Research Article

Effect of Focus on Form on Vocabulary Acquisition in Computer-Assisted Learning

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This study analyzes the impact of focus on form on task-based contextual word acquisition to inform EFL vocabulary learning in a computer-assisted learning environment, with the goal of gaining a better understanding of the cognitive processes behind vocabulary acquisition. A classroom experiment was conducted at a high school in Fujian, China, to investigate two vocabulary acquisition settings for intermediate-level EFL students: maintenance rehearsal and elaborative rehearsal. The results showed that participants in the elaborative rehearsal group outperformed those who recited vocabulary in the maintenance rehearsal condition on the word recall and recognition test. The outcome also indicated that by practicing the input and output of the target words with contextual information in sentence rewriting, the focus-on-form impact of elaborative rehearsal promotes semantic and word form processing.

1. Introduction

Vocabulary learning is central to language and has been undervalued in foreign language learning (EFL) throughout its development of language acquisition and up to the present day. EFL is time-consuming and lengthy for most young people. Furthermore, interference from the learner's native language and the significant difference between the native and target languages make foreign language learning even more challenging. Also, there are few opportunities to practice a foreign language outside the classroom. EFL learners are typically not in an environment that supports English language acquisition, nor are they given sufficient opportunities to practice English both within and outside the classroom. As a result, even after years of study, most students studying English as a second language only acquire minimal proficiency. In light of the aforementioned problem, we examine how best to use findings from studies on contextual word acquisition to apply them to computer-assisted language learning (EFL) vocabulary acquisition.

Furthermore, today's students, as well as their minds, are unique. They grew up in a distinct atmosphere from their parents. They have adapted to the new learning environment facilitated by IT technology, and their sensory preference is attracted to the unusual and unique, often known as a novelty. This desire for novelty is not physical changes in the brain but rather neuronal connections responding to the diversity of information technology development [1]. One thing is sure: children and youngsters brought up in the information era are digitally savvy. At home and school, films, electronic games, and computers play an essential role in their development and

learning—traditional teaching techniques struggle to keep participants on the task because of students' shifting sensory preferences. However, schools and instructors have remained primarily unchanged.

Recent research by Vu and Peters [2] reveals that EFL learners generally have insufficient knowledge of various vocabulary components in vocabulary learning. Most schools and colleges still use lecturing as the primary mode of education, with overhead projectors and PowerPoint presentations functioning as one-way instructional technology. At the same time, computer-assisted learning plays an increasing role in vocabulary learning by providing online resources [3]. Majuddin et al. [4] demonstrated word acquisition using audiovisual resources via repetition and typographic embellishment. Barcroft [5] found that sentence writing involving deep semantic processing had a considerable inhibitory influence on word form during early foreign language vocabulary learning phases. To overcome the various reasons contributing to most EFL learners' low success, Ellis [6] suggests that "Focus on Form" plays a critical role in learning English as a foreign language. Focus on form refers to form-focused information processing in communicative or task-based learning activities [7]. Previous studies conducted by Boulkroun [8] identified the effect of focus on form in grammar learning and communicative activities. According to Jelani and Boers [9], the test modality affects the interpretation of vocabulary acquisition. That incidental word acquisition happens as a byproduct of message-focused activities provided by the word meaning tasks, such as reading or audio-video input. Despite previous substantial studies on vocabulary learning, questions remain to explore the cognitive process of EFL students in vocabulary acquisition, including the focus-on-form effect of cognitive processing in contextual learning. Hence, research into the EFL learners' information processing on vocabulary acquisition in the computer-assisted learning environment is meaningful and practical.

2. Literature Review

2.1. Research Objectives and Questions. Many EFL students struggle with reading due to a limited vocabulary. This study aims to examine how the focus-on-form effect in elaborative rehearsal and maintenance rehearsal affects EFL learners' vocabulary acquisition. According to Nairne [10], rehearsal is the mental activity connected with an item's overt or covert repetition. As proposed by Craik and Lockhart [11, 12], maintenance rehearsal is the mechanical repetition of the auditory representation of an item. In contrast, elaborative rehearsal entails a deeper or more significant level of semantic elaboration [13]. Repetition of newly learned words does not ensure that they will be transferred from the short-term memory to the permanent memory [14]. From a cognitive standpoint, new words must be integrated into existing knowledge—the learner's network of word connections or mental lexicon.

Many intermediate-level EFL students struggle with reading due to a limited vocabulary, despite being told that reading more will help them learn English more effectively.

What kinds of cognitive processing are beneficial to memory? To put it another way, what learning strategies should we use to memorize words? Instructors must also keep this in mind when creating courseware or instructional strategies. Traditionally, the repetition practice would follow instructions. Such exercise often takes the form of spoken repetition (rote rehearsal), which is also the primary method used by vocabulary learning software programs.

To gain a precise understanding of EFL students' cognitive process in vocabulary acquisition, we formulate the following two research questions:

(1) How does focus on form affect word recognition and word recall assessments in vocabulary acquisition?

(2) Under which of the following conditions, elaborative rehearsal and maintenance rehearsal, would the focus on form be more effective for EFL learners at the intermediate proficiency level to acquire new words in computer-assisted learning?

2.2. Role of Rehearsal in Learning Words. According to Baddeley et al. [15], the phonological loop component of working memory is the primary cause of rote repetition of an item's auditory representation to retain more sound patterns in memory. Although influential, the theory of phonological working memory lacks accuracy and constitutes a bottleneck in learning new words. This is because one could only rehearse limited chunking simultaneously with the limited phonological working memory capacity. Several conceptual models with more precisely described mechanisms have been developed. Two of these models are considered, one based on the chunking mechanism [16] and the other on connectionism. The computational model of children's vocabulary acquisition (EPAM-VOC) proposed by Jones et al. [16] provides a detailed specification of how phonological working memory and long-term memory interact. In addition, Jones et al. [17] also suggest that long-term knowledge plays a more important role in the acquisition of vocabulary than the capacity of working memory, which is in line with the connectionist model [18].

2.3. Role of Semantic Elaboration in Learning Words. The connectionist model [18] states that learning new vocabulary involves cognitively modifying the connection weights of current knowledge, and that new information must be assimilated. According to Craik and Lockhart's [19] view, memorization is only improved by repetition of information when done thoroughly and by processing the knowledge semantically. In the "processing depth theory," Craik and Lockhart [11] proposed that word memory can be assimilated into learners' current network of word associations or mental lexicon through the deep processing of semantic elaboration. Additionally, the Atkinson–Shiffrin model [20] postulated that if the information was processed and learned quickly enough, short-term memory (STM) might be transferred to long-term memory (LTM). In contrast to surface-level sensory processing, semantic elaboration is a type of in-depth, meaningful information processing that

enhances long-term memory retention, according to Matlin [13]. Adding additional information to existing traces makes them more thorough and detailed. Expanding on any key characteristic requires learners to use cognitive effort. Elaboration, formerly known as "deep processing" (metaphorically), produces higher retention than "shallow processing" [21].

Semantic processing in word learning guarantees long-term retention and recall [22, 23]. Meanwhile, the information is retained in phonological working memory and exposed to various processes through rehearsal. Such procedures could include disassembling and reassembling and comparing, merging, matching, and sorting.

This study hypothesises that language input and output information processing in word acquisition has a separate effect on words' form and semantic attributes [5, 23]. The focus-on-form development occurred when word form and semantic association were simultaneously processed during vocabulary learning. The influence of dominating processing would likely affect the focus-on-form outcome at transfer appropriateness. Participants will perform better when the learning process is more interactive, consistent with Krashen's input hypothesis [24, 25] and Swain and Lipkin's language output model [26] in the second language acquisition set as the theoretical groundwork for EFL vocabulary acquisition in a computer-assisted learning environment.

In this study, EFL learners at the intermediate proficiency level were asked to employ keywords in short texts for language input and comprehensive output to aid in vocabulary learning. So, participants can choose short texts based on their interests and also can practice target words by reading a text of their choice and then producing new sentences that include the target words.

Furthermore, the use of authentic texts improves reading vocabulary acquisition by providing a more specific setting and comprehension of the target words within a larger context by matching the approximate semantic meaning of the target words within an appropriate context.

Previous computer-assisted learning experiments [23] revealed that computer-assisted language learning research was primarily concerned with the subject matter and not with the learners. In contrast, learning strategies are discussed with the learners and what can be learned rather than what is taught. Words cannot be crammed into a student's brain in the same way that a computer can.

For EFL learners, vocabulary acquisition might be challenging or time-consuming at the initial stage. Learning new vocabulary by repetition or acquiring vocabulary in modified reading material with glossing is common. Boers [27] advocated adding annotations to new words in reading materials to increase reading vocabulary growth through extensive glossary explanations.

Most lexical acquisition strategies and computer-assisted software are based on practicing word form with audio input. Reading vocabulary acquisition received less emphasis. While second language scholars [24, 25] focused on the quality of language input in semantic elaboration and communicative ability, they stressed vocabulary acquisition

in reading. It would be a good strategy for EFL students to learn vocabulary via reading, just like native speakers. On the other hand, EFL students feel that a lack of vocabulary is the cause of their weak receptive and productive vocabulary knowledge. Many students struggle to read when studying a foreign language at an elementary or intermediate level due to a limited vocabulary. It seems contradictory to recommend reading vocabulary acquisition to EFL students who have difficulty reading due to a lack of vocabulary. Cognitive science could provide answers to this dilemma.

2.4. Focus on Form in Learning Words. The ongoing accumulation of semantic information, which increases the overall number of stored features, is known as semantic elaboration. It might also reflect the participants' constant attempts to organize or integrate the processed information into more meaningful units, resulting in a better data collection configuration. When Elgort et al. [28] weighed the costs and benefits of inferring word meanings from context versus studying definitions of new words before reading, they concluded that having access to definitions improves learning word meanings when new words are encountered in reading. In the relative effects of focus on form (FonF) and focus on forms (FonFs) on second language acquisition, Pouresmaeil and Gholami [29] examined EFL learners' explicit and implicit knowledge development. The focus-on-form effect was more successful in building learners' implicit knowledge. In contrast, the focus-on-forms impact was found to be more advantageous in cultivating their explicit knowledge. Furthermore, it was shown that time played a part in the FonF group's form consolidation. The focus-on-form effect identified in elaborative rehearsal in contextual word learning may commit a portion of brain resources to incidental learning of word form. This prediction is consistent with Morris et al.'s TAP theory [30] and Barcroft's TOPRA model [5], which relate semantic and structural processing to verbal learning. As discussed above, this study's purpose (especially the classroom-oriented research) is to offer concrete evidence to instructors regarding which strategies and procedures perform best in computer-assisted language acquisition to clarify the advantage of contextual word learning and the focus-on-form effect.

3. Methodology

An educational experiment was designed to explore the impact of various learning conditions and associated information processing models on vocabulary acquisition using language corpora. The focus-on-form influence of contextual word acquisition was studied under two conditions: elaborate rehearsal with language output and maintenance rehearsal. The research followed the APA's Ethics Code [31], which mandates that researchers must inform participants about informed-consent rules. Upholding participants' rights to confidentiality and privacy is a fundamental tenet of the study.

Based on the previous studies [23] on the effects of rehearsal and semantic elaboration, a classroom experiment

was designed to investigate the impact of focus on form in the task-based contextual word learning strategies when combining language input and output. Participants composed new sentences with the word strings from the authentic context. It is a learning state that involves semantic processing and elaborative rehearsal. Participants in the task-based focus-on-form learning condition were asked to elaborate on semantic meaning until they could use each target word in an actual situation to construct sentences. As a result, the research was meant to contrast two forms of processing: focus-on-form elaborative rehearsal and maintenance rehearsal.

The outcomes of semantic recognition and word recall tests were the dependent variables. The word recognition test required students to demonstrate a greater degree of input and output of the semantic meaning and word form knowledge than other more receptively oriented assessments (e.g., definition recall or translation) that do not need students to generate the word forms [5]. Based on prior studies [5, 23], the elaborative rehearsal entailed high semantic elaboration was predicted to facilitate the effect of focus on form when rewriting sentences with target words. This study presents cognitive processing information that teachers may utilize to determine which optimal methods and practices for vocabulary development. As a result, classroom research falls within the category of real-world experimentation.

3.1. Participants. The vocabulary learning experiment gained the support of 96 high school students in Fujian, China. Participants were chosen at random. The experimental and control groups were divided into two groups at random, namely, participants in Group 2 applied the chunking strategies to 20 new words by maintenance rehearsal with access to definitions in the traditional way. Meanwhile, participants in Experimental Group 1 facilitate learning word meanings by searching for target words in authentic texts and composing new sentences accordingly. The learning condition is similar to the information processing of elaborative rehearsal in which the effect of focus on form occurs when novel words are encountered in reading.

3.2. Research Design. The classroom experiment uses a single-factor design, with a two-level learning condition as the main component (Experimental Group 1 and Experimental Group 2). In either group, each participant sought to learn 20 new English words from the authentic text or rehearsal using a word list. Group 1 participants learned the 20 target words in a learning condition that was similar to the computer-assisted learning condition. Participants used the Internet to find the target words in the input text and rewrite them in new sentences, involving elaborative rehearsal. In contrast, like the maintenance rehearsal in a traditional instruction situation, Group 2 participants repeated the words on the word list with definitions and a reference sentence for each target word.

This study employed a between-group design for the post-test. The independent variable was the learning condition, with two dependent variables: word recalls and word recognition. As stated in Table 1, there are two learning conditions: elaborative rehearsal and maintenance rehearsal.

Ninety-six participants were chosen and randomly allocated to one of the two conditions. Students in Group 1 chose five short texts for each target word for sentence adaptation during a two-hour study time. According to Craik and Lockhart's definition [11, 12], two learning conditions were created. The learning tasks were defined based on the processing type and amount of semantic information in rehearsal: maintenance rehearsal and elaborative rehearsal. It was termed elaborative rehearsal in the study when participants were assigned the task of rewriting short sentences from the learning corpora for language input and output. The elaborative rehearsal requires more semantic processing in language input and output activities, which might trigger explicit word form learning at information transfer appropriateness. In contrast, participants who rehearsed the word list's target words were classified as maintenance rehearsal groups, needing less semantic processing. Two rehearsal conditions were added to investigate whether elaborative rehearsal or maintenance affects participants' focus-on-form processing. Two forms of rehearsal combined with semantic elaboration in language input and output were considered to study the ideal degrees of rehearsal and semantic processing settings to improve vocabulary learning. In addition, task-based elaborative rehearsal computer-assisted learning conditions were compared to maintenance rehearsal in traditional instructions.

3.3. Experimental Material. The two rehearsal conditions were added to investigate if elaborative rehearsal would affect students' word form processing. Twenty target words were chosen from the new word list for their learning activities. The 20 target words were selected from the pilot test among other similar high school students to ensure that the words are new to participants of equal English proficiency in Chinese high schools. There were two sorts of educational materials created. Authentic texts containing target words were chosen and stored in a learning corpus. The experimental group (Group 1) picked authentic short sentences containing target words in the Search Engine Simulator and rewrote them into full-length texts. Both groups' participants were given a printed paper with the definition and one sample sentence for each word. Participants in the experimental group were informed to explore the target words in the corpora and generate new sentences. Group 2 participants, on the other hand, were involved in a maintenance rehearsal of 20 words for the same time as Group 1.

3.4. Procedures. This study was administered to participants as out-of-class activities. Out-of-class activities were used to perform this experimental study, which took two hours. Before the experiment, all of the participants were chosen at random. At random, the experimental and control groups were allocated. The entrance examination was utilized as a preparatory test. SPSS was used to evaluate the students'

TABLE 1: Design of the experiment.

Group	Treatment	Materials	N
Experimental Group 1	Elaborative rehearsal	20 target words presented in authentic texts	48
Experimental Group 2	Maintenance rehearsal	A word list with 20 words and a sample sentence	48

outcomes in each group. No significant difference in language proficiency was found between the two groups before the experiment since $P > 0.05$.

The participants were split into two groups and assigned to either task-based vocabulary acquisition with elaborative rehearsal or maintenance rehearsal. The participants in both groups were informed they would be given a word recall and recognition test after the experiment. Participants were instructed to fill in blanks with words missing in the assigned texts in the word recall test. The total number of correct answers was used to calculate the test score. In contrast, participants in the word recognition test ticked multiple-choice to fill in blanks in the given texts with the expectation that they would focus on semantic components rather than word form.

3.5. Results and Analyses. The post-test scores were analyzed using one-way ANOVA (see Table 2), and the experimental outcome is provided in Table 3.

Table 2 shows that participants in the elaborative rehearsal task-based learning condition scored 71.7856 on the word recognition test and 66.7987 on the word recall test. In contrast, those in the maintenance rehearsal condition scored 62.8956 on the word recognition test and 60.8612 on the word recall test.

To assess if the two learning circumstances differed substantially, the researchers employed a one-way ANOVA. The two learning conditions differed significantly on both tests, with $F(1, 94) = 6.984$, $p < 0.01$, in the word recognition test and $F(1, 94) = 4.679$, $p < 0.05$, in the word recall test. Using elaborative rehearsal, participants who acquired English words performed better than participants in the maintenance rehearsal group.

The post-test findings demonstrated a substantial difference in performance between the two learning situations regarding word form recall and word recognition. According to the test result analysis, intermediate EFL students require greater semantic elaboration and rehearsal than language learners at the beginning to progress with new words to discern sense, recognize meaning, and memorize word formations. The findings support Wickens' claim [32] that limited processing capacity may hinder learner performance during time-sharing activities, as well as TAP theory [33] and the TOPRA model [5].

Despite the difference in the degree of semantic and word form processing in elaborative rehearsal and maintenance rehearsal, different "read and retell" language tasks were used in this study to emphasize the effect of using implicit knowledge of vocabulary and syntax rules in language input and output. The tacit language knowledge may be essential or valuable for developing specific components of EFL competence [5]; it also has the potential to promote

TABLE 2: Test scores of two learning conditions.

Test	Group	Mean score	Std. deviation	N
Word recall	1	66.7987	12.5453	48
	2	60.8612	17.8974	48
Word recognition	1	71.7856	12.8976	48
	2	62.8956	18.8975	48

TABLE 3: ANOVA factorial comparison.

Test		df	Mean square	F	Sig.
Word recall	Between groups	1	1187.287	4.679	.031
	Within groups	94	238.685		
Word recognition	Between groups	1	1814.587	6.984	.005
	Within groups	94	263.896		

long-term retention of linguistic information processed in elaborative rehearsal. Also, as Sousa [1] observed, no long-term retention without rehearsal exists. On the other hand, rehearsal assists in transferring language knowledge into long-term storage but does not guarantee it. As a result, EFL students at the intermediate proficiency level may require support with both semantic elaboration and rehearsal. Instructors must examine the time available and the rehearsal style suited for the specific learning target when combining focus-on-form learning activities with rehearsal for vocabulary development.

4. Analysis and Discussion

The research findings align with the vocabulary acquisition model proposed by Jones et al. [16, 17] and other connectionist models [18]. In the recall test of word form, participants in the elaborative rehearsal learning condition outperformed students in the maintenance rehearsal.

Elaborative rehearsal, which combines semantic elaboration with rehearsal, will improve the focus-on-form effect and word memory retention compared to maintenance rehearsal learning with less meaningful processing. Increased rehearsal duration does not ensure that word memory will be kept for an extended period in rote rehearsal. According to Atkinson-Stage Shiffrin's Stage Theory [20], the lifespan of word memory in rehearsal is shorter than that of semantic elaboration. The focus-on-form effect occurs when word form processing is connected with existing semantic mapping and is transferred to long-term memory by chance.

The study's findings were comparable to the research by Watanabe [34] and Jacobs et al. [35] on semantic elaboration and rehearsal conditions. The focus-on-form effect is

identified in the elaborative rehearsal in transferring the word forms at appropriateness on vocabulary acquisition processes in the studies. This is also consistent with Lockhart and Craik's notion [12] that deeper processing leads to a longer-lasting memory trace and Eysenck's claim [36] that processing level influences recall and learning. Text-based exercises like "read and retell," according to studies on foreign language acquisition [37], have a favorable influence on vocabulary development. This study found that higher levels of generative processing resulted in more significant vocabulary increases, proving the level of processing theory's validity [11, 12].

The finding that the task-based elaborative rehearsal learning group outperformed the maintenance rehearsal vocabulary learning group might be due to task instructions in elaborative rehearsal with varying degrees of semantic elaboration rather than more rehearsal time. This study examined the differences in information processing in foreign language vocabulary acquisition between a task-based elaborative rehearsal vocabulary learning condition and a traditional maintenance learning approach. The study's findings revealed the focus-on-form effect of elaborative rehearsal on task-based vocabulary learning with authentic texts, as indicated in Table 3. The task-based elaborative rehearsal condition had higher mean scores than the maintenance rehearsal condition, as shown in Table 2. There was a strong correlation between learning settings and outcomes (task-based elaborative rehearsal versus maintenance rehearsal). As a result, the theory was confirmed to be valid.

The task-based elaborative rehearsal vocabulary-learning group learned target words in authentic texts, focusing learners' attention on the semantic meaning and word form in "read and retell" elaborative rehearsal. Participants in the elaborative rehearsal condition significantly improved their semantic recognition and word recall performance as the semantic mapping with word form processing transfers the word memory into long-term retention. On the other hand, the maintenance rehearsal group recited the words with repetition primarily focused on word form processing, which may aid instant word recall but does not guarantee long retention.

This research explores whether cognitive-oriented theories about word acquisition may be applied to computer-assisted vocabulary learning. The results indicate that those vocabulary acquisition theories emphasize the importance of intensive processing in computer-assisted language learning for long-term retention [30]. The findings support the hypothesis that while word form and semantic association may be processed concurrently during some processes in vocabulary learning, the main effect of dominant processing occurs at transfer appropriateness due to the limited capacity of working memory, which is consistent with the processing level theory's revisionist view [12]. The difference between EFL word learning and L1 word acquisition is that the EFL learner already has a set of conceptual categories that connect to the new L2 word forms, whereas L1 word acquisition requires simultaneous learning of semantic meaning and word forms (e.g., spelling). Due to the limited capacity of working memory, semantic mapping only transfers word form processing into long-term retention for EFL learners when the focus on form happens at transfer appropriateness. Therefore, the cost-effectiveness of computer-assisted vocabulary learning and the focus-on-form effect at transfer appropriateness in reading vocabulary acquisition decide whether L2 word learning is not a simplified duplicate of the EFL word acquisition process.

5. Conclusion, Recommendation, and Limitation

The research results demonstrated the focus-on-form effect in language input and output activities facilitating implicit word knowledge gains. The vocabulary learning model developed in this study is expected to provide reliable data and information for use in learning activities and an example of vocabulary learning methodology based on the cognitive and SLA theoretical framework. The findings of this study show that different learning methods impact vocabulary expansion. The interpretation of these findings is generally good at uncovering partial cause effects based on previous studies. The results may not be applicable to all learning circumstances, as the classroom experiment was conducted with a limited sample of participants with intermediate language proficiency. The critical constraint that must be noted is that the validity of the classroom experiment must be enhanced by repeated studies over time, as the effects may vary depending on the language skills of the participants. Future research could look into the focus-on-form effect of different settings, including participants at varying levels of EFL proficiency, from a cognitive development perspective. Several adjustments to the tasks used in this study might be investigated, including various ages, levels of EFL proficiency, and processing intensity. The impact of semantic elaboration on focus-on-form processing varies depending on the level of EFL competence of the learner. More experimentation with these variables in well-controlled situations is recommended to understand their relative relevance further.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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