The Effects of L1 and L2 Hypertext Glosses on Reading Comprehension and Vocabulary Retention among Thai Secondary School Students

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Abstract
This study investigates the effects of first language (L1) and second language (L2) hypertext glosses on reading comprehension (RC), immediate vocabulary recognition (IVR), and delayed vocabulary retention (DVR). A group of 83 secondary school low-achieving students (10th grade) were assigned to read glossed texts, L1 and L2 hypertext glosses. This study may help teachers create glossed texts to improve students' incidental vocabulary learning and it can contribute to the raising of students' attitudes towards learning English with encouraging and interesting vocabulary learning conditions. A repeated measure *t*-test design (without control group) was employed. The results indicated that the effects between the L1 and L2 glosses were significantly different. The paired sample *t*-test revealed that the L1 gloss scores were significantly higher than the L2 gloss scores regarding RC (*p* = .014), IVR (*p* = .000) and DVR (*p* = .000). The pedagogical implications suggest that reading with the assistance of glosses can be successfully integrated into a real classroom setting to improve low-achieving students' vocabulary knowledge in an English as a Foreign Language (EFL) context. It is recommended that future studies use L1 written story retelling/recall techniques to collect the reading comprehension and vocabulary retention data as choices offer random guesses to the participants.

Keywords: hypertext gloss, incidental vocabulary learning, reading comprehension, Thai secondary school students, vocabulary retention

Introduction

Vocabulary has a vital role in foreign language learning, in improving other language skills, and especially in communication (Nation, 2011; Read, 2000). According to Hunt and Beglar (1998), there are three approaches to improving vocabulary learning: incidental learning, explicit instruction, and independent strategy development. It is mentioned that among these three approaches, incidental vocabulary learning is considered an important part of learning vocabulary. This approach directly supports Nation (1995), as reading is valued as a main source for expanding vocabulary storage. However, Thai students are weak in English reading comprehension (Kasemsap & Lee, 2015; Sawangsamutchai & Rattanavich, 2016). As a result, EFL teachers should look for some alternative ways of teaching vocabulary in the classroom because the problem of "knowing words" among EFL learners still exists in the Thai education context. According to National Institute of Educational Testing Service (NIETS), 2017's English test results from Ordinary National Educational Test (O-NET) showed that over 90% of students, 12th grade, scores below 50 and the average scores of every previous year are below 30 out of 100.

Researchers have investigated incidental vocabulary learning through glossing techniques, and the impacts of L1, L2, and multiple glosses on vocabulary learning have been studied by many educators (Hong, 2010; Yoshi, 2006; Ko, 2005; Lomicka, 1998). In addition, presenting vocabulary assistance in a computerized glossing format has received attention. The studies of AbuSeileek (2011) and Chen and Yen (2013) have revealed that the way a gloss is presented on the computer screen can influence reading competence based on the measures of reading comprehension and vocabulary learning. The evidence supports the use of the glossing technique to assist students in learning L2 words incidentally when reading L2 texts. Most teachers might recommend the use of the guessing technique to help learners determine the meanings of unknown words in reading passages through neighboring words. However, in a situation in which students have difficulty guessing the meaning of words because their vocabulary storage is not large enough, they might consult a dictionary, resulting in an adverse effect on their concentration. Therefore, developing effective reading methods to help remedy this problem seems mandatory.

The studies conducted in Thai or overseas contexts have confirmed the effectiveness of glossing techniques with reading comprehension and vocabulary retention. The unique characteristics of previous studies are the research design, which tended to investigate the effects between treatment and no treatment groups. Also, the participants are mostly intermediate students studying at the university level. There are not many studies that have focused on only low achievers, and especially Thai secondary school students. So, the main objectives are set to investigate the effectiveness of L1 and L2 hypertext glosses on reading comprehension and vocabulary retention of Thai low-achieving students learning English, based on the following research questions:

1. Which type of glosses (L1 or L2 glosses) is more effective in improving reading comprehension?
2. Which type of glosses (L1 or L2 glosses) is more effective toward immediate vocabulary recognition?
3. Which type of two glosses (L1 or L2 glosses) is more effective in delayed vocabulary retention?

Literature Review
Vocabulary Knowledge and Coverage

It has been extensively admitted that vocabulary knowledge has a strong influence on communication in a second language. As a communicative tool, learners must know vocabulary as it is the mechanism with which to express messages (Krashen & Terrell, 1983). Webb (2005) conducted an experiment to test whether receptive or productive learning can aid in vocabulary growth. Among the results, it was revealed that the receptive group could retain its vocabulary knowledge longer than the productive group. According to Webb (2008), receptive vocabulary is more important than productive vocabulary for typical learners. Therefore, it is believed that learners acquire words receptively first before they can apply those words productively. This fact supports the idea that low achievers, that have a small vocabulary, can rely on the bottom-up process and receptive vocabulary first to build reading comprehension.

In reading an average text, the vocabulary coverage of 1,000 words is estimated 72% running words of a text. With the vocabulary coverage of 2,000 words, readers know around 80% of running words of a text. This percentage might not be sufficient for L2 learners to guess the meaning of unknown words in order to understand reading texts (Nation & Waring, 1997). Laufer (1989) stresses the value of having a large vocabulary in order to understand 95% of the words in a reading text. Readers whose lexical knowledge is not large enough may not understand the text. In addition, it is confirmed that "percentage coverage of a text is needed for unassisted reading for pleasure, where the learners are able to read without the interruption of looking up words" (Hu & Nation, 2000, p. 403). The study showed that their participants needed to recognize 98% to 99% of the words in reading texts before adequate comprehension were possible. All in all, it can be concluded that learners' vocabulary knowledge influences their comprehension which may allow for better reading comprehension.

Gloss

The glossing technique refers to a short definition or note to improve the reader's reading comprehension (Lomicka, 1998). Yanguas (2009) claims that glosses are a substitute for the dictionary as they attempt to help solving the reading problems of a reader. The good point is that glossing techniques can save readers' time and effort in reading L2 texts. According to Ko (2012), this technique can be used as the input modification and it has been concluded that it has advantages. First, learners will know the exact meaning of a new word instead of guessing the wrong meaning. This is an essential matter because if learners make the wrong guess, they will not understand the context in which the word appears. Next, electronic glosses lessen the number of look-up behaviors, which saves time and creates no interruptions while reading texts. Thirdly, with gloss assistance, prior knowledge will be triggered on the reading process with the new knowledge of the text, and this is useful for readers because it will help them to remember the content of the text which will possibly extend the vocabulary remembering period. Finally, the glossing technique provides students with better learning autonomy as it easily provides learners with the definitions of unknown words. Furthermore, Jacobs (1994) agrees with this point, saying, "Glossing strengthens the bottom-up component of the reading process. It is one of several possible repair strategies that readers can use when they recognize comprehension breakdowns" (Jacobs, 1994, p. 115). We can conclude from this statement that glossing technique is a useful strategy in

improving reading comprehension. However, a gloss has many forms and the following discussed the hypertext gloss and gloss language.

According to Kommers, Grabinger and Dunlap (1996), hypertext refers to applications in computer that provide additional information in many forms of media. This is very different from the paper-based gloss. A hypertext gloss allows for the generation of a link between vocabulary items and extra information. In terms of showing the definition of a word, a small pop-up window will show only the key point of the target word and a brief definition. According to Yun (2011), a hypertext gloss refers to short definitions or explanations in a computerized text. The meaning of the glossed words will show up with a pop-up window after the students move the cursor on the unknown word and click.

Next, L1 and L2 have been investigated according to which gloss type has more effects on vocabulary learning (e.g. Hong, 2010; Yoshi, 2006; Ko, 2005; Lomicka, 1998). The results have shown that the effectiveness of the glosses in L1 or L2 depends on the proficiency levels of individuals. High achievers can benefit from L2 glosses while low achievers can gain much knowledge from L1 glosses. As for Weschler (1997), L1 should not be neglected in the language learning process as it can contribute to learners' language proficiency. In fact, avoiding the application of L1 in language learning can delay target language comprehension. Nation (2011) also agrees with this point in emphasizing that first language translations offer a very useful choice of learning vocabulary, and for vocabulary recall. It is believed that translation helps L2 students acquire language skills such as reading, writing, and vocabulary. Studies related to psycholinguistics have also demonstrated that L1 can be used actively and its role will fade when their language skill increases (Sunderman & Kroll, 2006). Thus, using the L1 at the beginning stages of learning vocabulary is a good method (Schmitt, 2008).

Incidental Vocabulary Learning and Retention

Incidental vocabulary learning is a learning situation in which L2 students acquire unknown target vocabulary unintentionally after they experience them and engage in learning activities and where the focus is on communication rather than linguistic structure (Choi, 2016). In fact, one of the most commonly-accepted views of vocabulary acquisition is that second language vocabulary acquisition occurs incidentally through comprehensible input (Krashen, 1989) while reading a text.

Rouhi and Mohebbi (2012) conducted a study to investigate the effects of computer-assisted L1 and L2 glossing techniques on L2 vocabulary learning. The results of the recognition and production measures back up the positive effects of glosses on L2 vocabulary learning compared with no gloss conditions. Additional data analysis has demonstrated that the participants in L1 glosses condition performed better than the participants in L2 glosses condition. Moreover, Choi (2016) conducted a study to examine the effects of L1 and L2 glosses on incidental vocabulary acquisition. The results revealed that the students benefits from L1 rather than L2 glosses regarding the long-term retention of words. To sum up, incidental vocabulary learning promotes deeper mental processing and better retention (Web, 2005, 2007). Further, repeated exposure involves cognitive processing, which helps learners retain words longer. The benefit is that learning vocabulary through reading, as a consequence, improves learners' reading fluency

because they meet groups of words rather than single words while they are reading. As a result, successful vocabulary learning leads to successful application of language in daily situation.

Recent Studies in the Thai Context

Few gloss studies have been conducted in the Thai context. The topics to be elaborated relate to the effects of glosses on reading comprehension, incidental vocabulary learning, and vocabulary retention, which are the focus of the present study. First, Srichamnong (2011) investigated incidental L2 vocabulary learning, and the participants were asked to read the text on computers. The objective was to determine the effects of four different vocabulary learning tasks. Forty-five Thai intermediate-level students were put into four different groups and the results revealed that the more students joined the research activities the more their vocabulary retention improved even though the gain was only a little.

Second, regarding English vocabulary learning, Jenpattarakul (2012) investigated the glossing technique with 30 university students. Reading comprehension tests were administered and it was found that the students obtained higher scores on the posttest than on the pretest, $p = .05$, whereas the attitude towards the glosses was satisfactory. The results demonstrated that using glossing helped the students remember vocabulary in a reading passage. Therefore, the glossing technique contributes to the improvement of students' reading comprehension and enables them to comprehend their reading more quickly. This conclusion is in line with Ko (2005) who mentions that glossing offers reading flow without too much interruption and students can quickly get the definition. As suggested by Hong (2010), it prevents the readers from making the wrong guesses. There is the possibility that guessing is not effective when the reading context is not clear to their understanding.

Finally, Gasigijtamrong (2013) also studied the effects of multimedia annotations on words and text recall. The participants were still Thai university students. Moreover, the students' language proficiency was also at an intermediate level, as with previous studies. As multimedia vocabulary annotations were applied in reading texts, the results revealed that the Thai EFL learners recalled about 42% of target words, which was significantly higher than their pretest scores. Three weeks later, the retention test scores were significantly higher than their pre-test scores as well. The study confirms that the multimedia annotations helped with vocabulary recall. In general, the studies conducted in Thai contexts confirmed the effectiveness of glossing techniques in relation to reading comprehension and vocabulary retention. Furthermore, these findings from previous studies in Thailand correlate to findings mentioned in the introduction of this literature review which mention that glossing techniques improve reading comprehension and vocabulary recall. However, more gloss and vocabulary research needs to be conducted in Thailand and there are some research gaps which need to be bridged for the enhancement of L2 vocabulary learning.

Methodology

This study has a quasi-experimental orientation because true experimental designs are sometimes impractical because the research can only effectively be carried out in the laboratory. Moreover, the present study investigates a group of people, so the researcher utilized a quasi-experimental design to minimize threats to ecological validity as the study was conducted in a

natural environment and not a well-controlled laboratory setting. The findings which allowed for some generalizations to be made may be applied to other subjects and settings. The present study employed a repeated measure *t*-test design, which is a type under the umbrella of the quasi-experimental design. According to Mcleod (2017)*,* repeated measure design is also known as the within group design where the participants experience the same experimental conditions (each level of the independent variables). Since the same participants were used in each experimental condition, the participant variables, such as individual difference or socioeconomic status, were reduced. The characteristic of the design was that only one group of participants was exposed to the research activities, L1 and L2 glosses.

Population and Sampling

A total of 199 participants were the population in the study and all were Thai secondary school students of Matthayom-Four (10th grade) at a secondary school in Thailand. First, the students' scores on the nation's vocabulary level test provided a first look at the target students. This is a tool that is widely used to roughly measure the written receptive vocabulary knowledge required for reading. The test consists of two versions, which are parallel forms. The vocabulary level test (VLT) was used to select the target participants. After the researcher received VLT scores, 161 students that had above 60% on the vocabulary test remained. However, the vocabulary level test score might not give the entire view. Their pre-existing O-NET scores in Matthayom-Three (9th grade) were next used to select the target students. Within the context of this study, the average 9th grade students' O-NET English score was 31.94 in 2013. The scores ranging between 16 and 30 were used to frame the group for the study. As the score of 30 is obviously one third of 100 (the total scores), it indicates a low proficiency level. A score below 16 is too low for students to comprehend average texts, and scores above 30 and 60 may indicate average and high levels of proficiency, respectively, which were not the target objective of the sampling frame of the present study. At this stage, 93 students that met the criteria were selected. Finally, the total number came down to 83 after 10 students were removed from the pilot study.

Reading Texts

The students would encounter a text with approximately 240 words. The number of words from first text to the fourth text was $241, 245, 239,$ and 243 words per text, respectively. The percentage of K1 word coverage ranged from %73 to %82, which showed that the texts contained a large number of high-frequency words. The researcher selected the reading texts based on the students' preference, as they first chose the reading themes in the pilot study. The four English reading texts were from breakingnewsenglish.com, which provided nine themes of texts, and each text had seven different levels of difficulty. The most preferable themes were health, technology, and lifestyle, which obviously outweighed the fourth preferred theme, so the researcher randomly selected the stories based on these three themes. Moreover, the pilot study revealed that the reading ease score of the target texts should be between 60 and 70, which means that the texts were average, and the Flesch-Kincaid Grade level results also revealed the texts were for 8th-9th students.

Glossed Words in the Text

After obtaining the reading texts with the appropriate readability, the researcher then chose and put four texts into an online service word calculator website, lextutor.ca, in order to categorize

every word into groups, i.e. K1 family, K2 family, academic word lists, or the off-types. As a result, the researcher was able to pick feasible glossed words to check later as to whether the pilot students knew or did not know the definitions. As a result, 40 words were then used to be glossed in the reading texts. For clear textual definitions, the researcher used definitions of target words from the Macmillan Dictionary, for L2 definitions (English), and LongdoDict, for L1 definitions (Thai). As the target texts from breakingnewsenglish.com and the Macmillan Dictionary are both British sources, and LongdoDict is the most visited online dictionary ranked by Truehits Ranking, the present study used the English and Thai definitions from these sources. The researcher edited some of the definitions to match the target words with the reading contexts. The texts were less than %5 glossed, with 11-9 words per text. The target words were 13%, 42%, 45% from K2, the academic word list, and the off-types, respectively.

Reading Comprehension Tests

Multiple choice tests were used and they consisted of 16 items for each text. The testing session lasted 40-45 minutes (including recognition tests). The given time was enough for the students as the pilot study suggested. In addition, the test items were on the paper but the reading texts were on the computer screen. For construct validity, the test items were sent to language experts to evaluate the relationship between the Bloom Taxonomy's Learning Domains and each individual item. The experts were asked to rate each test item in order to see whether the content was congruent with the domain. In the present study, the average scores from the experts for text 1 to text 4 were respectively 0.72, 0.68, 0.62, and 0.66, indicating that the tests were acceptably congruent with the objectives. Moreover, after the IOC scores and comments were received, the researcher made the appropriate changes. The items that were not congruent were removed, while the rest were edited to fit the scheme of each test.

Immediate and Delayed Vocabulary Tests

According to research questions two and three, the purpose of immediate vocabulary recognition and delayed vocabulary retention tests is to investigate the effects of both text types and glosses (L1 and L2), that is, whether or not they influence retention. After finishing each comprehension test, the test papers were brought back and the participants logged out of the program and turned off the computer screen. The matching tests were given to the students immediately in order to test their immediate recognition of the target glossed words that they had encountered in the reading texts. The students completed the tests as the researcher provided altogether 40-word matching tests to check the students' immediate vocabulary recognition. The definitions provided were the same as the glossed words which appeared in the reading texts. Then, the delayed vocabulary retention tests were given to the target participants to complete four weeks later in four consecutive days. The test format was the same as the immediate vocabulary recognition test so that the data could be compared. Each test took 8-10 minutes to complete in pencil-and-paper format.

Results and Discussion

The group of students, 83 participants, experienced the L1 hypertext glosses that were embedded in the English text. The main findings for the first three research questions were reported. The explanations are first provided under descriptive statistics and, secondly, the pair sample *t*-test aspects.

Research Question 1
This section of the results presents the comprehension scores obtained from the participants.

Data from the Reading Comprehension Tests (L2 and L1 glosses)
The reading comprehension test scores of the Thai secondary school students were that, out of sixteen points each, the means for the tests were 4.31 and 3.86, respectively, with SD values of 2.24 and 2.15. Regarding the L1 gloss scores, the means of the tests were 3.90 and 5.34, respectively, with SD values of 1.54 and 2.18. The mean for the 2 L2 hypertext gloss test scores was 4.08 and the mean for the 2 L1 hypertext gloss test scores was 4.62 and they were then put into the paired sample *t*-test analysis. The results indicated that there was a statistically significant difference in the two types of glossing techniques at the .05 level *(p=.014)*. The table of the paired sample *t*-test scores is presented next.

Table 1

Paired Sample t-test Scores for the Reading Comprehension Test

Paired Samples Test					
	95% Confidence Interval of the Difference				
	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 - L2 and L1	-0.96166	-0.11063	-2.507	82	0.014

Therefore, the results showed that the average comprehensive score for the L1 hypertext gloss was significantly higher than the L2 hypertext gloss, *p* = .014. Apart from the effects of the L1 and L2 glosses on reading comprehension, the next sections present the L1 and L2 glossing effects on the immediate vocabulary recognition test results.

The reasons behind the effect of L1 and L2 hypertext glosses on reading comprehension could be that glosses are functional and practical in terms of accessibility, as the reading process is not interrupted while readers are negotiating with the meaning of reading texts. The findings suggest that the glossing technique can be a substitution for a dictionary (Yanguas, 2009). Another advantage is that this technique can help to prevent wrong guessing and direct readers to correct inferences (Nation, 2001). The understanding of each student was more precise when he or she knew definitions as the L1 (Thai) gloss condition was more influential than that of the L2 definitions. In line with Nation (2011), the findings concluded that first language translations offer the more useful choices for learning vocabulary without a doubt.

In addition, with the significance differences between the L1 and L2 gloss scores on the reading test, the means for the L1 gloss scores in the present study were significantly higher than the L2 gloss scores. This showed that learners can benefit more from their L1 in terms of learning L2 vocabulary. Based on the questionnaire responses, the L2 learners in the present study preferred L1 to L2 vocabulary support. According to Schmitt (2008), this preference can be supported with positive L1 transfer in L2 vocabulary learning for both low and high achievers. According to Schmitt (2008, p. 337), "although it is unfashionable in many quarters to use the L1 in second language learning, given the ubiquitous nature of L1 influence, it seems perfectly sensible to exploit it when it is to our advantage."

Incidental vocabulary learning occurs through reading for meaning comprehension, and comprehension is developed and enhanced by reading highly-informative contexts. If the findings are looked at through the lens of the vocabulary threshold, the reading success might be based upon the individual's vocabulary capacity within reading contexts. Learners must be able to recognize the surrounding words in order to correctly infer the meaning of an unknown word, or to recognize a great amount of word to comprehend a whole text.

This amount ranges from 3,000 words, in order to reach 95% word coverage o (Laufer, 1989), to 5,000 words, in order to reach 98% word coverage of a general text (Hu & Nation, 2000) for full textual comprehension. However, Bonk (2000) asserted that learners whose vocabulary coverage is less than 75% rarely comprehend reading texts. Table 2 shows the percentage of K1 words per text and 78.03% was the average. Based on the results, the students rarely comprehended the reading texts evaluated using the multiple choice tests even though the readings contained more than 75% of K1 words. These results were obviously in line with the concepts discussed earlier.

Table 2

The Number of K1 Words (1-1000) in Each Text

	Families	Types	Tokens	Percent
Text 1	82	96	191	79.25%
Text 2	78	95	179	73.06%
Text 3	85	106	196	82.01%
Text 4	78	95	189	77.78%
Average				78.03%

To sum up, the average score that the participants achieved the four reading comprehension tests was 4.35 out of 16 items. This number accounted for 27.1% of text comprehension (4.35x100/16). Regarding the O-NET scores and the vocabulary threshold of 1000, which were used to select the participants, it might be concluded that the secondary school students that had an O-NET score below 30 will probably have fewer than 1000 English words in their memory. They also are likely to have reading problems as the limited vocabulary number negatively influences the perfect reading comprehension.

According to Nation and Waring (1997), the L2 learner needs to know 3,000 words of the target language for successful reading. Based on the findings, this seems inapplicable to the secondary school students in the research context because they would have to have more than 2 times their existing vocabulary in order to touch the K3 threshold. Moreover, if 95%, or 5,000 words, and 98%, or 8,000 words, are the learning goals (Laufer & Ravenhorst-Kalovski, 2010), the students will take a long time to acquire the vocabulary. The results suggest that vocabulary learning and teaching should be paid attention to at the earlier school level so that the average O-Net test scores will improve and the gaps between the low and high achieving students can be reduced.

Research Question 2

Data from the IVR Tests revealed that the means for immediate vocabulary recognition tests were 2.31 (*SD*=1.48) and 2.14 (*SD*=1.22) for L2 glosses. For the L1 glossed words, the means were 4.88 (*SD*=1.29) and 4.45 (*SD*=1.35), respectively. The minimum score found in the results

was 0, and the maximum score was 8. In analyzing the data, the researcher combined the two sets of scores in order to find the mean values. Out of 20 L2 and L1 target words, the means for the tests were 2.22 and 4.66 with SD values of .95 and .99, respectively. The means for both the L2 and L1 immediate vocabulary recognition test scores were put into the paired sample *t*-test analysis to find the difference of the two means. The paired sample *t*-test results, as shown in Table 3, indicated that there was a statistically-significant difference in the two types of glossing techniques at the .05 level (*p*=.000).

Table 3

Paired Sample t-test Scores for the Immediate Vocabulary Recognition Test

Paired Sample Test					
	95% Confidence Interval of the Difference				
	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 - IVR2 and IVR1	-2.69665	-2.17082	-18.414	82	.000

Therefore, the result show that the average immediate vocabulary recognition score for L1 hypertext gloss was significantly higher than that for the L2 hypertext gloss. Apart from the effects of the L1 and L2 glosses on immediate recognition, the next sections present the L1 and L2 glossing effects on delayed vocabulary retention.

Research Question 3

The descriptive statistics from the DVR revealed that the means for delayed vocabulary retention test were 1.96 (*SD*=1.36) and 2.06 (*SD*=1.58) for L2 glossed words. In terms of the L1 glossed words, the means were 4.22 (*SD*=1.69) and 4.57 (*SD*=1.80), respectively. The minimum score found in the results was 0, and the maximum score was 8. As with the calculation of the immediate vocabulary recognition test scores, the researcher combined the two sets of scores in order to find the mean values of the total 20 L1 gained words and 20 L2 gained words. Out of the 20 L2 and L1 target words, the means for the tests were 2.01 and 4.39 with SD values of 1.05 and 1.26, respectively. Moreover, the means were put into a paired sample *t*-test analysis to find out the differences in the means (L2 and L1 glosses). As shown in Table 4, the paired sample *t*-test results indicated that there was a statistically-significant difference in the two types of glossing techniques at the .05 level *(p*=.000).

Table 4

Paired Sample t-test Scores for the Delayed Vocabulary Retention Test

Paired Sample Test					
	95% Confidence Interval of the Difference				
	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 - DVR2 and DVR1	-2.70643	-2.05261	-14.480	82	.000

Therefore, the results show that the delayed vocabulary retention score for L1 hypertext gloss were significantly higher than for the L2 hypertext gloss. On the immediate recognition test, the L2 gloss showed more limitations than the application of the L1 gloss, as the students that experienced the L1 gloss scored higher in IVR and retained more target words in DVR. The present results support hypothesis L1's positive transfer in aiding vocabulary learning. The significant

results of the study reflect Hulstijn et al.'s (1996) statement that incidental vocabulary learning by reading definitely takes place. In contrast with Yoshi (2006), the students of the present study benefited more from the L1 gloss. This can perhaps be explained by the fact that university students in Yoshi (2006) and secondary school students can be differently influenced by types of gloss in terms of proficiency levels. The present study's results support Nation's (2011) view that first language translations offer a very useful choice for learning vocabulary and in the recall of vocabulary.

In line with Rouhi and Mohebbi (2012) and Lomicka (1998), reading on a computer with glosses promotes a deeper level of textual comprehension. Based on the present study results, when reading is given to students in the computer room, students have a lot of opportunity for gloss consultation. This could be influential not only for comprehension but also for vocabulary recognition. It can be summed up that glosses enrich the vocabulary learning environment, resulting in stronger retention. In addition, hypertext glosses may positively change learning activity atmosphere to be more comfortable, and the glossing technique provides more guidance to readers so the positive results towards reading comprehension and retention. However, the incidental learning of vocabulary through reading may be slow as only a slight word gain was noticed. Even if learners are equipped with facilitative devices such as glosses, significant gains cannot be expected unless students are regularly exposed to the target words. Regarding the delayed vocabulary retention scores, they were in line with the immediate vocabulary recognition scores. The researcher predicts that the repeated exposure of reading activities could make a difference in vocabulary gains and it might aid students in establishing stronger connections between the glossed words and definitions.

Conclusion

Regarding the comparison between the L1 and L2 glossing, it can be concluded that the L1 gloss had significant effects on the reading comprehension and vocabulary retention of the Thai secondary school students. The positive roles of glossing can be claimed due to the fact that both comprehension test scores and retention test scores on the hypertext L1 gloss were significantly higher. It is recommended that any task that aims to provide students with opportunities to learn subconsciously/incidentally needs to be formed and created in a way that attracts students' attention. This will serve as a learning facilitator to influence L2 learners. Moreover, the results of the present study obviously demonstrated the benefits of the L1 gloss over the L2 gloss. At low proficiency levels, students can be supported more with L1-glossed reading texts, because L1 can provide scaffolding and decreases affective filters, and students can gradually make progress in language learning. Moreover, this is in line with the saying which is mentioned in literature review, "Glossing strengthens the bottom-up component of the reading process." (Jacobs, 1994, p. 115). Clearly, then, both the use of L1 and the bottom-up process should not be neglected in teaching and learning program where low-achieving students are present. In addition, one of the most useful and practical ideas is integration learning with the Internet. The Internet is today's reality, and students and teachers should use it because of the easy access to never-ending amounts of instructional materials. It is asserted that "technology-based annotated texts present us with new opportunities to assist our students in getting beyond the 'mechanical' aspects of the reading process and to provide them with a means of developing good reading strategies" (Martínez-Lage & Herren, 1998, p. 146-147). Such a view should be taken seriously because it is technology era

which students and teachers are living in, and technology will not be expired, never move back, but progress further both in foreign language learning and in our society.

Recommendations for Further Studies

Conducting study for longer periods by providing double reading amounts with learners at the same or earlier schooling ages is recommended since language learning is a long process. Finally, it is recommended that future studies use L1 written story retelling/recall techniques to collect the reading comprehension and vocabulary retention data as choices offer random guesses to the participants. In addition, the length of the story in the reading texts might have caused contamination in the data collection (e.g. different readability scores, power of contextual clues or boredom with reading). Further study should take these factors into consideration.

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