

The Relationship Between Vocabulary Recall and Critical Thinking

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Abstract

The study aimed to investigate whether there was a relationship between Iranian EFL learners' critical thinking (CT) and ability to recall vocabulary. Also, the relationship between gender and recall was investigated. In so doing, 128 upper-intermediate language learners were selected from Islamic Azad University based on convenience sampling. After homogenizing the participants on general language proficiency level using Babel test, the researchers implemented Watson Glaser critical thinking appraisal (W-GCTA) and divided the participants to experimental (critical thinkers) and control (non-critical thinkers) groups. The researchers also gave a researcher-made vocabulary test to the participants to examine their vocabulary knowledge. As a result, 60 unknown words were recognized and used in the form of completion items for both the experimental and control groups. The participants of the groups knew that they should recall the vocabulary items later on a recall test. After applying Mann-Whitney U test, the researchers found that there was a significant difference in recalling ability of the control and experimental groups ($U=.40, p<.05$). The results revealed that there was a weak correlation between gender and the learners' ability to recall vocabulary ($\tau_b = .113, p = .803$).

Key Words: assumption, critical thinking, deduction, implication, inference, recall, recognition

1. Introduction

CT, based on educational approach, is concerned with the work of Benjamin Bloom (Lai, 2011). According to Lai, Bloom's taxonomy of information processing skills is one of the most widely referred sources in education concerning teaching and assessing CT skills. The hierarchical structure of Bloom's taxonomy is traced as with comprehension (at the bottom), evaluation (at the top), and the three levels including analysis, synthesis, and evaluation referred to CT. Recalling happens at the lowest level of Bloom's taxonomy, that is, knowledge. According to Paul (2012), "the knowledge itself is produced by thought, analyzed by thought, comprehended, organized, evaluated, maintained, and transformed by thought" (p. 11). Respectively, recall cannot be divorced from thinking. To be able to recall, one depends on thought. What to recall, how to do it, and why to recall are all done mindfully by the learners. In fact, the learners at this stage do not sacrifice thinking for the mere appearance of CT. Rather, they practice thinking by recognizing the missed data and recall relevant data to fill it and this may lead to CT skills. In this regard, Bransford and Stein (1984) pointed out that recalling engages learners in problem solving that requires thinking. Stated differently, to be able to recall, students have to identify a problem and devise a solution that works for the problem. Similarly, Collins (2014) argued that recalling engages learners in the thinking process.

Although many studies have shown the importance of CT in recalling (e.g., Dunlosky & Matvey, 2001; Gillund & Shiffrin, 1984; Matvey, Dunlosky, & Schwartz, 2006), less is known about the relationship between CT ability and recalling vocabulary. Therefore, this study aimed to explore the relationship between EFL learners' ability to recall the English vocabulary and their CT ability.

2. Literature Review

CT is defined as metacognition (Tempelaar, 2006), or the process of thinking about thinking (Flavell, 1979). In fact, Flavell saw CT as forming part of the construct of metacognition when he argued that "critical appraisal of message source, quality of appeal, and probable consequences needed to cope with these inputs sensibly" could lead to "wise and thoughtful life decisions" (p. 910). The most studied aspects of metacognition are to know how a learner understands and manages memory tasks (Leader, 2008). Leader went on to hold that metacognition influences recall. In this regard, Gillund and Shiffrin (1984) stated that recalling could not happen without CT (as a part of metacognition). To McClelland (1981, cited in Wilson & Keil, 1999), recalling refers to "a process of constructing a pattern of activation that is taken by the recaller to reflect not the present input to the senses, but some patterns previously experienced" (p. 138). As McClelland showed, in an early model of memory retrieval, items in memory might become activated partially which lead to filling in missing information. This partial activation is due to the

similarity of the item under inquiry in memory and the information retrieves initially in response to the investigation.

The SAM (The Search of Associative Memory Model) also demonstrates that recall is conducted with a memory search and requires thinking. The search involves sampling and recovery operations in which each cycle requires an image from the long-term store and an evaluation of the information recovered from the sampled image. Gillund and Shiffrin (1984) argued that the learner, on each cycle, selects the probe cues based on a retrieval plan and employs both the prior knowledge and the outcome of the retrieval process to date. Having selected the probe cues, the relatively automatic sampling and recovery phases occur. Then the subject evaluates the result and decides whether to stop or continue the search. The termination decision, in free-recall tasks, is presumably based on the number of proportions of search cycles that are failures. If the search continues, the cycle begins a new with the choice of probe cues.

Krathwohl (2002), on the other hand, stated that CT processes, as part of metacognition, could not be activated if one cannot remember the information one is supposedly thinking about it. In other words, the ability to think critically about specific information (i.e., analyze, evaluate, and infer reasonable conclusions) is directly affected by one's ability to recall and understand (i.e., lower-order thinking skills) the information one is required to think about (Halpern, 2003).

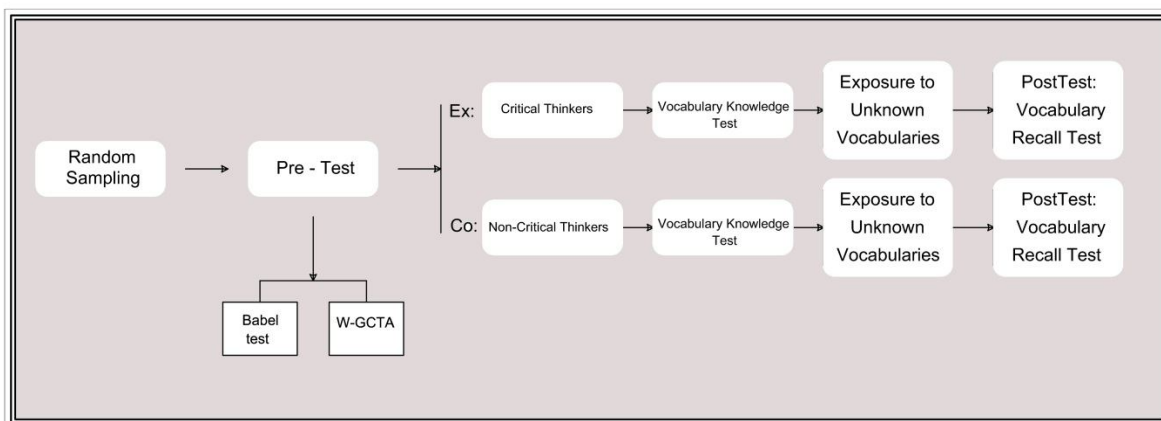
Moreover, the literature reveals that the same part of the memory (i.e., hippocampus) is responsible for both recalling ability and CT. The hippocampus is considered as the most influential factor in the ability to recall items (Eichenbaum, 2004). The hippocampus is also a crucial element in complex decision making (Gupta, Duff, Denburg, Cohen, Bechara, Tranel, 2009). Besides, the transitive inference is based on the hippocampal region (Eichenbaum, 1997).

Regarding CT and vocabulary development, several studies referred to the critical role of CT in vocabulary learning and lexical inferences among EFL learners. Sharafi-Nejad, Raftari, Mohamed Ismail and Eng (2016) showed that CT skills had a significant effect on vocabulary learning. Faramarzi, Elekaei, and Heidari Tabrizi (2016) also concluded that the learners with high CT ability had eminent lexical knowledge. Mirzai (2008) also examined the relationship between CT ability of learners and lexical inference (as a CT skill) and found that the learners with high CT ability were better in lexical inference compared with those with low CT ability. In a similar vein, Farahanynia and Nasiri (2016) who investigated the relationship between CT and lexical inference among 68 intermediate EFL learners signified that the group with higher CT skills performed better in lexical inference. Zarei and Haghgoo (2012), on the contrary, after conducting a study on 150 EFL learners concluded that the relationship between CT and vocabulary knowledge of learners was not significant.

Concerning the relationship between gender differences and memory performance, studies have produced equivocal findings. While some studies reported a significant relationship between gender and memory performance (e.g., Albus et al., 1997; Bolla-Wilson & Bleecker, 1986; Geffen, Moar, O' Hanlon, & Clark, 1990; McGivern, Mutter, Anderson, Wideman, Bodnar, & Huston, 1998; Ruff, Light, & Quayhagen, 1989), other studies did not find any relationship (e.g., Freides & Avery, 1991; McCarty, Siegler, & Logue, 1982). Regarding different memory tasks, various studies have been conducted. Temple and Cornish (1993), for example, found that females outperformed males on the verbal memory task. Huang (1993) found that Chinese boys outscored females on a visual-spatial memory task, whereas Chinese girls outperformed boys on a verbal memory task. Ullman, McKee, Campbell, Larrabee, and Trahan (1997) assessed 138 children, 67 females and 71 males, in grades 1–5 and found no significant gender differences on a task measuring visual recognition memory. Despite the reported studies, gender differences and vocabulary recall has rarely been investigated explicitly.

Investigating the theoretical contention on CT and vocabulary recall led the researchers of the present study to explore the relationship between CT and recalling vocabulary as well as the relationship between gender and recall. Figure 1 illustrates the procedure of the present study:

Figure 1. Flowchart of the Procedures of the Study



Therefore, the following research questions were formulated:

1. Is there any difference between Iranian EFL critical thinkers and non-critical thinkers in recalling the English vocabulary items?
2. Is there any relationship between gender and recalling ability of Iranian EFL learners?

3. Method

3.1 Participants

Totally, 128 EFL learners (72 females and 56 males), who were attending Islamic Azad University, participated in the study. The native language of the participants was Persian. Babel English Language Placement Test was used to examine the participants' homogeneity regarding their English language proficiency. The scores between 52 and 80 were considered as the upper-intermediate level and were selected accordingly. Additionally, the participants were required to take the W-GCTA. As a result, the participants were divided into two groups of critical thinkers and non-critical thinkers. The participants also took a vocabulary test which could show their vocabulary knowledge at the onset of the study.

3.2 Instrumentation

One of the instruments employed in this study was Babel English language placement test to examine the participants' homogeneity in language proficiency and the recognition of correct responses to reading prompts, grammatical forms, and lexical choices in different contexts. The test is based on Nelson Quick-check placement test and is in multiple-choice format. The time allotted for the test was 60 minutes. Three experienced university lecturers of TEFL verified its suitability and approved the clarity of its directions. The test was piloted with 50 students who were representative of the target population. The reliability estimate computed through KR-21 displayed a high reliability index ($r=.91$).

The second instrument was the W-GCTA used both as the pretest and the posttest. There are five different sections in the W-GCTA which are specially designed to check every learner's ability to think analytically and logically. The questionnaire consists of 80 questions in five parts. The five sections comprise making correct inferences, recognizing assumptions, making deductions, coming to conclusions, and interpreting and evaluating arguments (Watson & Glaser, 2010). The items of the test are similar to problems, statements, arguments, and interpretations which we encounter in different situations every day such as reading a newspaper or book or listening to the news.

The researchers also utilized a vocabulary test. The purpose of the test was to examine the learners' ability to recall vocabulary. It was a multiple-choice test on 60 lexical items extracted from the participants' course book, American English File 4 published by Oxford. Before

administering, the test was piloted with 40 participants. The result of the KR-21 formula showed an acceptable reliability index ($r=.83$). The test was used as the pretest and the posttest.

3.3 Procedure

Initially, the researchers administered the babel test to assure that the participants were homogeneous regarding language proficiency level. Then they employed a questionnaire of CT proposed by Watson and Glaser (2010). As a result, the participants were divided into two groups of critical thinkers and non-critical thinkers. Subsequently, the researchers used a vocabulary test to gauge the level of vocabulary knowledge of the participants. By implementing the vocabulary test, the researchers figured out 60 unknown lexical items (Appendix A). Then the researchers exposed the learners to the unknown words on a computer screen in the form of completion items. After ten days, they used recall test (i.e., the post-test) to measure the participants' ability to recall the words.

In the posttest, the vocabularies appeared randomly on the computer screen for 15 seconds each. All participants were told that they should answer the questions as quickly as possible. If they could not answer the questions within 15 seconds, the computer automatically moved on to the next question. The participants' answers were saved in a computer file to be hand scored later.

The learners were aware that they were participating in a study because the researchers believed that the experimentation was putting pressure on them and ethically they had the right to quit the study. For each correct answer, there was one point, but wrong answers did not receive any points.

4. Results

The first research question of the study was as follows:

RQ1. Is there any statistically significant difference between critical thinkers and non-critical thinkers in recalling vocabulary?

The researchers employed the non-equivalent pretest-posttest control group design, thus ANCOVA was run to examine whether the treatment affected recall and CT after the effects of covariate have been removed. Before running the ANCOVA, certain assumptions should be met. The first is the assumption of linearity which was inspected visually.

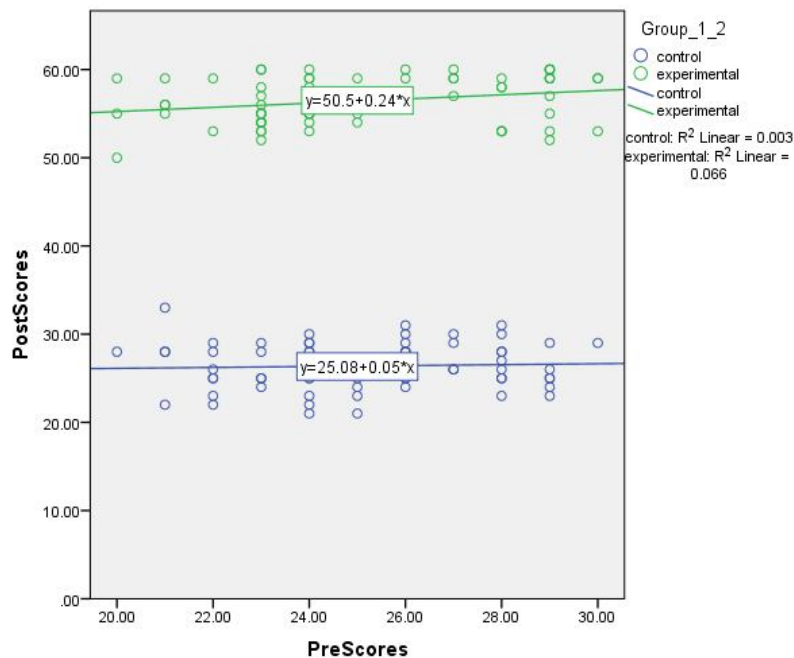


Figure 1. The Scatterplot for the Assumption of Linearity

The chart above shows that there is a linear relationship between the pretest- and posttest-scores for each level of the independent variable, as assessed by visual inspection of a scatterplot. The next assumption is related to the homogeneity of the regression slopes. Table 1 shows, the assumption of the homogeneity of regression slopes was met as the interaction term was not statistically significant, $F(1, 124) = 1.13, p = .290$.

Table 1

Testing the Assumption of the Homogeneity of the Regression Slopes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	28981.986 ^a	3	9660.662	1362.233	.000
Intercept	2093.163	1	2093.163	295.153	.000
Group_1_2	236.781	1	236.781	33.388	.000
PreScores	19.633	1	19.633	2.768	.099
Group_1_2 * PreScores	8.021	1	8.021	1.131	.290
Error	879.381	124	7.092		
Total	249563.000	128			
Corrected Total	29861.367	127			

The next assumption is related to the normality of the residuals. As Table 2 shows, the standardized residuals for the interventions were not normally distributed for the critical thinkers'

group, as assessed by Shapiro-Wilk's test ($p < .05$). Therefore, the ANCOVA test could not be run for the first research question, instead, the gain score comparison was used.

Table 2
Testing the Normality for the Residuals

	Group_1_2	Shapiro-Wilk		
		Statistic	df	Sig.
Standardized Residual for PostScores	control	.978	64	.324
	experimental	.943	64	.005

In order to choose the appropriate statistical test for the gain score comparison, the normality assumption was checked through Shapiro-Wilk's test. The result of the test shows that the scores for the critical thinkers' group do not enjoy normal distribution. Therefore, the non-parametric Mann-Whitney U test was run to compare the mean difference between the two groups.

Table 3
Test of Normality for the Vocabulary Gain Scores of Critical Thinkers and Non-Critical Thinkers

	Group_1_2	Shapiro-Wilk		
		Statistic	df	Sig.
Gain_Scores	control	.983	64	.541
	experimental	.956	64	.023

The mean ranks are shown in Table 4. The description of the ranks showed a higher mean rank for the critical thinkers (96.50) as compared to the non-critical thinkers (32.50).

Table 4
The Ranks Table for the Vocabulary Gain Scores of Critical Thinkers & Non-Critical Thinkers

Ranks				
	Group_1_2	N	Mean Rank	Sum of Ranks
Gain_Scores	control	64	32.50	2080.00
	experimental	64	96.50	6176.00
	Total	128		

Table 5 shows the significance level. Mann-Whitney U test showed a significant difference in recalling ability of the critical thinkers and non-critical thinkers ($U = .40$, $p < .05$), meaning that critical thinker group outperformed the non-critical thinker group.

Table 5
Comparison Between the Vocabulary Gain Scores of the Groups

	Gain Scores
Mann-Whitney U	.400
Wilcoxon W	2080.000
Z	-9.776
Asymp. Sig. (2-tailed)	.000

RQ2. Is there any relationship between gender and recalling ability of EFL learners?

In order to answer the second research question, the point-biserial correlation was used. However, the researchers first checked the assumptions of the mentioned test to find if it could be run. Table 6 shows the result of the first assumption. As Table 6 shows, the homogeneity of variances for vocabulary recall scores for males and females was not met, as assessed by the Levene's test for equality of variances ($p = .017$).

Table 6
The Result of the Test of Homogeneity of Variance

	Levene Statistic	df1	df2	Sig.
Recall Based on Mean	6.058	1	62	.017
Based on Median	1.463	1	62	.231
Based on Median and with adjusted df	1.463	1	58.626	.231
Based on trimmed mean	5.732	1	62	.020

The researchers also checked the assumptions of outliers. As Figure 2 shows, there are outliers in the data of males, as assessed by inspection of a boxplot. Therefore, the parametric

point-biserial correlation could not be run. Marascuilo and McSweeney (1997) suggested using Kendall's tau b (τ_b) as a nonparametric point-biserial correlation.

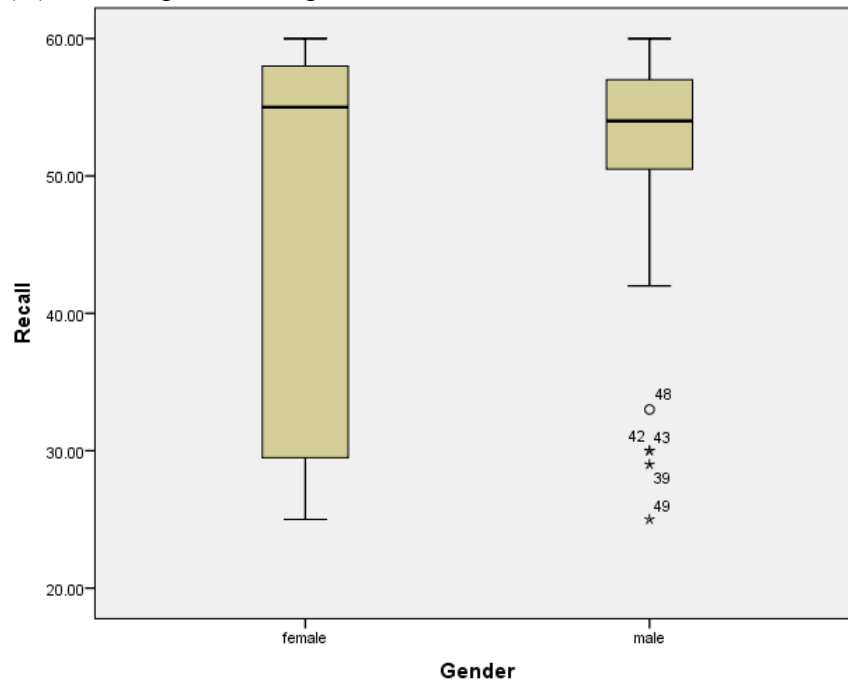


Figure 2. Boxplot for the Assumption of Outliers

Table 7 shows the descriptive statistics of the recall scores for males and females. The mean and standard deviation for males and females were 50.21, 47.63 and 10.59, 13.37 respectively. Males (50.21 ± 10.59) showed better recall than females (47.63 ± 13.37).

Table 7

The Descriptive Statistics for the Recall Scores across Gender

	N	Minimum	Maximum	Mean	Std. Deviation
Recall_Male	28	25.00	60.00	50.2143	10.59824
Recall_Female	36	25.00	60.00	47.6389	13.37407
Valid N (listwise)	28				

The result of Kendall's tau b test (Table 8) shows that there was no statistically significant relationship between gender and vocabulary recall, $\tau_b = .113$, $p = .803$.

Table 8

Kendall's tau_b Test of Association Between Gender and Recall

		Gender	Recall
Kendall's tau_b	Gender	Correlation Coefficient	1.000 .113
		Sig. (2-tailed)	. .803
		N	64 64
Recall		Correlation Coefficient	.113 1.000
		Sig. (2-tailed)	.803 .
		N	64 64

5. Discussion

The present study aimed to investigate the relationship between CT ability and recall of vocabulary among Iranian EFL learners. It also examined the relationship between gender and the ability to recall. The findings revealed that CT enhances the learners' ability in recalling English vocabularies which may result from the deep processing of CT such as evaluating, questioning, inferencing, interpreting the words from the context. As Schmitt (2000) argued, "the deeper the processing, the better it is for retention and recall" (p. 132).

Another reason for obtaining a better result among critical thinkers might have been that critical thinkers made it easier to find a semantic association among words. Likewise, Ellis (1995, p. 12) advocated that "semantic associations lead to long-term retention of words". The findings also find support from Dunlosky and Matvey (2001) and Matvey, Dunlosky, and Schwartz (2006) who asserted that CT influences recall performance since CT ability helps learners to make semantic relatedness among words.

The findings also revealed that critical thinkers distinguish the logic behind each word and can make a good inference. By considering inference as for the ability to recall the relevant item from the knowledge base, Cain, Oakhill, Barnes, and Bryant (2001) also emphasized the relationship between CT and recalling ability. The critical thinkers could also recognize the difference between rationality and reasoning, evidence and conclusion, data and interpretation which gives the learner the responsibility to recall relevant data and locate evidence for the true implication of the recalled item.

Moreover, the findings revealed that the critical thinkers made sense of the new words by assimilating the previously learned vocabularies with the newly learned words. Likewise, Ruiz (2013) argued that recalling is a primary CT skill. Through basic CT skills, students were able to integrate that previous knowledge with the new language learned to make sense out of words, concepts, and texts in the foreign language.

Regarding the second research question, a number of studies have been conducted to examine gender differences in vocabulary acquisition. The results, however, are inconclusive. Lynn, Fergusson, and Horwood (2005) studied a sample of 897 New Zealand children and figured out that boys scored significantly higher than girls in vocabulary knowledge. Edelenbos and Vinje (2000) also found that males outperformed females in vocabulary knowledge in the foreign language. Meara and Fitzpatrick (2000), on the contrary, concluded that female learners performed better than males. Jimenez Catalan (2003) even observed that girls were superior to boys in vocabulary learning strategies. The analysis of the data analysis revealed that males and females prefer different vocabulary learning strategies. To Agustin Llach and Gallego (2012), there is no significant difference between males and females in vocabulary acquisition. Similarly, Jimenez and Gallego (2005-2008) discovered no significant difference between men and women in a vocabulary test. In line with Agustin Llach and Gallego (2012) and Jimenez and Gallego (2005-2008), the findings of the present study did not show any significant difference between males' and females' ability in recalling vocabulary.

6. Conclusion

For many EFL learners, vocabulary learning is a challenging task (Catalan, 2003; Hiebert, 2011, Read, 2000). Considering vocabulary learning as a multifaceted process (Nation, 2004) which involves mental process (Catalan, 2003) such as memorizing words, recalling them, and using them in the appropriate context, this study attempted to investigate the relationship between EFL learners' CT and vocabulary recall. Based on the findings of the present study, the critical thinkers outperformed noncritical thinkers in recalling vocabularies. Put differently, those learners with higher CT skills had an advantage over non-critical thinkers in recalling items. The main difference between critical thinkers and non-critical thinkers was that critical thinkers had deeper processing for vocabulary learning and were better in making semantic association among words. They could also make logical inferences in the context. Moreover, they assimilated the unknown to known words which led to enhancement in learners' recalling ability. The findings are compatible with Bedell (1934) who found a positive relationship between the CT and recall abilities of 324 boys and girls who had enrolled in general science courses in Columbia. Similarly, Smith's (1946) study revealed that the participants' ability to recall information and their reasoning ability was closely correlated.

The results of the present study have some pedagogical implications for language teachers, researchers, and syllabus designers. The findings inspire teachers to consider CT skills as the vital components of vocabulary learning, rather than considering vocabulary learning as the mere memorization of a list of words. The findings may also inspire language researchers to examine the relationship between CT skills and other components and skills of language. Also, it helps the syllabus designers to consider the CT skills in the table of specifications and design some exercises for each skill to promote both the CT ability and the vocabulary retention.

This study, like other studies, is not without limitations. One of the major limitations of the study was the small size of the participants. Therefore, the present study does not make any claim on the generalizability of the findings. Moreover, further research can be conducted to test the appropriateness of CT skills concrete and abstract concepts. Although knowledge and CT skill work together in the critical thinker, one should bear in mind that a head full of knowledge and with the ability to recall relevant data does not make someone a critical thinker.

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