

## Effects of Working Memory Capacity and Task-induced Involvement on Lexical Collocation Acquisition

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### Abstract

Working memory is a memory system of limited capacity to keep information, master such complex human cognitive skills as problem solving, reasoning, reading comprehension, etc. Involvement Load Hypothesis assumes that tasks with different degrees of involvement load affect learners' vocabulary acquisition. This study applies working memory theory and design tasks on the basis of the involvement load hypothesis to verify whether working memory capacity and task-induced involvement affect students' collocation acquisition. 1) What is the effect of working memory capacity on collocation acquisition under different conditions of involvement load? What are the differences of the effect of working memory capacity on immediate and delayed collocations acquisition of two task groups? 2) What is the effect of task-induced involvement on incidental collocation acquisition? In this study, 64 participants are selected from Henan University of Technology in China. The experimental subjects in this thesis are divided into two groups (32 students of each group) to read the same passage and finish two different kinds of reading tasks. After participants finish reading the material, an immediate collocation test is given to them. Participants are required to translate the target collocations from English to Chinese. A week later, a delayed collocation test will be given to these 64 participants to test the retention of these collocations. The quantitative analysis is applied to analyze the data collected. Major research findings are presented below: 1) working memory capacity exerts a great influence on immediate collocation acquisition both in the multiple-choice task group and in paraphrasing task group; 2) participants taking tasks with higher involvement load can better acquire collocations and memorize the target collocation for a longer period than those taking tasks with low involvement load. The results of this study will bring certain enlightenment to teaching which is helpful for teachers in designing reading tasks and for students in more effectively acquiring English collocations.

### Keywords

Working memory capacity, involvement load hypothesis, collocation acquisition.

### 1. Introduction

Wray (2002) points out that the effective use of collocations will better guarantee the interactive accuracy and fluency. In other words, acquiring and using lexical collocations in English is of vital importance for English speakers and learners. In China, countless researchers have done research on acquisition of single words both implicitly and explicitly. Though recent years researchers have drawn their attention to collocation acquisition, seldom paid attention to ways and effects of collocation acquisition.

In 1974, Baddeley and Hitch proposed the concept of working memory. Baddeley et al. referred to working memory as a memory system of limited capacity to keep information, master such complex human cognitive skills as problem solving, reasoning, reading comprehension, etc.

Work memory has been defined as "the temporary storage of information that is being processed in any range of cognitive tasks" (Baddeley, 1986). Its function is to process and store information for a short period of time. Baddeley et al. (1998) suggested that the role of working memory is a tool for recalling familiar words. A number of Second Language Acquisition researchers have agreed that working memory capacity of second language learners, especially the phonological loop, has a great effect on second language acquisition, which includes the acquisition of lexical knowledge. Nevertheless, there is almost no literature concerning the effects of L2 learners' working memory on incidental collocation acquisition through accomplishing tasks of different involvement load.

In 2001, Lauer and Holstein put forward the concept of Involvement Load Hypothesis. The assumption of this hypothesis is that tasks with different degrees of involvement load affect learners' vocabulary acquisition. In China, a lot of experiments have been made to analyze the effect of involvement load, but there are still some arguments on the validity of this hypothesis. Firth (1968) holds that lexical collocation plays a significant part in a word's meaning. One cannot acquire the genuine meaning of a word if he does not know its relevant collocations. Therefore, native-like performance of second language learners depends on their stock of collocations. Since it is of great significance in having a good knowledge of lexical collocations, it becomes more and more important for researchers to find a better way in helping second language learners grasp lexical collocations. Although there have been several researches on collocation acquisition, few are based on the two theories mentioned above.

Therefore, this study aims at testing the effect of working memory capacity under different conditions of involvement load and that of task-induced involvement load on incidental collocation acquisition process.

## **2. Methodology**

### **2.1. Research Questions**

The present study is done to identify whether participants' working memory capacity and tasks of different degrees of involvement load are related to the effect of incidental collocation acquisition through reading, and investigate their collaborative effects on collocation acquisition. Accordingly, the following research questions are proposed:

- (1) What is the effect of working memory capacity on collocation acquisition under different conditions of involvement load? What are the differences of the effect of working memory capacity on immediate and delayed collocations acquisition of two task groups?
- (2) What is the effect of task-induced involvement on incidental collocation acquisition?

### **2.2. Participants**

Participants of this study are 76 English majors in Henan University of Technology. They are freshmen with the average age of 19.5 learning English as a foreign language (EFL) and all of them have learned English for about 8 years and shared the same English learning background. In order to ensure that participants have similar level of English language proficiency and that students' vocabulary knowledge has little influence on the research results, the scores of students' intensive reading course and the results of the vocabulary test in the SPSS 16.0 are carefully analyzed. Finally, the researcher chooses 64 participants whose test scores are very close.

### **2.3. Instrument**

Working memory capacity can be measured in several ways. The simplest one is a memory span test. This study is desired to measure participants' working memory capacity by applying Daneman and Carpenter (1980)'s complex span measure. In this experiment, participants are exposed to a number of sentences with a specific order. They should remember the last word

of each sentence. The item number ranges from 2 to 5. Three groups of items are of the same working memory span level. Participants would not move on to the next level until they finish items of the former one. Before the experiment, participants should practice the test so they would be familiar with the whole procedures when they take the test. There are totally 42 items in the working memory capacity test. These 42 items are presented to participants in a certain order on the computer screen.

After the working memory capacity test, the experimental subjects are divided into two groups (32 students of each group) in this thesis. According to the Involvement Load Hypothesis put forward by Laufer and Hulstijn, it assumes that different reading tasks will affect the cognitive processing of learners. There are three degrees of cognitive and motivational processing, namely need, search and evaluation. Need can be divided into internal need and external need. Search means that learners need to take efforts to find out the meaning of the target words. Evaluation can also be classified into weak evaluation and strong evaluation. If a learner evaluates the meaning of a word in the context, this process is weak evaluation. If he assesses the collocation of the word or combines the word with another word, this is strong evaluation. Group one has to do a multiple-choice task to fill in the blank with target collocations. The involvement load index of this task is 2. Group two is required to paraphrase several sentences with the target collocations. The involvement load index of this task is 3.

This study conducts the immediate collocation test and the delayed collocation test one week later to investigate participants' retention of target collocations. The immediate collocation test consists of 10 randomly arranged target collocations, and participants are required to translate these collocations from English to Chinese. The delayed test contains the same target collocations but their order is different from that of the immediate test.

#### **2.4. Procedures**

The experiment was conducted for 3 separate days. The researcher selected 76 English majors in Henan University of Technology. All the participants in this study voluntarily took part in the experiment. The vocabulary test was administered during class hours in the classroom. The researcher then put the scores of the vocabulary test into the SPSS 16.0. After analyzing the results of the vocabulary test, the researcher chose 64 participants at last. Then all the 64 students were arranged to take part in the working memory capacity test. When subjects took the working memory capacity test, they were required to carefully read the instruction on the computer screen. This experiment was conducted during school hours in a computer room. Participants were used to the procedures before the experiment and they were told the scores had no relation to their final exam performances to relieve their anxiety in process of this test. They needed to analyze whether the sentence was true or false, and remembered the last word of each sentence at the same time. If they thought the sentence was true, they would click on the true icon. If they thought the sentence was wrong, they should click on the wrong icon. After that, the next sentence would appear immediately.

After the working memory capacity test, a pilot study was needed. Five participants were selected to take part in the pilot study, and the requirement was that these students' English language proficiency was of the similar level. They were given 30 collocations including the target 10 collocations. This pilot study was to ensure that students didn't know the target collocations before they took the experiment. This study was conducted during normal class time. In order not to cause psychological anxiety of students, they were told that the results would not affect their scores of their final examination.

All the 64 subjects were divided into 2 groups with 32 students in each group. Each group was assigned to finish two different tasks. Group 1: read a passage and choose the correct collocations to fill the blank (a multiple-choice task). Group 2: read the same passage as group 1 and paraphrase several sentences with the target collocations. According to the definition of incidental vocabulary acquisition, if students' attention is focused on the tasks rather than the

target words, the process of vocabulary acquisition is a kind of incidental vocabulary acquisition. These two tasks were designed to ensure that participants' attention was concentrated on the completion of tasks instead of the target collocations. Students doing the first task were asked to choose the appropriate collocations which were printed at the bottom of the passage after reading.

Subjects doing the second task were required to use their own words to paraphrase sentences with the target collocations so as to ensure that they understand the meaning and the usage of the target collocations. In order to make sure that all participants have a full knowledge of the target collocations, both the Chinese and English explanations were provided for students as reference, so students had no need to look up the words or collocations in the dictionary or ask their teachers for help. The task was taken in the normal classroom time and students were given 20 minutes in total. After the task, students were required to hand in the reading material immediately and then they took the immediate collocation test. They were told that the scores of the task would not influence their final examination results.

Reading material of this study was carefully selected. It is a short passage with words of intermediate level downloaded from the website. According to Laufer (1992), the new words' rate of a reading passage should be lower than 5% so that readers could best comprehend the reading material. Therefore, the reading passage was modified to correspond to students' English level and understanding, and some complicated words of the original passage were modified by the researcher. The passage contains 10 target collocations.

Participants were given 20 minutes to read through the whole passage and finish the task. After that, they had an immediate test of target collocations. A week later, they would have a delayed test of collocations, but the order of these collocations in the delayed test was different from that of the immediate test. The collocation test was an English-Chinese translation test. Participants had to translate the target collocations from English to Chinese.

## **2.5. Data Collection and Analysis**

The research designs a working memory capacity test based on Daneman and Carpenter (1980)'s reading span task model. All the 64 participants of this study must measure their working memory capacity. And the scores of their working memory capacity are recorded by the searcher immediately after the experiment. SPSS 16.0 is applied to make independent samples t-tests and correlations analysis for the scores of working memory capacity and scores of both the immediate and delayed tests of different groups. The scores of these participants reflect their working memory capacity. The scores of all participants are recorded by the researcher immediately after the working memory span test and analyzed by using SPSS 16.0. There are 10 items in total of the immediate and delayed collocation tests. The scores of both immediate collocation test and delayed collocation test of each student are collected in this study.

## **3. Results and Discussion**

### **3.1. Results of Working Memory Capacity of the Two Groups**

Before analyzing the effect of working memory capacity and task-induced involvement on collocation acquisition, this chapter begins by examining whether there are differences in working memory capacity of participants in both groups. The results of participants' working memory capacity were entered into the SPSS 16.0, and the statistics (Table 1) show that the means of the working memory capacity of the two groups are nearly the same. The mean score of working memory capacity in the multiple-choice task group is 27.9688, and that of the paraphrasing task group is 27.7812. Scores of the working memory capacity of two groups are not significantly different ( $t=.084$ ,  $p=.537$ ).

**Table 1.** Independent Sample T-test of Working Memory Capacity of the Two Groups

	M	Std. Deviation	t	Sig.
Multiple-choice task group	27.9688	9.38593	0.84	0.537
Paraphrasing-task group	27.7812	8.35014		

### 3.2. Results of Immediate and Delayed Collocation Acquisition Tests

The results of the immediate collocation test of 64 participants are displayed in table 2. From the statistics, we can see that the performance in paraphrasing task group is better than that of the multiple-choice task group in immediate collocation test. The average score of the multiple-choice group is 4.2188 with the highest score 7 and lowest score 1, while the participants in paraphrasing group can recall 6.1875 items in the immediate collocation test on average with the maximum 8 and the minimum 4.

**Table 2.** Independent Sample T-test of Immediate Collocation Test Results

	M	Minimum	Maximum	Std. Deviation	t	Sig.
Multiple-choice task group	4.2188	1.00	7.00	2.16623	-4.381	0.00
Paraphrasing-task group	6.1875	4.00	8.00	1.33047		

The results of the delayed collocation test of 64 participants are displayed in table 3. The results show that the average score of the paraphrasing task group is a little bit higher than that of the multiple-choice task group.

**Table 3.** Independent Sample T-test of Delayed Collocation Test Results

	M	Minimum	Maximum	Std. Deviation	t	Sig.
Multiple-choice task group	3.5938	1.00	7.00	2.02977	-4.336	0.012
Paraphrasing-task group	5.5000	2.00	8.00	1.43684		

The results demonstrate that participants in the paraphrasing task group do a better job in both the immediate collocation acquisition and the retention of collocation than those in the multiple-choice task group. In the immediate and delayed collocation test, there are significant differences of the scores of participants taking different reading tasks. The performance of participants of different task groups is significantly different ( $t = -4.381$ ,  $p = .000$ ,  $t = -4.336$ ,  $p = .000 < .05$ ). The statistics indicate that participants in the paraphrasing task group have a better performance in the immediate acquisition and retention of collocations than those in the multiple-choice task group. The involvement load hypothesis assumes that participants taking tasks of a higher degree of involvement load will have the better performance in word retention. The reading task plays an important role in participants' both immediate and delayed collocation acquisition process. Therefore, the researcher can conclude that the performance of immediate collocation acquisition of participants in the paraphrasing group is better than that of the multiple-choice group. The results of the independent samples T-test are consistent with the assumption of the involvement load hypothesis.

### 3.3. The Correlation between Working Memory Capacity and Collocation Acquisition

In order to identify whether working memory capacity has a positive effect on immediate collocation acquisition and delayed collocation acquisition, this thesis analyzes the correlations between working memory capacity and immediate collocation acquisition and correlations between working memory capacity and delayed collocation acquisition in table 4 and table 5.

**Table 4.** Correlation between Working Memory Capacity and Immediate Collocation Acquisition

	Pearson Correlation	Sig. (2-tailed)
Working Memory Immediate Collocation Acquisition	0.436*	0.00

**Table 5.** Correlation between Working Memory Capacity and Delayed Collocation Acquisition

	Pearson Correlation	Sig. (2-tailed)
Working Memory Delayed Collocation Acquisition	0.125	0.32

The results in table 3.4 show that the Pearson correlation between working memory capacity and immediate collocation acquisition is .436\*,  $p = .000 < .05$ , which means participants' working memory capacity affects their immediate collocation acquisition. Participants with higher memory capacity will perform better in the process of immediately acquiring collocations. Table 5. is the correlations between working memory capacity and delayed collocation acquisition. However, in table 5, Pearson correlation is .125,  $p = .324$ , which indicates that participants' working memory capacity is not so significantly important in their delayed collocation acquisition.

**Table 6.** Correlation between Working Memory Capacity and Immediate Collocation Acquisition in the Multiple-choice Task Group

	Pearson Correlation	Sig. (2-tailed)
Working Memory Immediate Collocation Acquisition	0.430	0.014

Table 6 is the correlations between working memory capacity and immediate collocation acquisition. The results show that in the multiple-choice group, the participants' working memory capacity positively affects the results of their immediate collocation acquisition (Pearson correlation = .430\*,  $p = .014 < .05$ ). In other words, participants who have a higher working memory capacity will have a better performance in the process of immediate collocation acquisition.

**Table 7.** Correlation between Working Memory Capacity and Immediate Collocation Acquisition in the Paraphrasing Task Group

	Pearson Correlation	Sig. (2-tailed)
Working Memory Immediate Collocation Acquisition	0.663	0.000

Table 7 is the correlation between working memory capacity and immediate collocation acquisition in the paraphrasing task group. The results of table 7 demonstrate Pearson correlation is .663,  $p = 0.000$ , which indicates that working memory capacity significantly influences participants' immediate collocation acquisition when they are paraphrasing the sentences with target collocations.

**Table 8.** Correlation between Working Memory Capacity and Delayed Collocation Acquisition in the Multiple-choice Group

	Pearson Correlation	Sig. (2-tailed)
Working Memory Delayed Collocation Acquisition	-0.026	0.887

Table 8. Is the correlations between working memory capacity and delayed collocation acquisition in the multiple-choice group? The statistics in table 8 represent that the working memory capacity is not significantly important in delayed collocation acquisition in the multiple-task group.

**Table 9.** Correlation between Working Memory Capacity and Delayed Collocation Acquisition in the Paraphrasing Task

	Pearson Correlation	Sig. (2-tailed)
Working Memory Delayed Collocation Acquisition	0.479	0.006

Table 9. is the correlations between working memory capacity and delayed collocation acquisition in the paraphrasing group. Pearson correlation in this table is 0.479,  $p=0.006 < 0.05$ , which indicates that if participants paraphrase the sentences with the target collocation, the working memory capacity will also affect the results of the delayed collocation acquisition.

#### 4. Conclusion

This study is undertaken to investigate the effects of working memory capacity on immediate collocation acquisition and delayed collocation acquisition under different conditions of involvement load and explore whether involvement load plays an important role in collocation acquisition through reading in a quantitative way.

By applying the independent samples test and correlations analysis of SPSS 16.0, the current research is designed to investigate the role the working memory capacity plays in collocation acquisition under different conditions of involvement load and whether involvement load affects Chinese L2 learners' immediate collocation acquisition and retention of collocations. Besides, the study explains the effects of involvement load hypothesis on incidental collocation acquisition from cognitive perspective. The major findings can be summarized as follows. First, the working memory capacity exerts a great influence on immediate collocation acquisition both in the multiple-choice task group and in paraphrasing task group. Participants with higher working memory capacity will perform better in the process of immediately acquiring collocations. However, participants' working memory capacity is not so significantly important in their delayed collocation acquisition. The results of the delayed collocation task show that the working memory capacity only plays an important role for participants of the paraphrasing task group and does not affect the performance of the multiple-choice group members. Second, participants taking tasks with higher involvement load can better acquire collocations and memorize the target collocation for a longer period than those taking tasks with low involvement load. The performance in paraphrasing task group is better than that of the multiple-choice task group. The results of this study are consistent with the assumption of the involvement load hypothesis. Therefore, the current study can verify the involvement load hypothesis. period than those taking tasks with low involvement load. The results of this study will bring certain enlightenment to teaching which is helpful for teachers in designing reading tasks and for students in more effectively acquiring English collocations.

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## References

- [1] Baddeley, A. D., & Hitch, G. J. 1974. Working memory. *The psychology of learning and motivation*,
- [2] Baddeley, A. D. 1986. *Working Memory*. Oxford: Oxford University Press.
- [3] Baddeley, A. D., Gathercole, S., & Papagno, C. 1998. The phonological loop as a language learning device. *Psychological review*, 105 (1), 158.
- [4] Daneman, M., & Carpenter, P. A. 1980. Individual differences in working memory and reading. *Journal of verbal learning and verbal behavior*, 9(4), 450-466.
- [5] Firth, J. R. 1968. *Papers in Linguistics*. London: Oxford University Press.
- [6] Hulstijn, J. H., & Laufer, B. 2001. Some empirical evidence for the Involvement Load Hypothesis in vocabulary acquisition. *Language Learning*, 51, 539-558.
- [7] Laufer, B. 2008. Form-focused instruction in second language vocabulary learning: A case for contrastive analysis and translation. *Applied Linguistics*, 29, 694-716.
- [8] Wray, A. 2002. *Formulaic Language and the Lexicon*. Cambridge: Cambridge University Press.