The Effect of Four Enhancement Techniques on Second Language (L2) Vocabulary Acquisition through Reading

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Abstract

This study investigated the differential and interactive effect of four enhancement techniques on L2 vocabulary acquisition through reading among 82 L2 English learners in China, with particular attention to receptive and productive vocabulary gain and retention. The four techniques are two enhancement techniques facilitating the search for word meanings, glosses and dictionaries, and two after-reading enhancement techniques, reading comprehension and reading comprehension plus a fill-in-blank vocabulary task. Students who were provided with glosses were found to have gained more receptive knowledge than those provided with dictionaries. Reading comprehension plus a vocabulary task was more effective in boosting both receptive and productive vocabulary gains than reading comprehension alone. An interactive effect of enhancement techniques facilitating the search for word meanings and after-reading enhancement techniques was found to be significant on receptive vocabulary gain, indicating that after-reading vocabulary task may be more effective in boosting receptive vocabulary gain when students are provided with glosses than dictionaries.

Keywords: L2 vocabulary gain and retention, reading, enhancement techniques, EFL learners

Introduction

The important role of vocabulary knowledge in second language (L2) acquisition has been recognized by many language researchers (e.g., Krashen, 1989; Laufer, 1992; Nation, 2001; Widdowson, 1989). Vocabulary knowledge correlates positively with both L2 reading comprehension (Anderson & Freebody, 1981; Coady, 1997a, 1997b; Laufer, 1997; Qian, 2002) and composition writing (Engber, 1995; Lee & Muncie, 2006; Santos, 1988). Therefore, considerable attention has focused on ways to facilitate the vocabulary development of L2 learners. In general, L2 learners are usually engaged in two types of vocabulary acquisition, direct vocabulary acquisition and incidental (indirect) vocabulary acquisition. Direct vocabulary acquisition is efficient but it usually lacks the communicative context in which a word is used, making it hard for learners to acquire a rich sense of the word (Laufer & Shmueli, 1997; Nation, 2001; Oxford & Crookall, 1990). Incidental vocabulary acquisition describes learning vocabulary as “a by-product of any activity not explicitly geared to lexical learning” (Hulstijn & Laufer, 2001, p. 554), most often through reading. L2 learners benefit from incidental vocabulary acquisition by
obtaining a richer sense of word (i.e., spelling, meaning, grammatical characteristic, collocation, and colligation; Kweon & Kim, 2008; Pigada & Schmitt, 2006), but at the same time, they suffer from the drawbacks of incidental vocabulary acquisition, such as a low acquisition rate (Nation, 2001; Read, 2004; Waring & Takaki, 2003).

In light of the potential advantages of incidental vocabulary acquisition, it has been a recurrent theme for researchers to identify factors that might account for the low acquisition rate of incidental L2 vocabulary acquisition as well as factors that might foster incidental vocabulary acquisition in the hope of designing corresponding enhancement techniques. For example, Hulstijn, Hollander, and Greidanus (1996) list the following factors that adversely affect L2 incidental vocabulary acquisition through reading. First, L2 learners might not notice the unknown words in reading. Sometimes even when they notice the unknown words, they tend to ignore them if they consider the words as unimportant or irrelevant to their understanding of the reading passage. Second, there might not be enough contextual cues for learners to make correct inference about the meaning and thus learners cannot build a form-meaning connection. Third, learners do not look up all unknown words in a dictionary even though they are provided with one. Fourth, a single encounter with an unknown word in a reading passage does not guarantee acquisition. High encounter frequency entails better chances for an unknown word to be acquired (Coady, 1997a; Rott, 1999). Accordingly, factors that foster incidental vocabulary acquisition have also been explored. For example, the more frequently appeared words are better learned than less frequently appeared words as the reappearance of words consolidates the form-meaning connection (Hulstijn et al., 1996, Kweon & Kim, 2008; Nation 2001; Shu, Anderson & Zhang, 1995). Easy gloss access or dictionary access facilitate vocabulary acquisition by providing learners basic vocabulary knowledge for bottom-up processing and preventing learners from making erroneous inference about meaning (Jacobs, Dufon, & Hong, 1994; Paribakht & Wesche, 1997). Moreover, after-reading exercises, such as reading comprehension, matching, fill-in-blank, and sentence translation, allow learners to elaborately process the form-meaning connection of new words and thus foster vocabulary acquisition (Min, 2008; Peters, Hulstijn, Sercu & Lutjeharms, 2009).

Drawing on previous literature in L2 vocabulary acquisition, memory research and information processing theory, Peters et al. (2009) propose that enhancement techniques that make learners “look up the meaning of unknown words, process their form-meaning relationship elaborately, and process them again after reading” (p. 114) lead to successful L2 incidental vocabulary acquisition. In their study, students in the plus-vocabulary-task group outperformed those in the minus-vocabulary-task group in recalling the unfamiliar words which not only appeared in the reading passage but also in the reading comprehension exercise. As students also had access to a computerized dictionary in their study, the findings have supported their hypothesis that enhancement techniques can greatly boost L2 vocabulary acquisition when students discover the meaning of words, elaborately process the lexical information, and reinforce the form-meaning connection again, which were realized in their study through the provision of dictionaries, reading comprehension exercises, and after-reading vocabulary tasks respectively.

Meanwhile, discovering the meaning of unfamiliar word from contextual cues, glosses, or dictionaries is considered to be a necessary step to vocabulary acquisition
but not a sufficient one (Laufer, 2001). According to the “depth of processing” hypothesis (Craik, 2002) and Involvement Load Hypothesis (Laufer & Hulstijn, 2001), the various features of words (e.g., meaning, pronunciation, grammatical category, and collocation) have to be elaborately processed by learners in order for acquisition to take place. Furthermore, to retain a word in memory, the form-meaning connection of a word should be immediately reinforced by means of repetition after learners’ first encounter with the words (Baddeley, 1997).

The effects of different enhancement techniques on L2 incidental vocabulary acquisition have often been examined separately and sometimes compared (Hulstijn et al., 1996; Jacobs et al., 1994; Knight, 1994; Laufer, 2000, 2001; Min, 2008; Paribakht & Wesche, 1997; Peters et al., 2009). The possible interactive effects of different enhancement techniques, however, have seldom been explored. Furthermore, previous research focused more on receptive vocabulary knowledge (i.e., the recognition and meaning of words), leaving productive vocabulary knowledge (i.e., the use of words) largely unexplored, although the major advantage of vocabulary acquisition through reading is claimed to be the mastery of a richer sense of a word that enables students to better use the words (Kweon & Kim, 2008; Pigada & Schmitt, 2006). Based on the necessary properties of enhancement techniques proposed by Peters et al. (2009), the present study examined the differential and interactive effects of four enhancement techniques, two enhancement techniques facilitating the search for meaning, glosses and dictionaries, and two after-reading exercises enhancement techniques, reading comprehension and reading comprehension plus a fill-in-blank vocabulary task on receptive and productive vocabulary gain and retention respectively. In this study, vocabulary gain refers to the situation where the meaning of a word or its usage is stored in learner’s short term memory, while vocabulary retention reflects that the meaning of a word or its usage is stored in one’s long term memory and can be retrieved later.

Literature Review

Previous studies have invariably shown that reading plus enhancement techniques resulted in better L2 vocabulary acquisition through reading than reading alone (Hulstijn et al., 1996; Knight, 1994; Laufer, 2000, 2001; Min, 2008; Paribakht & Wesche, 1997; Peters et al., 2009). Enhancement techniques such as glosses and dictionaries can facilitate learners to search for the meanings of unknown words. Enhancement techniques such as reading comprehension questions, fill-in-blank, and sentence writing can be adopted after reading, which help to draw learners’ attention to the unknown words, make them elaborately process the lexical information of words and reinforce the form-meaning connection.

Enhancement Techniques Facilitating the Search for Word meanings: Glosses and dictionaries

Some researchers have compared the effect of various types of glosses and no glosses utilized during reading on incidental vocabulary gain and retention (Cheng & Good, 2009; Huang, 2003; Jacobs et al., 1994). For example, Jacobs et al. (1994) found that students provided with either L1 (first language) glosses or L2 glosses performed better in the immediate vocabulary test than students who were not provided with any glosses; no significant differences were found across the three
conditions (L1 glosses, L2 glosses, no glosses) on the delayed vocabulary test. Two other studies conducted by Huang (2003) and Cheng and Good (2009) both concluded that the provision of certain types of glosses could increase students’ vocabulary gain and retention. In Cheng and Good (2009), L1 glosses with L2 examples and L1 in-text-glosses were found to foster both vocabulary gain and retention but L1 marginal glosses did not. In Huang (2003), L1 glosses and L2 glosses with L2 examples were effective in fostering both vocabulary gain and retention but L2 glosses were not. Collectively, these investigations indicate that the effect of glosses may be related to the learner’s language proficiency, the types of glosses and the level of difficulty of the text (Cheng & Good, 2009).

Another often used enhancement technique that facilitates the search for word meanings is dictionary use. Knight (1994) explored the effect of dictionary use on vocabulary learning and reading comprehension among English-speaking learners of Spanish. Students who had access to computerized dictionaries not only gained more words but had higher reading comprehension scores compared with those who did not have access to dictionaries. This finding is corroborated by Luppescu and Day (1993) and Cho and Krashen (1994), where students who read a text and looked up unknown words in a dictionary were found to remember more unknown words than those who read a text without a dictionary.

When the effects of dictionaries and glosses on incidental vocabulary acquisition are compared, the findings become a little perplexing. In the study of Hulstijn et al. (1996), the Dutch undergraduates studying advanced French were put into three conditions, L1 marginal glosses, paper dictionaries, and control. Their findings revealed that learners seldom used the paper dictionaries during reading and students in the gloss group outperformed those in the dictionary group in the immediate vocabulary test. In contrast, Laufer (2000) reported the superior effectiveness of electronic dictionary use than L1 marginal glosses on incidental vocabulary gain and retention among Israeli English language learners. This conflicting result might be attributed to the different types of dictionaries, electronic or paper dictionaries used in these two studies. With the click of a mouse, students in Laufer’s (2000) study gained access to the electronic dictionaries which presented the L1 translation, L2 definition, and example of usage of the unknown words. The convenience of the electronic (computerized) dictionaries might have resulted in more look-ups than paper dictionaries. Additionally, electronic dictionaries provided more information than glosses, which made it more facilitative than glosses to the elaborate processing of the unknown words. In the natural reading environment, however, glosses are preferred by learners as they are more convenient than paper dictionaries in looking up the meaning of a word and interrupt less with the reading process (Karp, 2002).

**After-reading Enhancement Techniques**

The use of enhancement techniques such as glosses and dictionaries facilitates learners to search for the meanings of the unknown words. The use of glosses or dictionaries alone, however, is not effective enough to ensure the acquisition of new vocabulary. For instance, Laufer (2001) revealed that reading with glosses was not as effective as reading plus after-reading sentence writing in facilitating vocabulary acquisition. A series of studies conducted by Laufer (2000, 2001) showed that
vocabulary tasks such as sentence writing, composition, and fill-in-blank were superior to reading alone or reading plus glosses or dictionaries in improving vocabulary acquisition.

Hulstijn and Laufer (2001) propose the Involvement Load Hypothesis, which postulates that the tasks that require the most involvement will yield better vocabulary acquisition. Task-induced involvement is composed of three components: need, search, and evaluation, among which need is motivational while search and evaluation are cognitive. To test the hypothesis, L2 English learners in Israel (Hebrew as the native language) and the Netherlands (Dutch as the native language) were randomly assigned to three groups. Group one read a text with L1 marginal glosses and completed reading comprehension questions. Group two read the same text and filled in the given blanks with target words which were explained in L2 and translated into L1 on a separate page. Group three wrote a composition using the same target words and the information of the target words were provided to the learners as they appeared in a dictionary entry, including word class, L2 explanation, L1 translation, and example of usage. Involvement index was used to measure the degree of involvement of different tasks. The absence of an involvement factor was marked as 0, a moderate presence of a factor as 1, and a strong presence as 2. The involvement load was 3 for the composition task (moderate need + no search + strong evaluation), 2 for the fill-in-blank (moderate need + no search + moderate evaluation), and 1 for the reading comprehension task (moderate need + no search + no evaluation). The performance of the Hebrew group fully supported the hypothesis that the composition task produced the best result, followed by the fill-in-blank task and then the reading comprehension task, with these three tasks inducing a descending level of involvement load. The Dutch group only partially supported the hypothesis as students doing the composition task retained most of the given words but the fill-in-blank and comprehension task did not yield different retention results. Although the Involvement Load Hypothesis needs further empirical evidence, previous research has shown that reading plus after-reading enhancement techniques is superior to reading alone in boosting vocabulary acquisition. Learners who are engaged in productive vocabulary activities retain more words than those who are engaged in receptive vocabulary activities (Laufer & Hulstijn, 2001; Min, 2008; Paribakht & Wesche, 1997).

In a similar line of research, Min (2008) compared the effectiveness of narrow reading (i.e., reading several thematically related texts) and reading plus various receptive and productive vocabulary tasks such as meaning matching, word translation, filling-in-blank, and rearranging words among L2 English learners in Taiwan. The results showed that the students in the reading-plus-vocabulary-task group outperformed those in the narrow-reading-task group in both receptive and productive vocabulary gain and retention tests. Peters et al. (2009) compared the effects of three enhancement techniques, test announcement, word relevance, and after-reading vocabulary task (i.e., providing L1 translation or L2 explanation) on the acquisition of receptive vocabulary knowledge. Word relevance was operationalized as a within-subject factor in their study. The plus-relevant words referred to half of the target words which appeared in both the reading passage and the subsequent reading comprehension questions. The minus-relevant words referred to those target words that only appeared in the reading passage but not in the reading comprehension questions. Generally speaking, test announcement and vocabulary task facilitated
word recognition while word relevance and vocabulary task positively affected word retention. An interactive effect was found between word relevance and vocabulary tasks. Participants who did the vocabulary tasks recalled the meanings of more plus-relevant words than those who did not do the vocabulary tasks. They concluded that enhancement techniques that enabled learners to discover the meanings of unknown words, elaborately process the form-meaning connection, and reinforce the lexical information led to successful receptive vocabulary acquisition through reading. The findings have also indicated that interactive effect on the acquisition of receptive vocabulary knowledge exists among different enhancement techniques.

Despite the importance of enhancement techniques in facilitating L2 vocabulary acquisition, there is one critical limitation to this corpus of work. The differential and interactive effects of different enhancement techniques on the acquisition of productive vocabulary knowledge have seldom been explored. Most of the previous research has only tested learners’ receptive knowledge of newly acquired words through reading (Hulstijn & Laufer, 2001; Peters et al., 2009; Waring & Takaki, 2003). Few studies examined the effectiveness of enhancement techniques on the productive vocabulary acquisition (Min, 2008), let alone their interactive effect. For instance, although previous research compared the effectiveness of the provision of glosses and dictionaries in boosting vocabulary acquisition through reading (Hulstijn et al., 1996), their effectiveness on the acquisition of receptive and productive vocabulary knowledge has not been compared in the presence of after-reading enhancement techniques.

To fill this research gap, this study aimed to study the effect of two enhancement techniques facilitating the search for word meanings, glosses and dictionaries, and two after-reading enhancement techniques, reading comprehension and reading comprehension plus a vocabulary task (fill-in-blank), and their possible interactive effect on receptive and productive vocabulary knowledge on gain and retention tests. Specifically, the study explored the following research questions:

1. To what extent can students retain the vocabulary knowledge (both receptive and productive) they acquire through reading with enhancement activities?
2. Is the provision of gloss more effective than the provision of dictionary in fostering vocabulary knowledge (both receptive and productive) gain and retention?
3. Do students who do the reading comprehension plus an after-reading vocabulary task gain and retain more vocabulary knowledge, both receptive and productive, than those who only do the reading comprehension?
4. Does the effect of an after-reading vocabulary task on vocabulary knowledge gain and retention, both receptive and productive, depend on the provision of glosses or dictionaries?

Methods

Research Design

The study used a Between-Within Subject design. The between factors were enhancement techniques facilitating the search for word meanings (the provision of glosses or the provision of dictionaries) and after-reading enhancement techniques
(reading comprehension plus a fill-in-blank vocabulary task or reading comprehension minus a fill-in-blank vocabulary task). The within subject factor was time. Participants were randomly assigned to four conditions “glosses + reading comprehension plus” ($n = 19$), “dictionary + reading comprehension plus” ($n = 21$), “glosses + reading comprehension minus” ($n = 23$), “dictionary + reading comprehension minus” ($n = 19$). Participants in all four conditions read two English texts. Participants in the gloss group read the texts in the presence of marginal glosses. Participants in the dictionary group were provided with paperback English-Chinese bilingual dictionaries. Participants in the reading-comprehension-minus group did a reading comprehension exercise after reading. Participants in the reading-comprehension-plus group did both reading comprehension questions and a fill-in-blank vocabulary task. The dependent variables were the receptive and productive vocabulary gain and retention scores measured by a modified Vocabulary Knowledge Scale (VKS, Min, 2008).

**Participants**

Participants were 82 L2 English learners in a university in East China. Of the participants, 12 were male and 70 were female. They were all sophomore English majors falling into the age range of 17 to 21, with an average age of 19.2. Prior to this study, they had studied English as a foreign language for an average of 8.5 years in school settings. To ensure that students’ English proficiency was at the same level, the researcher conducted a one-way ANOVA to compare participants’ final examination scores from the previous semester. The final examination paper is a general proficiency test capturing students’ English knowledge in vocabulary, grammar, reading, and writing. No significant difference existed among the four groups’ English proficiency level ($F(3, 78) = 0.23, p = .88$).

**Materials**

*Texts.* The reading materials were two English passages. One reading passage entitled “Unmasking Virus Writers and Hackers” (hereafter Virus) was taken from Min (2008) and the other was adapted from a text entitled “Can We Know the Universe—Reflections on a Grain of Salt” (by Carl Sagan, hereafter Universe) in an English textbook in China (Liu, 2007). The “Virus” passage discusses the stereotypes that people have about hackers and explains the differences between hackers and virus writers. It contains 828 words, among which 20 were considered to be new words to the participants. The “Universe” passage presents the author’s reflection on what science is and discusses whether the universe has regularities or rules that are knowable to man. It contains 769 words, among which 25 were new words to the participants. These two passages were chosen as they were deemed to be appropriate for the participants in difficult level in terms of length and new vocabulary ratio determined by the researcher and the three English instructors who taught the participants in an intensive English course. In addition, the topic of popular science should be familiar and interesting to students. The known words ratio of 97.6% in the “Virus” passage and 96.8% in the “Universe” passage fell into the optimal ratio between 96% and 99% as suggested by researchers for reading comprehension and vocabulary learning (Hu & Nation, 2000; Waring & Takaki, 2003).
Target words. Ten target words were chosen from each passage and thus there were 20 target words in total. All the target words were content words. The 20 words were first tested among 10 sophomore English majors who were considered to be of the same English proficiency level as those in this study based on their final exam scores and the length of their English learning. Three students reported knowing one word and all the others reported knowing none. As not one word was recognized by more than one student, all the 20 words were then included in this study. Sixteen participants of the present study reported knowing one of the 20 target words prior to the study, three participants two words, and one participant three words.

Glosses and dictionaries. Students in the gloss group read the texts with glosses provided at the bottom of each page. The glosses provided information of the unknown words including word class, L2 explanation, and L1 translation. A combination of L2 explanation and L1 translation was used in the glosses for the following two reasons. First, in students’ textbooks, new words were glossed in L2 but in many English reading materials in China new words were glossed in L1. Second, previous research showed that L1 glosses were more effective than L2 glosses but some readers preferred L2 glosses that they could comprehend (Hulstijn et al., 1996; Jacobs et al., 1994). Therefore, to resemble the natural reading environment to the largest extent and to cater for students’ preferences, both L2 explanation and L1 translation were provided in the glosses. Altogether 45 words were glossed in the two passages. An example of a gloss is as follows:

1. **intrepid**: adj. very brave, not afraid of danger or difficulties. 无畏的 **wuweide**, 勇敢的 **yonggande**

Participants in the dictionary group were each provided with an English-Chinese bilingual dictionary, where each entry includes pronunciation, word class, L2 explanation, L1 translation and examples of usage.

Reading comprehension. There were eight true or false reading comprehension questions following the “Virus” passage and nine following the “Universe” passage. Reading comprehension questions were designed in such a way that either the target words appeared in the questions or students needed to refer to the target words in the text in order to answer the questions. An example for the first situation is, “The hackers and virus writers do not have a rationale to justify their behavior.” The word “rationale” in this sentence is a target word. An example for the second situation is, “The virus writers Gordon has come to know are all male.” There is no target word in this comprehension question but the participants need to go to the text where it says “The virus writers Gordon has come to know have varied backgrounds; while predominantly male, some are female” for information to answer this question. In this sentence, the target word “predominantly” appears. In this way, the reading comprehension questions make students pay attention to the new words and establish an initial form-meaning connection by searching for their meanings. When students answered these questions, they still had the text, the glosses or dictionaries at their disposal.

Vocabulary task. The fill-in-blank vocabulary task was employed as one enhancement technique for participants in the reading-comprehension-plus-vocabulary-task group. For each passage, 10 target words appeared in a box as word
pool for participants to choose from and 10 sentences followed with one blank in each sentence. The participants decided which target word fit in each sentence and were required to write down their answers in the blanks. Students still had the glosses or dictionaries at their disposal when they did this exercise and therefore gave them another chance to search for meanings of these target words if they had not done so in the previous reading. Also, the vocabulary task provided participants a chance to elaborately process and reinforce the form-meaning connection of new words and obtained a feel of how these words were used in context.

**Test Instruments.** This study adopted a Chinese version of modified *Vocabulary Knowledge Scale* (VKS, Min, 2008; Paribakht & Wesche, 1997). The modified scale has four categories: category I (unknown words), category II (partially known words), category III (receptive knowledge) and category IV (productive knowledge). The scale was chosen as it elicits not only the receptive vocabulary knowledge but also the productive vocabulary knowledge on one scale. Furthermore, the scale includes unprompted word meaning items, which provides no hints to word meanings as other prompted-word-meaning items do and thus can more accurately reflect learners’ vocabulary knowledge (Min, 2008). The 20 target words were randomly organized to control for the order effect. The scale was used for both the immediate vocabulary test and delayed vocabulary test one month after the immediate one. At the bottom of the immediate test paper, students were asked to write down the target words they had already known prior to the study, which was then considered as their pre-knowledge of the words.

**Procedure**

During the regular class time, participants in all four groups were first asked to read two passages and complete the true or false reading comprehension questions. Participants in reading comprehension plus vocabulary task group also finished a fill-in-blank vocabulary task using the target words. All participants were able to finish the reading (and vocabulary tasks) in one class period (50 minutes). The researcher collected the reading materials and vocabulary exercises and then gave students the immediate vocabulary test. Students were not informed of the coming vocabulary test of 20 target words. One month later, 82 students finished the same delayed vocabulary test. “Receptive/ productive vocabulary gain” was calculated using immediate receptive/ productive vocabulary test score minus the number of known words prior to the study. “Receptive/ productive vocabulary retention” was calculated using the delayed receptive/ productive vocabulary test score minus the number of known words prior to study.

**Scoring**

The scoring rubric for the receptive vocabulary knowledge (Category III) is as follows. One point was assigned to a correct L2 synonym or L1 translation. No point was assigned if the L2 synonym or L1 translation was wrong. For example, no point was assigned to 理智 *lizhi* “rational” for “rationale”, 操作者 *caozuozhe* “manipulator” for “perpetrator”, or 贪婪的 *tanlande* “greedy” for “geeky”. For the productive vocabulary knowledge (Category IV) the scoring rubric is as follows. One point was assigned if the word was used grammatically and semantically correct in a sentence. No point was assigned for incorrect grammatical usage or misunderstanding...
of the meaning. The following two sentences are examples of incorrect grammatical usage, “Tom is a **geeky**.” And “We should not say **abusive** to our friends.” Examples of misinterpretation of word meanings are, “A **rationale** person can always make a right decision.” and “Tuition is always **infallible** to guard us.”

**Results**

The descriptive statistics of the students’ vocabulary gain and retention scores are presented in Table 1.

**Table 1**

*Descriptive statistics of vocabulary gain and retention scores for the four conditions*

<table>
<thead>
<tr>
<th>Conditions</th>
<th>n</th>
<th>Gain Mean (SD)</th>
<th>Retention Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Receptive mean</td>
<td>Productive mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receptive mean</td>
<td>Productive mean</td>
</tr>
<tr>
<td>+ glosses + voc. task</td>
<td>19</td>
<td>12.47 (4.01)</td>
<td>10.00 (4.93)</td>
</tr>
<tr>
<td>+ glosses – voc. task</td>
<td>23</td>
<td>6.26 (3.60)</td>
<td>4.09 (3.19)</td>
</tr>
<tr>
<td>+ dictionary + voc. task</td>
<td>21</td>
<td>7.81 (4.32)</td>
<td>7.43 (5.11)</td>
</tr>
<tr>
<td>+ dictionary – voc. task</td>
<td>19</td>
<td>5.26 (3.11)</td>
<td>3.42 (2.19)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>82</td>
<td>7.87 (4.60)</td>
<td>6.16 (4.75)</td>
</tr>
</tbody>
</table>

*Note:* + voc. task means that participants did both the reading comprehension exercise and vocabulary task. – voc. task means that participants only did the reading comprehension exercises but not the vocabulary task.

MANOVA with repeated measures for receptive and productive vocabulary scores was conducted with enhancement techniques facilitating the search for word meanings (the provision of glosses versus the provision of dictionaries) and after-reading enhancement techniques (reading comprehension plus a fill-in-blank vocabulary task versus reading comprehension minus a fill-in-blank vocabulary task) as between factors and time (immediate versus delayed) as the within factor. For all statistical analyses, the alpha level was set at .05.
Research Question One: To what extent can students retain the vocabulary knowledge (both receptive and productive) they acquire through reading with enhancement activities?

The time effect was significant for receptive vocabulary knowledge, $F(1, 78) = 205.55, p < .01$, partial $\eta^2 = .73$ (Table 2).

Table 2
MANOVA with repeated measures results for receptive and productive vocabulary scores

<table>
<thead>
<tr>
<th>Source</th>
<th>Measure</th>
<th>SS</th>
<th>df</th>
<th>$F$</th>
<th>$\eta^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between-subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After-reading enhancement techniques (A)</td>
<td>receptive</td>
<td>149.58</td>
<td>1</td>
<td>10.10</td>
<td>0.12</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>293.98</td>
<td>1</td>
<td>23.90</td>
<td>0.24</td>
<td>0.00</td>
</tr>
<tr>
<td>Enhancement techniques facilitating the search for word meanings (S)</td>
<td>receptive</td>
<td>85.93</td>
<td>1</td>
<td>5.80</td>
<td>0.07</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>22.00</td>
<td>1</td>
<td>1.79</td>
<td>0.02</td>
<td>0.19</td>
</tr>
<tr>
<td>A × S</td>
<td>receptive</td>
<td>62.71</td>
<td>1</td>
<td>4.24</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>14.72</td>
<td>1</td>
<td>1.20</td>
<td>0.02</td>
<td>0.28</td>
</tr>
<tr>
<td>Error</td>
<td>receptive</td>
<td>1155.08</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>959.40</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Within-subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>receptive</td>
<td>1214.59</td>
<td>1</td>
<td>205.55</td>
<td>0.73</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>1204.66</td>
<td>1</td>
<td>191.47</td>
<td>0.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Time × A</td>
<td>receptive</td>
<td>247.25</td>
<td>1</td>
<td>41.84</td>
<td>0.35</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>210.69</td>
<td>1</td>
<td>33.49</td>
<td>0.30</td>
<td>0.00</td>
</tr>
<tr>
<td>Time × S</td>
<td>receptive</td>
<td>77.43</td>
<td>1</td>
<td>13.10</td>
<td>0.14</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>31.82</td>
<td>1</td>
<td>5.06</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Time × A × S</td>
<td>receptive</td>
<td>14.31</td>
<td>1</td>
<td>2.42</td>
<td>0.03</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>5.04</td>
<td>1</td>
<td>0.80</td>
<td>0.01</td>
<td>0.37</td>
</tr>
<tr>
<td>Error</td>
<td>receptive</td>
<td>460.91</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>productive</td>
<td>490.74</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students had significantly more immediate receptive vocabulary knowledge gain than receptive vocabulary knowledge retention tested one month later. The mean receptive vocabulary knowledge gain was 7.87 while the mean receptive vocabulary knowledge retention one month later was 2.48 (See Table 1). The time effect was also significant for productive vocabulary knowledge, $F(1, 78) = 191.47, p < 0.01$, partial $\eta^2 = 0.71$ (See Table 2). The mean productive vocabulary knowledge gain was 6.16 while the mean productive vocabulary knowledge retention was 0.78 (See Table 1). Students forgot most of the productive vocabulary knowledge they acquired during reading.

Research Question Two: Is the provision of gloss more effective than the provision of dictionary in fostering vocabulary knowledge (both receptive and productive) gain and retention

The time*enhancement techniques facilitating the search for meaning interaction for the receptive vocabulary knowledge was significant, $F(1, 78) = 13.10,$
p < .01, partial $\eta^2 = .14$ (Table 2), suggesting that the effects of glosses and dictionaries on receptive vocabulary gain were different from those on retention. Two separate two-way ANOVAs using after-reading enhancement techniques (reading comprehension plus vocabulary task versus reading comprehension minus vocabulary task) and enhancement techniques facilitating the search for word meanings (the provision of glosses versus the provision of dictionaries) as two independent variables and receptive vocabulary knowledge gain or retention as dependent variable were conducted. A significant main effect of enhancement techniques facilitating the search for word meanings was found on receptive vocabulary gain, $F(1, 78) = 11.37, p < .01$, partial $\eta^2 = .13$ (Table 3).

### Table 3

Two-way ANOVA results for receptive vocabulary gain and retention

<table>
<thead>
<tr>
<th>Source</th>
<th>Measure</th>
<th>SS</th>
<th>df</th>
<th>F</th>
<th>$\eta^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>After-reading enhancement techniques (A)</td>
<td>gain</td>
<td>390.73</td>
<td>1</td>
<td>27.21</td>
<td>.26</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>6.10</td>
<td>1</td>
<td>.96</td>
<td>.01</td>
<td>.33</td>
</tr>
<tr>
<td>Enhancement techniques facilitating the search for word meanings (S)</td>
<td>gain</td>
<td>163.26</td>
<td>1</td>
<td>11.37</td>
<td>.13</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>.11</td>
<td>1</td>
<td>.02</td>
<td>.00</td>
<td>.90</td>
</tr>
<tr>
<td>$A \times S$</td>
<td>gain</td>
<td>68.46</td>
<td>1</td>
<td>4.77</td>
<td>.06</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>8.56</td>
<td>1</td>
<td>1.35</td>
<td>.02</td>
<td>.25</td>
</tr>
<tr>
<td>Error</td>
<td>gain</td>
<td>1120.09</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>495.89</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifically, students provided with glosses had significantly more receptive vocabulary gain ($M = 9.37$) than those provided with dictionaries ($M = 6.54$). However, no significant main effect of enhancement techniques facilitating the search for word meanings was found on receptive vocabulary retention, $F(1, 78) = 0.02, p = .90$, partial $\eta^2 = 0.00$. Specifically, students provided with glosses had very similar receptive vocabulary retention ($M = 2.53$) as those provided with dictionaries ($M = 2.46$).

The time*enhancement techniques facilitating the search for word meanings interaction for productive vocabulary knowledge was also significant, $F(1, 78) = 5.06, p < .05$, partial $\eta^2 = 0.06$, indicating that the effects of glosses and dictionaries were different on productive vocabulary knowledge gain and retention. Two separate two-way ANOVAs were conducted, using after-reading enhancement techniques (reading comprehension exercises plus vocabulary task versus reading comprehension exercises minus vocabulary task) and enhancement techniques facilitating the search for word meanings (the provision of glosses versus the provision of dictionaries) as two independent variables and productive vocabulary knowledge gain or retention as the dependent variable. Results from the separate two-way ANOVAs showed that there was a non-significant effect of the enhancement techniques facilitating the search for word meanings on productive vocabulary knowledge gain, $F(1, 78) = 3.27, p = .07$, partial $\eta^2 = .04$ (Table 4). Specifically, students provided with glosses had more productive vocabulary knowledge gain ($M = 7.04$) than those who were provided with dictionaries ($M = 5.43$), but the difference did not reach statistical significance. There was also a non-significant effect of enhancement techniques facilitating the search for word meanings on productive vocabulary knowledge...
retention, \( F(1, 78) = .20, p = .66, \) partial \( \eta^2 = .00. \) Students provided with glosses retained little productive vocabulary knowledge (\( M = 0.72 \)) as those provided with dictionaries (\( M = 0.87 \)).

**Table 4**  
*Two-way ANOVA results for productive vocabulary gain and retention*

<table>
<thead>
<tr>
<th>Source</th>
<th>Measure</th>
<th>SS</th>
<th>df</th>
<th>( F )</th>
<th>( \eta^2 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>after-reading enhancement techniques (A)</td>
<td>gain</td>
<td>501.21</td>
<td>1</td>
<td>30.74</td>
<td>.28</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>3.46</td>
<td>1</td>
<td>1.51</td>
<td>.02</td>
<td>.22</td>
</tr>
<tr>
<td>Enhancement techniques facilitating the search for word meanings (S)</td>
<td>gain</td>
<td>53.37</td>
<td>1</td>
<td>3.27</td>
<td>.04</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>.45</td>
<td>1</td>
<td>.20</td>
<td>.00</td>
<td>.66</td>
</tr>
<tr>
<td>A × S</td>
<td>gain</td>
<td>18.49</td>
<td>1</td>
<td>1.13</td>
<td>.01</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>1.27</td>
<td>1</td>
<td>.55</td>
<td>.00</td>
<td>.46</td>
</tr>
<tr>
<td>Error</td>
<td>gain</td>
<td>1271.60</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>retention</td>
<td>178.54</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Research Question Three**: Do students who do the reading comprehension plus an after-reading vocabulary task gain and retain more vocabulary knowledge, both receptive and productive, than those who only do the reading comprehension?

The results of MANOVA with repeated measures also indicated a significant time*after-reading enhancement technique interaction for receptive vocabulary scores, \( F(1,78) = 41.84, p < .01, \) partial \( \eta^2 = .35 \) (See Table 2), showing that the effect of after-reading enhancement techniques on receptive vocabulary knowledge gain was different from that on retention. The separate two-way ANOVA indicated a significant main effect of after-reading enhancement techniques on receptive vocabulary gain, \( F(1, 78) = 27.21, p < .01, \) partial \( \eta^2 = .26 \) (See Table 3). Students who did the after-reading vocabulary task had significantly more receptive vocabulary gain (\( M = 10.14 \)) than those who did not (\( M = 5.76 \)). However, the separate two-way ANOVA did not show a significant main effect of after-reading enhancement techniques on vocabulary retention, \( F(1, 78) = .96, p = .33, \) partial \( \eta^2 = .01 \) (See Table 3). Students who did the after-reading vocabulary task had similar vocabulary retention (\( M = 2.22 \)) to those who did not (\( M = 2.76 \)).

The results of MANOVA with repeated measures showed a significant time*after-reading enhancement techniques interaction effect for productive vocabulary scores, \( F(1, 78) = 33.49, p < .01, \) partial \( \eta^2 = .30 \) (See Table 2), which suggests that the effect of after-reading enhancement techniques on productive vocabulary knowledge gain is different from that on retention. The separate two-way ANOVA indicated a significant main effect of after-reading enhancement techniques on productive vocabulary gain, \( F(1, 78) = 30.74, p < .01, \) partial \( \eta^2 = .28 \) (See Table 4). Students who did the after-reading vocabulary task had significantly more productive vocabulary gain (\( M = 8.71 \)) than those who did not (\( M = 3.75 \)). However, the significant effect of after-reading enhancement techniques was not found on productive vocabulary retention, \( F(1, 78) = 1.51, p = 0.22, \) partial \( \eta^2 = .02 \) (See Table 4).
4). Students who did the after-reading vocabulary task retained as little productive vocabulary knowledge ($M = 1.00$) as those who did not do the vocabulary task ($M = .59$).

Research Question Four: Does the effect of an after-reading vocabulary task on vocabulary knowledge gain and retention, both receptive and productive, depend on the provision of glosses or dictionaries?

The separate two-way ANOVA indicated a significant interactive effect of enhancement techniques facilitating the search for word meanings*after-reading enhancement techniques on receptive vocabulary gain, $F(1, 78) = 4.77, p = .03$, partial $\eta^2 = .06$ (See Table 3), which means that the effect of the provision of glosses and dictionaries on receptive vocabulary gain depended on the presence of an after-reading vocabulary task. An after-reading vocabulary task had a much larger facilitative effect on receptive vocabulary gain when students were provided with glosses than dictionaries. By contrast, such an interactive effect was not found on receptive vocabulary retention, or productive vocabulary gain or retention, suggesting that the effect of a vocabulary task on receptive vocabulary retention, productive vocabulary gain and retention does not depend on the presence of glosses or dictionaries.

To sum up, both the receptive and productive vocabulary gains from reading plus enhancement techniques were satisfactory, 7.87 and 6.16 (out of 20) respectively. However, a sharp decrease was found in both receptive and productive vocabulary retention, 2.48 and 0.78 respectively. Students failed to retain most of the vocabulary knowledge they acquired through reading plus some enhancement techniques. The results of this study also revealed that the provision of glosses was more effective than the provision of dictionaries in facilitating receptive vocabulary gain. No significant differences were found between the provision of glosses and dictionaries in boosting receptive vocabulary retention, productive vocabulary gain or retention. Students who did the after-reading vocabulary task gained more receptive and productive vocabulary knowledge but the effect of the vocabulary task ceased to exist in both receptive and productive vocabulary retention. An after-reading vocabulary task was found to be more effective in facilitating receptive vocabulary gain when students were provided with glosses than dictionaries.

Discussion

The purpose of the study was to examine the effect of enhancement techniques facilitating the search for word meanings, the provision of glosses and the provision of dictionaries, and two after-reading enhancement techniques, reading comprehension and reading comprehension plus a vocabulary task (fill-in-blank), and their possible interactive effect on receptive and productive vocabulary gain and retention. Four major findings have emerged from the present study.

First, the present study has demonstrated that reading plus enhancement techniques led to both receptive and productive vocabulary gain but students were unable to retain most of the vocabulary knowledge they acquired one month later, especially the productive vocabulary knowledge. This finding partially conforms to that of Min (2008), suggesting that reading plus enhancement techniques are effective
in boosting the gain and retention of both receptive and productive vocabulary knowledge. In Min’s (2008) study, students in the reading plus vocabulary task group increased their receptive vocabulary knowledge from 2.8% to 35.12% and their productive vocabulary knowledge from 1.12% to 37.36% in the immediate test. Students still retained a considerable proportion of both receptive and productive vocabulary knowledge in the delayed test (16.08% for receptive, and 18.96% for productive). Two reasons can be offered to explain the differences with regard to the retention rate between the present study and Min (2008). First, in Min (2008), students in the reading-plus-enhancement group were engaged in several different vocabulary tasks such as matching, fill-in-blank, rearranging word order and translation. Students had four or five opportunities to elaborately process the meanings of the words and practice using them in sentences in order to complete the reading comprehension questions and vocabulary tasks. In contrast, in the present study, although all students were provided with either dictionaries or glosses and did one reading comprehension exercise, only half of the students were required to do one vocabulary task (fill-in-blank). Therefore, students only had one or two opportunities (reading comprehension or a combination of reading comprehension and a vocabulary task) to elaborately process the word meanings after reading depending on the groups they were in. In fact, previous research showed the effect of frequency on vocabulary acquisition in that the repeated processing of word reinforces the form-meaning connection in one’s mental lexicon (Hulstijn et al., 1996; Kweon & Kim, 2008). Second, in Min’s (2008) study, instructors went over the vocabulary tasks with students, which provided another opportunity for students to encounter the words and might have clarified any confusion concerning the target words and deepened students’ understanding. In the present study, the instructors did not do a follow-up explanation of the vocabulary task.

Our second finding has revealed that the provision of glosses was more effective than the provision of dictionaries in facilitating receptive vocabulary gain. This finding conforms to Hulstijn et al. (1996) but is in conflict with Laufer (2000), who found that the provision of electronic dictionaries was more facilitative than the provision of glosses in fostering receptive vocabulary gain and retention. In Laufer’s (2000) study, electronic dictionaries was used while in the present study, paper dictionaries were used. It is easier to consult an electronic dictionary and the frequency for learners to consult a paper dictionary is much lower (Hulstijn et al., 1996). We may presume that students might not look up new words frequently in dictionaries although they were provided with one. The reading comprehension and vocabulary tasks were designed in such a way that they drew students’ attention to the target words. However, they might guess the meanings based on the context instead of consulting the dictionaries. Moreover, participants were not forewarned of a vocabulary test and their attention was thus directed at comprehending the text and doing the comprehension questions rather than the unknown words. Therefore, even though students were provided with dictionaries, they might not take the time to look up the unknown words since that might interrupt their reading process (Hulstijn et al., 1996).

Glosses, however, were located at the bottom of each page of the reading passage in this study and thus very easy to look at. When students consulted the glosses, they were engaged in multiple encountering with the words by first encountering the word in the text, deciding if it is unknown, reading its explanation in
Effect of enhancement techniques on second language vocabulary acquisition

the glosses, going back again to the text to see if the explanation fit the context, and last figuring out the meaning of the whole sentence. This process of searching for word meanings may enhance the form-meaning connection of the unknown words. In this study, the glosses provided the word class, L1 definition and L2 explanation but not word usage (i.e., explaining collocations or giving examples of how the words should be used in a sentence). The design of glosses in this study focused on word meanings and thus might be conducive to receptive vocabulary knowledge but not productive vocabulary knowledge, which might explain why the provision of glosses was more effective than the provision of dictionaries in boosting receptive vocabulary gain but not productive vocabulary gain.

Our third finding has demonstrated that students who did both the reading comprehension exercise and the after-reading vocabulary task (fill-in-blank) gained more receptive and productive vocabulary knowledge than those who only did the reading comprehension exercises. This result lends support to Peters et al.’s (2009) statement that enhancement techniques can boost receptive vocabulary acquisition through reading if these techniques can a) make students discover the word meanings, b) process the form-meaning connection elaborately and c) process them again as reinforcement. In this study, students in the reading comprehension plus vocabulary task group had chances to search for the meanings of unknown words either from glosses or dictionaries, process the form-meaning connection of unknown words elaborately by doing reading comprehension exercises, and process the words again by doing vocabulary task. This group of students outperformed those who did not do the vocabulary task, which supported three indispensable steps for enhancement techniques to take effect: “look up the meaning of unknown words, process their form-meaning relationship elaborately, and process them again after reading” (Peters et al., 2009, p. 114). The lack of the reinforcement step, as what happened to those students who did not do the vocabulary task, resulted in poorer receptive and productive vocabulary gains. Thus, this finding also expands Peters et al.’s (2009) statement by showing evidence that the three indispensable steps that the enhancement techniques involve are not only effective in boosting receptive vocabulary gain but also in productive vocabulary gain.

The after-reading vocabulary task (i.e., fill-in-blank) in this study involved students in an elaborate information processing or reinforcement activity. When doing this task, students needed to first make sure they knew all the unfamiliar words in the word bank. It was likely that they would consult the dictionaries or glosses or go back to the reading passage to search for meanings if they were not sure they knew all the words. Then students read the sentences in which there was a blank and decided which word fit the blank best. In this process, students not only needed to know the meanings of the words but also had a chance to attend to their grammatical category and study their collocations. It was possible that students had to go back to the previous sentences or to compare the meanings of candidate words when they proceeded from one sentence to the next in order to reaffirm their choices. Therefore, the fill-in-blank exercises provided students with a chance to attend to receptive knowledge (i.e., word meaning) as well as productive knowledge (i.e., grammatical category, morphology and collocation) of a word, and thus were found effective in boosting vocabulary gain at both the receptive and productive levels.
Although the after-reading vocabulary task (fill-in-blank) was found to boost vocabulary gain, its effectiveness disappeared on the delayed retention test. This finding is in contrast with those of Min (2008) and Peters et al. (2009) in that the two studies revealed the consistent superiority of reading plus a vocabulary task over reading in both the immediate gain test and in the delayed retention test. The different results might be attributed to the different time when the delayed test was taken and/or the types of vocabulary tasks involved. Previous research has shown that vocabulary recall after reading decreases over time (Cheng & Good, 2009; Huang, 2003). In Peters et al. (2009), the delayed test was carried out two weeks after the reading while in this study the delayed test was carried out one month after the reading. It seems plausible to surmise that participants may forget more words one month after the reading than two weeks after the reading. It may also be possible that the effect of after-reading vocabulary tasks on vocabulary recall also decreases over time as participants forget more words. Given that we did not collect data to examine this hypothesis, further study examining the effect of after-reading vocabulary tasks on several retention tests is needed. In Min (2008), participants were engaged in several different vocabulary tasks, meaning matching, word translation, filling-in-blank, and rearranging word, which provided more processing and reinforcing chances for students. Although reading comprehension and vocabulary task in the present study provided students with the chance to discover word meanings, process the lexical information and reinforce the form-meaning connection, the one after-reading vocabulary task as reinforcement might not be enough for retention to happen. Therefore, we suspect that the enhancement techniques that make participants “look up the meaning of unknown words, process their form-meaning relationship elaborately, and process them again after reading” (Peters et al., 2009, p. 114) might work well for vocabulary gain but not for vocabulary retention. To retain a word, necessary reinforcement between the immediate test and delayed test should be added.

The fourth major finding has shown a significant interactive effect of enhancement techniques facilitating the search for word meanings and after-reading enhancement techniques on receptive vocabulary gain but not on receptive vocabulary retention or productive vocabulary gain or retention. Specifically, the after-reading vocabulary task (fill-in-blank) was more effective in boosting receptive vocabulary gain when students were provided with glosses than when they were provided with dictionaries. This interactive effect indicates that the presence of the after-reading vocabulary task might have amplified the differences between the effects of two enhancement techniques facilitating the search for word meanings: the provision of glosses and dictionaries. Or, the provision of glosses has enhanced the effect of vocabulary task on receptive vocabulary gain. Future study may continue this line of research to explore the possible interactive effect of different enhancement techniques and find the best combinations of enhancement techniques for vocabulary acquisition through reading.

**Limitations**

A number of limitations and future research areas warrant notes. First, one of the findings revealed that the provision of glosses was more effective than the provision of dictionaries in facilitating vocabulary gain. However, the exact frequency in which the participants consulted the glosses or dictionaries was not recorded in this study. It is also possible that students might not use dictionaries to look up the
unfamiliar word even though they were provided with one. Future research might provide computerized dictionaries to students and keep record of the frequency participants use these dictionaries via computer programs in order to compare the effectiveness of the use of dictionaries and the use of glosses. Second, another drawback of this study is that the research design did not take into consideration the role of individual differences in vocabulary acquisition through reading, such as reading motivation, reading beliefs, reading anxiety and vocabulary learning strategies. Future research might study the effectiveness of enhancement techniques among students with different motivations, beliefs, anxiety and strategies.

**Conclusion**

This study investigated the effect of four enhancement techniques and also their interactions on receptive and productive vocabulary gain and retention: (a) two enhancement techniques facilitating the search for word meanings, the provision of glosses and dictionaries, (b) two after-reading vocabulary enhancement activities, namely, a reading comprehension task and a reading comprehension task plus a fill-in-blank vocabulary task. The findings of this study corroborates previous findings that reading plus vocabulary enhancement techniques can greatly boost receptive vocabulary gain if these techniques can make students search for the meanings of these words, process elaborately the form-meaning connection, and reinforce the lexical information again (Peters et al., 2009). The findings also add to the previous findings by showing evidence that vocabulary enhancement techniques with the above-mentioned features can also boost productive vocabulary gain. However, these vocabulary enhancement techniques did not yield a good result in either receptive or productive vocabulary retention. We speculate that in order for retention to happen, some reinforcement activities need to be carried out several days after the reading activity and therefore we suggest future research focus on reinforcement tasks that are conducive to vocabulary retention and the optimal time to carry out the tasks. The interactive effect of enhancement techniques facilitating the search for word meanings and after-reading vocabulary tasks revealed the possible interactive effect between different enhancement techniques. Therefore, teachers and researchers might take into account the interactive effect between different enhancement techniques when devising enhancement techniques supplementing reading activities.

**Acknowledgement**

This research is supported by the Independent Innovative Research grant (2009TB002) awarded to the first author by Shandong University.

**References**


