

Enhancing Vocabulary Acquisition Efficiency Through Metacognitive Strategies and Vocabulary Tasks: A Study of EFL Learners in a Taiwanese University of Technology

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Abstract—Recently, universities of technology in Taiwan have shifted their emphasis from teaching everyday English to workplace English to improve graduates' employability. Such a transformation has presented significant challenges to college students from universities of technology with low learning proficiency. Particularly when acquiring workplace English vocabulary, including unfamiliar terminology, a large number of complex words, and diverse meanings, EFL learners in universities of technology frequently confront a range of obstacles. Therefore, learners need to implement effective learning strategies, such as metacognitive strategies, to enhance their vocabulary acquisition proficiency. In addition, educators can design appropriate vocabulary task activities to improve learners' vocabulary acquisition efficiency. This study aims to investigate the efficacy of learners' metacognitive strategies and suitable vocabulary tasks in enhancing their vocabulary acquisition efficiency. The results reveal that frequent utilization of metacognitive strategies improves vocabulary acquisition in comparison to low-frequency users. Furthermore, the degree of vocabulary task involvement also impacts vocabulary retention. These findings demonstrate that metacognitive strategies and vocabulary tasks can promote vocabulary acquisition and provide educators with an opportunity to improve English vocabulary learning efficiency for EFL learners in universities of technology.

Index Terms—vocabulary acquisition, metacognitive strategies, vocabulary task activities, EFL learners, vocabulary retention

I. INTRODUCTION

English language courses are initiated for most Taiwanese students in the first grade of elementary school, and some even begin at kindergarten, implying that students have over 12 years of English learning experience before entering university. Despite such extended learning, college students at universities of technology are not performing as expected. A significant number of students abandoned English in junior high due to struggling with grammar and insufficient vocabulary. To ensure students' English learning while accommodating their abilities, the Ministry of Education's Curriculum Review Committee in 2018 reduced the required English vocabulary for vocational high school students by 1,000 words compared to general high school students. Nevertheless, it remains challenging for vocational high school students to meet this standard. With only two hours per week devoted to English courses at vocational high schools, which is half the time for general high schools, the odds are stacked against vocational high school students' proficiency in English. At universities of technology, most schools continue with only two hours of English classes per week, with a shift towards workplace English to equip technical students with the skills for future employment. Students find workplace English topics such as recruitment, company organization, and business trips unfamiliar, with limited vocabulary to aid their learning.

In recent years, there has been growing interest in the relationship between metacognitive strategies and vocabulary learning, with many studies exploring the effectiveness of various metacognitive techniques in enhancing learners' vocabulary acquisition and retention. In addition, there is a growing body of research investigating the relationship between task-induced involvement load (TIL) and vocabulary learning. TIL refers to the cognitive effort required to complete a task, including attention, memory, and problem-solving. Tasks that require higher TIL are thought to promote deeper processing and greater language gains. Therefore, the research objective is to investigate the relationship between the use of metacognitive strategies and task-induced involvement load in vocabulary acquisition.

II. LITERATURE REVIEW

A. Involvement Load Hypothesis

Acquiring a second language heavily relies on vocabulary as its foundation. However, research on vocabulary acquisition in ESL did not gain significant attention until the 1990s. Krashen (1989) argued that reading not only enhances

learners' vocabulary but also their spelling ability. Nevertheless, Fraser (1999) questioned whether reading is the most effective means of vocabulary learning for L2 learners, acknowledging that while incidental vocabulary learning occurs in reading, there is no agreement on its effectiveness as a vocabulary learning approach. On the other hand, the acquisition of new vocabulary words among adult learners can be facilitated through communication and interaction, as proposed by Newtown (1995). An experiment on incidental vocabulary learning for advanced learners was carried out by Hulstijn et al. (1996), who observed that incidental learning can be facilitated by providing marginal gloss if not allowing learners to refer to dictionaries. Conversely, Paribkht and Wesche (1997) discovered that the integration of reading with vocabulary exercises could prove to be more advantageous in learners' acquisition of vocabulary than reading in isolation. To sum up, the effectiveness of incidental learning can be enhanced by introducing supplementary tasks. Therefore, Laufer and Hulstijn (2001) developed the Involvement Load Hypothesis, which uses the concepts of need, search, and evaluation to explore the relationship between memory and different facets of deep processing. Motivation propels the need component, which can stem from either externally imposed or self-imposed factors. A moderate need arises when a teacher requires a learner to use a specific word in a sentence, while a strong need arises when it is self-imposed by the learner. The search dimension involves actively trying to learn the meaning of a new vocabulary word, which can be accomplished through consulting a dictionary or seeking assistance from a teacher. Finally, the evaluation dimension involves comparing the meaning and form of words to assess their appropriateness in a given context. Moderate evaluation is needed when identifying differences between words or senses, while strong evaluation necessitates making decisions about additional words to combine with the new word in an original sentence or text.

To summarize, the Involvement Load Hypothesis outlines three interrelated dimensions of vocabulary learning that represent the learners' motivation, attention, and cognitive effort during the process. The need component pertains to the motivational aspect of involvement, with the degree of need reflecting the strength of the motivation, whether it is externally imposed or self-imposed. The search involves active efforts to learn the meaning of unfamiliar words or concepts, while evaluation entails comparing the meaning and form of words to determine the most appropriate one for a given context. The levels of moderate and strong need, search, and evaluation reflect varying degrees of involvement, reflecting different levels of cognitive effort and attentional allocation to the L2 vocabulary acquisition process.

One of the purposes of this study was to examine the efficacy of incidental vocabulary learning and retention for EFL learners enrolled at a university of technology in Taiwan. When completing the article, the subjects were instructed to take a test assessing their comprehension of the material. In addition, to better understand the impact of the subjects' incidental vocabulary learning and retention, the two vocabulary tasks, fill-in-the-blank tasks, and smartphone app activities would be introduced.

B. Metacognition

(a). Early Research in Metacognition

In the 1970s, Flavell (1981) brought significant attention to the idea of metacognition and defined metacognition as meta-cognitive knowledge and experience, and strategic employment of metacognitive processes. Paris (1991) further divided metacognition into two major parts: cognitive self-assessment knowledge, which includes declarative knowledge, procedural knowledge, and conditional knowledge, and self-regulated thinking, which includes planning, monitoring, and regulating. This categorization emphasizes the importance of both the knowledge about one's own cognitive processes and the ability to use that knowledge to manage one's own thinking effectively. Early metacognition research focused primarily on children and aimed to explore their knowledge developed during the memory process.

(b). Metacognition in Second Language (ESL) Teaching and Learning

The focus on metacognitive research of ESL learners was not acknowledged until the 21st century. According to Anderson (2002), metacognition refers to the act of reflecting on one's own thinking. By using metacognitive strategies, individuals can stimulate their cognitive processes and potentially achieve more effective learning outcomes. In fact, as Anderson notes, acquiring the ability to comprehend and regulate one's own cognitive processes may be a critical skill for second language learners to develop, and educators can play an important role in fostering its development. Drawing on prior research, Anderson has put forward a set of five primary elements that constitute metacognition. These consist of the following: (1) Preparing and planning for learning. Students can enhance their motivation for learning by setting clear, challenging, and realistic goals with the help of their teacher, which involves preparation, planning, and reflection on their progress toward achieving their goals within a set time frame. (2) Selecting and using learning strategies. It allows learners to make conscious decisions about the learning process. It is essential to educate students not only on the use of learning strategies but also on when and how to use them to optimize their effectiveness in various learning contexts. (3) Monitoring strategy use. To increase their likelihood of achieving learning goals, students should evaluate and regulate their use of learning strategies. It is essential to instruct students explicitly to periodically assess the effectiveness and proper implementation of their selected strategies, such as by pausing while reading to verify the accuracy of their vocabulary in context and modify their approach if necessary. (4) Orchestrating various strategies. The ability to coordinate and integrate various strategies is a crucial metacognitive skill that distinguishes strong from weak second language learners. Teachers can help students develop this skill by teaching them multiple strategies and how to recognize when a strategy is ineffective and switch to another. (5) Evaluating strategy use and learning. Second-language learners

engage in metacognition when they evaluate the effectiveness of their learning strategies. This reflective process integrates all aspects of metacognition, including preparation and planning, selecting and using strategies, monitoring strategy use, and orchestrating strategies, allowing learners to evaluate their learning cycle comprehensively. On the other hand, Haukås (2018) defined metacognition as an awareness of and reflection on one's knowledge, experiences, emotions, and learning, specifically within the contexts of language learning and teaching. The importance of prior knowledge in subsequent learning is highlighted, and the role of metacognition in reflecting on both known and unknown aspects of learning is elucidated. Additionally, Haukås pointed out that the correlation between metacognition and language awareness is underscored by the fact that metacognition necessitates the introspective analysis of one's knowledge, experiences, emotions, and learning within the three subdomains of language, language learning, and language teaching. In short, metacognition is crucial for successful language learning and teaching.

(c). *Teaching and Learning Metacognition*

Numerous empirical studies have supported the affirmative influence of metacognition on ESL learning (Rahimirad & Reza, 2014; Mahmoud & Oraby, 2015; Teng, 2020; Wongdaenga & Higgins, 2023). However, metacognition is thinking about thinking, and thinking cannot be directly taught. Teachers must focus on fostering and guiding learners' metacognitive abilities through carefully designed curriculum activities. As Wilson and Bai (2010) suggest, teachers play a critical role in cultivating learners' metacognitive strategies by creating learning environments that encourage and support students to think deeply and reflectively about their learning processes. By doing so, teachers can help learners become more aware of their own thinking, develop effective learning strategies, and ultimately enhance their overall learning outcomes.

(d). *Oxford's Strategy Inventory for Language Learning (SILL)*

The SILL is a widely used tool for assessing language learning strategies in students of second and foreign languages. Developed by Rebecca L. Oxford in 1989, the SILL has undergone several revisions, with the current version, Version 7.0, designed specifically for ESL/EFL students. The SILL is a valuable tool for identifying areas where students need improvement and helping them develop more effective language learning strategies. It has been extensively used in research studies and has demonstrated reliable and valid results. The SILL comprises a comprehensive taxonomy of language learning strategies, divided into six parts: memory strategies, cognition strategies, compensation strategies, metacognition strategies, affective strategies, and social strategies. Each part consists of a series of statements, which students rate on a scale of 1 to 5 based on how true each statement is for them.

This study employed the metacognitive strategy items (Questions 30, 32, 33, 34, 36, 37, 38) from the SILL and adapted them into 14 metacognitive strategy items. The adapted items were used in a questionnaire administered to tertiary-level EFL learners. The other objective of this study was to explore the potential correlation between the utilization of metacognitive strategies among EFL students and their impact on word acquisition.

III. RESEARCH QUESTIONS

This study aims to examine the impact of various vocabulary tasks on learners' performance of vocabulary retention within the context of task-induced involvement. Furthermore, the study seeks to explore the extent to which learners' metacognition strategies affect their vocabulary acquisition efficiency. To this end, the following research questions will be addressed:

- (1) What is the relationship between the level of involvement in vocabulary tasks and the efficacy of vocabulary retention?
- (2) How is a learner's performance in vocabulary acquisition associated with their utilization of metacognition strategies?

IV. METHOD

A. *Research Design*

This study utilized a quasi-experimental design comprising one experimental group and one control group, both of which completed two vocabulary tasks at similar levels of language proficiency. The data used in this study were collected during my prior research (Tu, 2023), where participants were recruited from a university of technology in Taiwan. The current study applies this dataset to investigate vocabulary acquisition efficiency through metacognitive strategies and vocabulary tasks. The research design had two parts. Firstly, in the initial week, participants from both groups completed a metacognition questionnaire adapted from SILL to determine the metacognition strategies they used in vocabulary learning. Secondly, in the following week, vocabulary tasks and tests were carried out. The participants took a pre-test in the first week to establish their prior knowledge of the target words. Then, an immediate test was administered after they finished the tasks, followed by a post-test a week later. All tests were conducted in an online format.

B. *Participants*

The study recruited two groups of 34 EFL learners at the tertiary level, comprising 10 male and 24 female participants. The majors of the participants encompassed diverse fields, such as Insurance, Accounting, Leisure Management, Finance, Business Administration, Marketing, Golden-Ager Industry Management, and Applied Chemistry. The age range of the participants was relatively narrow, with all of them being young adults between 19 and 20 years old. Notably, the sample size had initially consisted of 48 participants. However, due to various reasons, such as personal commitments and scheduling conflicts, a subset of participants withdrew from the study, resulting in a final sample size of 34 participants (n=34).

C. Instruments

The study employed two instruments for research purposes. Firstly, a metacognition questionnaire adapted from SILL was administered. Secondly, a reading passage pertaining to workplace English was selected. From this passage, a total of seven vocabulary items were chosen as target words to be used in the vocabulary tasks. Finally, vocabulary pre-, immediate, and post-tests were implemented to gather data for the study.

(a). Metacognition Questionnaire

The questionnaire covers a range of strategies, including word association, active learning, word grouping, ongoing review, scheduled review, and strategy evaluation. Respondents are instructed to indicate the frequency of their use of each strategy using a 5-point Likert scale ranging from "Never" to "Always," which provides insight into their metacognitive awareness of effective vocabulary learning practices.

The survey outcomes have been partitioned into two distinct clusters based on participants' reported employment of metacognitive strategies: a high-use group and a low-use group. Specifically, the high-use group consists of respondents whose questionnaire scores ranked within the top half of the total scale score, whereas the low-use group is comprised of those whose scores ranked within the bottom half of the total scale score. Table 1 presents the results of the questionnaire survey conducted in the present study.

TABLE 1
EMPLOYMENT OF METACOGNITIVE STRATEGIES

Task	High-use group	Low-use group
Reading and comprehension questions and filling in blanks	12	7
Reading and comprehension questions and smartphone app	4	11
Total	16	18

(b). Reading Passage

The selected reading materials for the study were sourced from Crane Publishing's New TOEIC textbook and consisted of two business trip-related emails (Lai & Liu, 2011). The first email is from a business traveler who had made an online reservation and seeks information on the hotel check-out policy. The second email, written by a hotel clerk, provides an explanation of the check-out policy. These emails are followed by a set of five questions that assess comprehension.

(c). Target Words

In this study, seven business trip-related vocabulary terms were chosen for examination. Of these seven words, six were determined to be unfamiliar to participants based on a vocabulary pre-test. These unfamiliar terms included 'accessible', 'embarkation', 'representative', 'reservation', 'terminal', and 'valid'. In contrast, the term 'expense' was found to be familiar to a majority (76%) of participants in the pre-test.

(d). Vocabulary Tasks & Task Involvement Load

Two groups of participants were assigned to complete two vocabulary tasks - a reading task and a fill-in-the-blanks task, and a reading task and a smartphone app task. Both tasks required the participants to read a passage and answer five comprehension questions. The fill-in-blank group had to complete seven fill-in-blank questions with the aid of L1 translation, while the smartphone app group utilized the Word Up app to create a list of seven target words and practice vocabulary. Word Up is a mobile app designed for English language learners, providing them with various learning materials and vocabulary activities, such as personalized vocabulary lists with definitions, synonyms, antonyms, and sentence examples, note-taking and picture-uploading features, and a variety of reviewing exercises like card flipping games, spelling, and listening & spelling.

The involvement load index of the reading task and the fill-in-blank task was moderate, with a need score of 2, no search, and moderate evaluation. On the other hand, the involvement load index of the reading task and smartphone app task was higher, with a need score of 3, strong search, and no evaluation. The involvement load index of the smartphone app task was found to be greater than that of the fill-in-blank task.

Table 2 provides a summary of the analysis described above, with the absence of an involvement factor marked by a minus (-), moderate presence indicated by a plus (+), and strong presence denoted by a double plus (++)

TABLE 2
TASK-INDUCE INVOLVEMENT LOAD

Tasks	Need	Search	Evaluation
Reading and comprehension questions and fill-in-the-blanks	+	0	+
Reading and comprehension questions and smartphone app	+	++	0

(e). *Vocabulary Tests & Scoring*

To measure the participants' vocabulary knowledge, a pre-test was conducted, followed by two post-tests to assess their vocabulary learning. The same target words were used in all three tests, but in a different order to prevent any recency effect. The pre-test was administered one week prior to the experiment, while the two post-tests were given immediately after the task implementation and one week later. All three tests were conducted using an online testing platform. Each test comprised of seven target words in English, and participants were required to provide the correct definition in L1. A score of 2 points was awarded for each correct answer, while incorrect or unanswered items were scored 0 points.

D. *Data Analysis*

Quantitative methods were used to analyze the data collected in the study. Firstly, a correlation analysis was conducted between data collected from the metacognition survey and the immediate post-test scores. Secondly, descriptive statistics, including average scores and standard deviations, were calculated for the immediate and delayed post-tests to compare the performance of the two groups. Finally, a one-way ANOVA was performed to test for differences in memory performance between the fill-in-blank group and the smartphone app group. The types of vocabulary tasks served as independent variables, while the immediate and delayed post-test scores of the participants were dependent variables.

V. RESULTS AND DISCUSSION

The descriptive results of the gain scores for the two tasks in the pre-test, immediate post-test, and delayed post-test are presented in Tables 3, 4, and 5. Table 3 displays the pre-test results of the two groups. The fill-in-blank group achieved a mean score of 9.41 with a standard deviation of 3.67, while the smartphone app group achieved a mean score of 4.23 with a standard deviation of 3.30. Table 4 shows the results of the immediate post-test, indicating that the mean score for the fill-in-blank group slightly increased to 10.23 with a standard deviation of 3.52. In contrast, the mean score for the smartphone app group dramatically increased to 12.94 with a standard deviation of 2.01. Finally, Table 5 reveals the mean scores and standard deviations of the two groups in the delayed post-test, where the fill-in-blank group obtained a mean score of 10.7 with a standard deviation of 3.31, and the smartphone app group obtained a mean score of 10 with a standard deviation of 5.14.

TABLE 3
DESCRIPTIVE STATISTICS FOR TWO GROUPS IN PRE-TEST

	Task	N	Mean	SD
pre-test	Reading and comprehension questions and fill-in-the-blanks	17	9.41	3.67
	Reading and comprehension questions and smartphone app	17	4.23	3.30

TABLE 4
DESCRIPTIVE STATISTICS FOR TWO GROUPS IN IMMEDIATE POST-TEST

	Task	N	Mean	SD
Immediate post-test	Reading and comprehension questions and fill-in-the-blanks	17	10.23	3.52
	Reading and comprehension questions and smartphone app	17	12.94	2.01

TABLE 5
DESCRIPTIVE STATISTICS FOR TWO GROUPS IN DELAYED POST-TEST

	Task	N	Mean	SD
Delayed post-test	Reading and comprehension questions and fill-in-the-blanks	17	10.7	3.31
	Reading and comprehension questions and smartphone app	17	10	5.14

The primary research inquiry for this study is to investigate the relationship between the level of involvement in vocabulary tasks and the effectiveness of vocabulary retention. To address this research question, a one-way ANOVA analysis was conducted to compare the scores of two distinct vocabulary tasks. The results of both groups on immediate and delayed post-tests are presented in Tables 6 and 7, respectively. As demonstrated in Table 6, the scores of the smartphone app group, which had a higher involvement load index, were found to be significantly better than those of the filling-in-blank group, with a statistically significant mean difference at the $p < 0.5$ level. Subsequently, a t-test was

employed to compare the progress scores of both groups on the immediate posttest, revealing a significant difference between the two groups, as shown in Table 8. However, the lack of a statistically significant difference obtained from the ANOVA test in Table 8 could also imply that the tasks performed were inadequate for long-term vocabulary retention.

TABLE 6
ANOVA FOR IMMEDIATE POST-TEST

	SS	df	MS	F	Sig.
Between Groups	62.235	1	62.235	7.543	0.009
Within Groups	264	32	8.25		
Total	326.234	33			

* $p < .05$

TABLE 7
ANOVA FOR DELAYED POST-TEST

	SS	df	MS	F	Sig.
Between Groups	4.235	1	4.235	0.22606	0.637
Within Groups	599.529	32	18.735		
Total	603.764	33			

* $p > .05$

TABLE 8
DESCRIPTIVE STATISTICS & T-TEST FOR IMMEDIATE POST-TEST

	N	M	SD	t
Reading and comprehension questions and fill-in-the-blanks	17	10.235	3.527	2.684*
Reading and comprehension questions and smartphone app	17	12.941	2.014	

* $p > .05$

In response to the second research question, an investigation was conducted to examine the correlation distribution between the utilization of metacognitive strategies and vocabulary test scores. As shown in Table 9, the results indicate that there is no significant correlation between the two variables.

TABLE 9
SCATTER PLOT OF METACOGNITION STRATEGY EMPLOYMENT AND VOCABULARY TEST SCORES



However, Table 10 presents a positive but weak correlation between the two variables, with a Pearson correlation coefficient of 0.117277455. This indicates that while there is a positive relationship between the utilization of metacognitive strategies and vocabulary test scores, the strength of this relationship is quite low. Moreover, the covariance of 2.788927336 in Table 11 suggests that the variables tend to change together, albeit not by a large magnitude.

TABLE 10
CORRELATION

	<i>metacognition strategy employment</i>	<i>vocabulary test</i>
metacognition strategy employment	1	
vocabulary test	0.117277455	1

TABLE 11
COVARIANCE

	<i>Metacognition strategy employment</i>	<i>vocabulary test</i>
metacognition strategy employment	58.93771626	
vocabulary test	2.788927336	9.595155709

In light of these findings, it can be concluded that while there is some association between the utilization of metacognitive strategies and vocabulary test scores, it is not strong enough to make any definitive conclusions or predictions based solely on these results. Further research may be required to investigate other potential factors that could influence the relationship between the variables.

VI. CONCLUSION

In conclusion, this study explored the impact of vocabulary tasks and metacognition strategies on learners' vocabulary retention in the context of task-induced involvement. The findings demonstrate that learners who were highly involved in vocabulary tasks achieved a significantly higher level of vocabulary retention than those who were less involved. This highlights the importance of task design and involvement load index in vocabulary acquisition. Additionally, the findings suggest a positive relationship between the utilization of metacognitive strategies and vocabulary test scores, although the strength of this relationship is not particularly strong.

Overall, this study contributes to the field of second language acquisition by shedding light on the relationship between task design, metacognition strategies, and vocabulary retention. It provides practical implications for language educators in designing effective vocabulary tasks and promoting learners' metacognitive awareness in vocabulary acquisition. The study also provides a basis for further research into the impact of other factors, such as learners' motivation and individual differences, on vocabulary acquisition.

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This commitment reverberates throughout her distinguished career. Since September 2007, she has been a dedicated full-time instructor at Chaoyang University of Technology in Taichung, Taiwan. Noteworthy achievements include founding the Chaoyang Tech Toastmasters Club, hosting English meetings, and orchestrating elite English programs that facilitated IELTS Exam success. Her innovative curriculum design, comprehensive learning materials, and pivotal role in nurturing English language skills exemplify her devotion to teaching. Alongside her pedagogical endeavors, her research contributions have garnered recognition in esteemed conferences and journals.

Dr. Tu's unwavering dedication to English education is underscored by her recognition, including the Teaching Excellence Award, and acknowledgment for her outstanding performance in teaching practice research programs. Her persistent focus remains on researching learning methodologies that effectively benefit English language learners.