table 2) was utilized. To reduce the potential for practice effects—particularly in relation to word form memory—only two post-tests were administered, with no pre-test included.

Table 1. English version of Vocabulary Knowledge Scale (Wesche & Paribakht, 1996, p. 27)

Stage	
I	I don't remember having seen this word before.
II	I have seen this word before, but I don't know what it means.
III	I have seen this word before, and I think it means _____ (synonym or translation).
IV	I know this word. It means _____ (synonym or translation).
V	I can use this word in a sentence: _____ (If you can do this section, please also do section IV).

Table 2. Chinese version of Vocabulary Knowledge Scale (Lian & Huang, 2010, p.111)

阶段	
A	我不记得曾经见过这个词。
B	我以前见过这个词，但现在我不记得它的意思了。
C	我以前见过这个词，我认为它的意思可能是_____（英语或汉语皆可）。
D	我记得这个词，它的意思是_____（英语或汉语皆可）。
E	我可以用这个词造一个句子：_____（如果你能做 E，请把 D 也填上）。

The scoring rubrics for the vocabulary test is as follows: selecting option A would yield 1 point; selecting option B would yield 2 points; selecting options C or D with the correct meaning would yield 3 points while selecting options C or D with an incorrect meaning would yield 2 points. For option E, two scenarios were considered: if both the meaning and grammatical usage of the word in the written sentence were correct, 5 points would be awarded; if the meaning was correct but the grammatical usage was incorrect, 4 points would be awarded.

4.4 Target Words

One week prior to the formal experiment, a task aimed at selecting appropriate target vocabulary was conducted among 48 students with an English proficiency level comparable to that of the experimental classes. Based on the results, six words were identified as target words: *unintentionally*, *stretch*, *creature*, *ashore*, *struggle*, and *commodity*. A subsequent verification after the study confirmed that no participants in the experimental classes had previously encountered these six words.

4.5 Task Design

Recognizing that the extent of task involvement can significantly influence vocabulary learning outcomes (Hulstijn & Laufer, 2001), this study, following Sarani, Negari, and Ghaviniat (2013), designed two tasks with equivalent involvement load: meaning matching and blank filling. The meaning matching task was structured into two columns, with the target words presented in the left column and their corresponding English definitions in a jumbled format in the right column. Participants were instructed to match the words with their correct definitions. Since this task only involved meaning recognition and did not require the production of the target words, it was categorized as an input task. In contrast, the blank filling task required participants to select appropriate words from a list, including some distractors such as *influence* and *continent*, to complete sentences based on contextual clues. Since this task necessitated the production of vocabulary, it was classified as an output task.

4.6 Procedure

The formal experiment spanned a total of four weeks. In the first week, all participants completed the working memory test. Based on the average score of the test, participants were classified into high and low working memory capacity groups. Subsequently, a random selection of participants from each group was allocated to form input task groups, output task groups, and control groups with the same working memory capacities. Ultimately, six groups were established: a high capacity input group (n = 19), a high capacity output group (n = 20), a high capacity control group (n = 19), a low capacity input group (n = 17), a low capacity output group (n = 18), and a low capacity control group (n = 17).

In the second week of the experiment, all participants watched the selected video. Following this, the experimental groups were informed that the subsequent tasks would reinforce their memory and understanding of the new vocabulary presented in the video through various vocabulary exercises. The input groups completed the meaning matching task, while the output groups engaged in the blank filling task, each with a duration of 15 minutes. The control groups did not participate in any subsequent tasks (no task). All groups took an immediate test 10 minutes after completing their respective tasks, and then a delayed test two weeks later. To mitigate practice effects from the immediate test, the order of the target words was rearranged for the delayed test.

4.7 Data Analysis

For the analysis of the results from the two tests, a repeated measures ANOVA was performed using SPSS 25.0. This statistical method allowed for a comprehensive examination of the data. Between-group comparisons were conducted to assess both the immediate and delayed effects of varying working memory capacities and different task types on vocabulary learning outcomes.

5. Results

Analysis of the immediate test results revealed significant main effects for both working memory and task type (working memory: $F = 15.484$, $p < 0.001$; task type: $F = 4.959$, $p = 0.009$); however, the interaction effect between these two variables was not statistically significant ($F = 0.356$, $p = 0.701$). In the delayed test, the main effect of working memory was significant ($F = 9.120$, $p = 0.003$), the main effect of task type approached significance ($F = 3.031$, $p = 0.053$), while the interaction effect remained non-significant ($F = 2.688$, $p = 0.073$).

5.1 Impact of Working Memory on Vocabulary Acquisition

Table 3 presents the descriptive statistics for the test scores across all groups in both tests. With both the input and output tasks, and for both the immediate and delayed tests, the mean scores of the high capacity groups

consistently exceeded those of the low capacity groups. With the no task or control groups, this was also the case for the immediate test.

Table 3. Descriptive statistics of test scores

Task Type	Working Memory	N	Immediate Test		Delayed Test	
			M	SD	M	SD
Input	High	19	17.74	5.704	14.37	2.266
	Low	17	14.47	3.243	12.06	1.749
Output	High	20	18.30	5.732	15.70	3.481
	Low	18	14.50	2.455	13.33	2.765
No task	High	19	14.74	3.212	13.16	2.340
	Low	17	12.53	2.401	13.29	2.687

Table 4 is a comparison of test scores across different working memory capacity groups under identical task conditions. In the immediate test, the mean scores of the high capacity groups were significantly higher than those of the low capacity groups, regardless of the type of tasks completed (input task: $p = 0.019$; output task: $p = 0.005$). A similar pattern was observed in the delayed test, with significant differences between different capacity groups (input task: $p = 0.010$; output task: $p = 0.007$). With the no task learners, the differences between the high and low capacity groups were not statistically significant for either test (immediate test: $p = 0.111$; delayed test: $p = 0.877$).

Table 4. Comparison of test scores by working memory

Test	Task Type	(I) Working Memory	(J) Working Memory	MD (I-J)	SE	Sig.	95% Confidence Interval	
							Upper	Lower
Immediate	Input	High	Low	3.266*	1.373	.019	.544	5.989
	Output	High	Low	3.800*	1.336	.005	1.151	6.449
	No task	High	Low	2.207	1.373	.111	-.515	4.930
Delayed	Input	High	Low	2.310*	.876	.010	.573	4.046
	Output	High	Low	2.367*	.852	.007	.677	4.057
	No task	High	Low	-.136	.876	.877	-1.873	1.600

5.2 Impact of Task Type on Vocabulary Acquisition

Table 3 also indicates that, regardless of participants' working memory capacity, and for both the immediate and delayed tests, the mean scores of the output groups consistently exceeded those of both the input and no task groups. The input groups' mean scores were also higher than those of the no task groups, except the delayed test scores of the low capacity groups.

Table 5 compares the test scores across different task types when working memory is controlled. In the immediate test, both the high capacity input and output groups scored significantly higher than the high capacity no task group, with a p-value of 0.027 and 0.008, respectively; however, no significant difference was observed between the two task groups ($p = 0.670$). With the low capacity learners, no significant differences were found between any two groups (all p-values > 0.05). In the delayed test, the high capacity output group demonstrated significantly superior performance compared to the high capacity no task group ($p = 0.003$). In contrast, no significant differences were noted between the high capacity input group and the high capacity no task group ($p = 0.158$), nor between the high capacity input and output groups ($p = 0.116$). Consistent with the immediate test findings, there were no significant differences among the three low capacity groups (all p-values > 0.05).

Table 5. Comparison of test scores by task type

Test	Working Memory	(I)Task Type	(J)Task Type	MD (I-J)	SE	Sig.	95% Confidence Interval	
							Upper	Lower
Immediate	High	Input	No task	3.000*	1.334	.027	.354	5.646
			Output	-.563	1.317	.670	-2.049	3.176
		Output	No task	3.563*	1.317	.008	.951	6.176
	Low	Input	No task	1.941	1.410	.172	-.856	4.738
			Output	-.029	1.391	.983	-2.728	2.787
		Output	No task	1.971	1.391	.159	-.787	4.728
Delayed	High	Input	No task	1.211	.851	.158	-.477	2.898
			Output	-1.332	.840	.116	-.335	2.998
		Output	No task	2.542*	.840	.003	.876	4.209
	Low	Input	No task	-1.235	.900	.173	-3.020	.549
			Output	-1.275	.887	.154	-.485	3.034
		Output	No task	.039	.887	.965	-1.720	1.798

6. Discussion

Given the absence of significant interaction effects between working memory and task type in both the immediate and delayed tests, we will focus our discussion on the main effects. By concentrating on the main effects, we can draw clearer conclusions about the roles of working memory and task type in shaping learning outcomes.

6.1 How does Working Memory Influence Vocabulary Acquisition When Task Type is Held Consistent?

The results of this study revealed a compelling pattern: irrespective of task type—whether participants engaged in input tasks, output tasks, or no tasks at all—the high capacity group consistently outperformed their low capacity counterparts in both the immediate and delayed tests. This observation is not merely an isolated incident; rather, it aligns with the findings of prior research conducted by Lee et al. (2022), Teng and Zhang (2024), and Zhou (2013), which robustly suggested a positive correlation between higher working memory capacity and enhanced vocabulary learning outcomes. Such findings emphasize the critical role of working memory in the acquisition of new L2 vocabulary. According to Baddeley's (2021) multicomponent model of working memory, the central executive functions as the control center, allocating attention and managing cognitive resources; the phonological loop and visuospatial sketchpad serve as vital storage systems for different forms of information; and the episodic buffer further integrates diverse inputs into coherent, usable knowledge. Numerous studies have confirmed the significant contributions of these components to L2 learning (see Li, 2023), underscoring the idea that a greater working memory capacity reflects not only a greater ability to store information but also a more robust integration of these cognitive processes.

During the audiovisual phase of this study, all four components of working memory were actively engaged, providing the high capacity groups with a distinct advantage. In the subsequent vocabulary practice phase, the roles of the central executive and the visuospatial sketchpad became particularly salient, facilitating the organization and manipulation of the new vocabulary being learned. Consequently, participants with higher working memory capacity were able to leverage these resources more effectively, leading to superior learning outcomes and test performance. The implications are significant; they indicate that learners with enhanced working memory can navigate new linguistic information more adeptly, ultimately resulting in better retention and application of vocabulary.

The advantage observed in the high capacity groups can also be attributed to the distinct functions of the phonological loop, which plays an instrumental role in vocabulary learning, especially when it comes to acquiring new words. Research indicates that individuals with larger phonological memory capacity exhibit greater proficiency in vocabulary acquisition (Baddeley, 2021; Li, 2023). This assertion is further substantiated by empirical studies (e.g., Hummel, 2009; Farnia & Geva, 2011), which have consistently shown that phonological memory capacity serves as a reliable predictor of vocabulary knowledge development. In this study, the target words presented to participants were unfamiliar, thereby underscoring the crucial role of the

phonological loop during the audiovisual phase. The high capacity groups, compared to their low capacity peers, demonstrated a more effective functioning of the phonological loop, likely facilitating deeper encoding of the target words. This encoding process, enriched by learners' superior phonological resources, was further reinforced during the vocabulary practice phase, enabling these learners to retrieve the information more efficiently during the tests. Consequently, this resulted in significantly higher scores for high capacity learners.

6.2 How does Task Type Affect Vocabulary Acquisition When Working Memory is Held Consistent?

The findings of this study showed that when working memory capacities were controlled, both the input and output groups demonstrated significant immediate improvement over the no task group, suggesting that both types of tasks exerted a positive effect on L2 vocabulary acquisition. Notably, there were no substantial differences between the input and output groups in both the immediate and delayed tests, corroborating the results reported by Duong et al. (2021), Namaziandost and colleagues (2019), and Silva and Otwinowska (2018). Krashen's (1985) Input Hypothesis posits that sufficient comprehensible input (i+1) is indispensable for L2 acquisition, whereas Swain's (2005) Output Hypothesis highlights the crucial role of output in fostering learner attention, enabling hypothesis verification, and enhancing metacognitive awareness—each of which is integral to effective language learning. These theoretical frameworks explain well the absence of significant differences between the input and output tasks in the present study: since both input and output contribute uniquely to vocabulary development, their effects may not differ substantially under similar learning conditions.

Meanwhile, the findings of this study contrast with those of several previous studies (e.g., Kida, 2022; Xin & Wang, 2021; Zhang et al., 2022), which may be attributed to the variability in the types of tasks involved and the variables controlled across these studies. For example, Kida (2022) focused on semantic and structural processing tasks, Xin and Wang (2021) focused on multiple choice and translation tasks, and Zhang et al. (2022) focused on reading plus continuation writing and reading plus continued cloze tasks. Unlike these studies, the present study specifically analyzed meaning matching and blank filling tasks. Also, this study controlled for involvement load, while the other three studies did not report this parameter, thereby resulting in different findings.

It is noteworthy that, despite the lack of significant differences between input and output tasks, only the high capacity output group outperformed the high capacity no task group in both the immediate and delayed tests. This finding suggests a potential advantage inherent to output tasks under similar conditions, possibly due to differential levels of attention and cognitive processing elicited by different task types. According to Schmidt's (1990) Noticing Hypothesis, for learning to take place, learners must notice the input provided to them. In the context of vocabulary acquisition, the more attention learners devote to vocabulary, the deeper their memory of the vocabulary will be (Schmitt, 2000). Additionally, Craik and Lockhart's (1972) Depth of Processing Theory posits that deeper processing enhances memory retention. In the present study, the meaning matching task was oriented towards input reception and required less cognitive engagement, resulting in shallower cognitive processing and consequently poorer test performance. Conversely, the blank filling task necessitated active vocabulary production, thereby demanding greater attention and facilitating deeper cognitive processing, ultimately leading to better performance in the tests. This underscores the importance of task design in optimizing vocabulary learning outcomes.

7. Conclusion

The present study revealed that working memory significantly influences learning outcomes. This highlights the importance of understanding individual differences in cognitive abilities when designing instructional interventions. In individualized vocabulary instruction, teachers can develop tiered vocabulary tasks tailored to learners' varying memory capacities, allowing for differentiated support that meets each learner's needs. If feasible, incorporating working memory training could further enhance students' cognitive capabilities, as suggested by Karousou and Nerantzaki (2022), potentially leading to improved vocabulary retention and application.

Furthermore, the findings indicate that both input and output tasks contribute positively to vocabulary acquisition; however, output tasks demand heightened attention and deeper cognitive processing, which can lead to better learning outcomes. This underscores the need for teachers to consider the distinct advantages of each task type in their instructional design. Consequently, they should not confine themselves to a single task type when selecting vocabulary exercises but rather adopt a flexible approach that accommodates actual instructional needs. By integrating a variety of tasks—such as those that enhance student engagement, encourage active output in the target language, and promote deep processing of linguistic information—teachers can create a more dynamic and effective learning environment that fosters greater language proficiency among students. This comprehensive

approach not only supports vocabulary acquisition but also equips learners with the skills necessary for successful communication in their target language.

The study has limitations that should be acknowledged. The working memory test was conducted in a standard classroom setting using a presentation format, which may have introduced variables affecting the reliability and validity of the findings. A controlled laboratory environment, with factors like noise and lighting managed, could significantly enhance these metrics. Additionally, we only used the Vocabulary Knowledge Scale to measure learning gains. Employing a broader range of assessments could provide a more comprehensive understanding of vocabulary acquisition and its influencing factors. Therefore, future research should employ more methodologically rigorous designs that incorporate controlled environments and diverse assessment tools, thereby strengthening the reliability of the findings and deepening our understanding of vocabulary acquisition.

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