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Exploring the Effectiveness of Hypermedia Glosses for Second Language Reading

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The aim of the study is to investigate whether hypermedia glosses (i.e., text only, text plus audio, and text plus video clips) promote EFL learners' reading comprehension and examine learners' preferences for using hypermedia glossing modes when they are reading a hypermedia text. The participants were 77 intermediate-level EFL learners from a university in China. Data were collected through pre- and post- reading comprehension tests, a questionnaire, and interviews. The reading comprehension findings reveal that all three glossing modes significantly promote learners' comprehension of the text, but no significant differences were found among these three types. In addition, the questionnaire and interviews data indicate that learners hold positive attitudes towards glosses and hypermedia reading. They preferred text coupled with video glossing mode more than text only and text plus audio glosses. The pedagogical implications were provided.

Keywords: hypermedia glossing, L2 definition, video glossing mode, audio glossing mode, reading comprehension

Introduction

In English language teaching (ELT) field, people are increasingly showing great interest in combining language teaching with technology in creative ways to promote leaning. The development of computer-assisted language learning (CALL), which refers to "the search for and study of applications of the computer in language teaching and learning" (Levy, 1997, p. 1) is a good reflection of this trend. The recent advances and ongoing development in technology have made both language teachers and administrators view technology as not only a significant pedagogical technique, but also an effective means of learning (Khezrlou, 2019). Therefore, many efforts have been made to integrate technological advancement into curriculum and take advantage of technology to enhance learning (Karber, 2001).

With the advent of the computer and educational technology, computerized glossing is widely used by foreign language teachers and it is considered as an effective way to teach reading in a foreign language (Gettys, Imhof, & Kautz, 2001). Hypermedia glossing also arouses researchers' attention and increasingly become a hot topic. Several studies have analyzed the effectiveness of hypermedia glossing on learners' vocabulary learning, few have focused on the effects on learners' reading comprehension. And their effects on reading comprehension has been controversial (e.g., AbuSeileek, 2011; Chen & Yen, 2013). Some studies showed that the presentation of glosses significantly promoted reading comprehension (e.g.,

Ko, 2005; Lomicka, 1998), whereas other research revealed that no significant effect was found regarding the effects of glossing on text comprehension (e.g., Bowles, 2004; Cheng & Good, 2009). Even some studies concluded that the addition of the hypermedia glossing, such as video and audio, exerted a negative influence on learners' reading comprehension (e.g., Ariew & Ercetin, 2004; Sakar & Ercetin, 2005).

When it comes to multimedia learning, cognitive theory of multimedia learning (CTML) is frequently used to account for the benefits of multimodal learning environment. CTML, put forward by Mayer (2001), aims to give an explanation of how verbal and visual information was processed. The theory, drawing on some classic theories, such as dual coding theory and cognitive load theory, is based on three major assumptions. Firstly, the dual channels assumption states that there are two separate channels to process visual and verbal information (Paivio, 1996). Next, the limited capacity assumption illustrates that the capacity of each channel is limited (Baddeley, 1999; Sweller, Ayres & Kalyuga, 2001). Lastly, active processing assumption points out that meaningful learning takes place when people are positively involved in adequate cognitive processing, including selecting the relevant words, organizing them into verbal and visual channel and then integrating them with the prior knowledge (Mayer, 2009; Wittrock, 1989). Mayer presented empirical evidence to back up this theory and suggested that effective learning happens when information is presented both visually and verbally, such as presenting both pictures and words, instead of only in a single mode (Mayer, 2014). However, the evidence provided by Mayer is mainly collected from the studies, in which participants are mostly native speakers of English and there is relatively little research that has examined the efficacy of multimedia learning in second language or foreign language learning (Sakar & Ercetin, 2005). Therefore, the main purpose of the present study is to investigate which of the three glossing modes is more conducive to EFL learners' text comprehension.

Literature Review

Glosses and Multimedia Glosses

Nowadays, glossing is widely used as a good means to adapt the texts because it helps L2 learners to comprehend the text by understanding the difficult words (Bell & LeBlanc, 2000). Glosses, or annotations, are defined as the explanation to the unfamiliar words, either written in learners' native language or a simpler style in second language, in order to enhance learners' comprehension of the text (Lin & Huang, 2008). The main aim of using glosses is to bridge the gap between the insufficient understanding of the reading texts, so that learners can have a better understanding of the original materials. With the advances in computer technology, multimedia glosses are available to readers. Unlike traditional paper-and-pen annotations, multimedia glosses enjoy considerable benefits. Firstly, besides textual information, multimedia glosses can give multimodal information by adding images, video clips, sounds and so on (Abuseileek, 2011). Then, a combination of various glossing modes, such as textual plus video animations (Akbulut, 2007), textual plus background music and sound (Kaplan-Rakowski & Loranc-Paszylk, 2019) can be adopted in CALL reading environment.

Glosses can also be divided into different categories. For example, L1 versus L2 glosses (e.g., Jacobs, Dufon, & Hong, 1994; Ko, 2012), traditional paper-and-pen glosses versus computerized glosses (e.g., Bowles, 2004), textual versus hypermedia glosses (e.g. AI-Seghayer, 2001; Yanguas, 2009), topic-level and word-level glosses (e.g. Sakar & Ercetin, 2005), dynamic versus nondynamic glosses (Rassaei, 2020). In this paper, we adopted the category of textual and multimedia glosses.

Empirical Studies on Using Multimedia Glosses for Reading

A great many researchers examined the efficacy of glosses on learners' reading comprehension, but they concluded inconsistent results. Lomicka (1998) carried out research with a total of 12 French

students who were asked to think aloud while reading computerized texts. The participants were randomly assigned to one of the three conditions: "full glosses", "restricted glosses" and "without glossing". In restricted glosses, participants had access to words' definitions in French and English translation, whereas in full glossing condition, besides words' definitions and translation, learners had access to other forms, such as images, questions and pronunciation. The results showed that students who were exposed to full glossing had a deeper level of text comprehension than those presented by limited glossing. But it is worth noting that Lomicka's results need to be treated with caution due to the small number of participants involved. Likewise, Davis (1989) found that both the addition of words' definitions as glosses during reading and prior to reading were more effective than presenting without glosses.

Chun and Plass (1996) examined whether reading comprehension can be enhanced when students read materials with multimedia glosses for the unknown words. This study also aimed to investigate whether providing visual advance organizer led to better comprehension of the text. Three experiments with altogether 160 second-year German students were carried out. Students were shown a video preview first, then they were encouraged to use the multimedia annotations while reading a story online and lastly, they were asked to write a recall protocol. The findings showed that most of the idea units from the video advance organizer were contained in the recall protocols, indicating that L2 learner's reading comprehension was facilitated by visual advance organizer. In addition, students recalled more words that were glossed with visual and textual information than the words without being annotated, suggesting that vocabulary multimedia annotations promoted understanding of the text.

Ercetin (2003) explores which kinds of multimedia glosses that intermediate and advanced ESL students were in favor of when they read a hypermedia text. 84 ESL adult leaners took part in the study. Data were gathered by a tracking tool, reading comprehension tests, a questionnaire and interviews. A tracking tool was used to record the frequency with which participants had access to glosses and the length of time spent on them. The findings revealed that there were significant differences regarding the frequency that students accessed the glosses and in particular, intermediate students used the glosses more frequently than advanced counterparts. But no significant differences were shown concerning the time they spend on the glosses. The questionnaire and interviews data showed that both intermediate and advanced students had a strong preference for textual glosses and contextual video annotations.

Yanguas (2009) explored the effectiveness of three types of hypermedia glosses, namely textual only, pictorial only and combination of textual and pictorial, on learners' reading comprehension. The results indicated that all three groups who were exposed to annotations got higher scores on reading comprehension than those who did not have annotations, and to be more specific, the combination of text and picture glossing type was more beneficial for text comprehension than other glossing types.

However, some other research indicated that the provision of multimedia annotations did not aid learners to comprehend a written passage. Cheng and Gu (2009) aimed to investigate the efficacy of three different kinds of glosses on university students' reading comprehension, namely L1 glosses coupled with L2 sample sentences, L1 in text glosses and marginal glosses. 135 participants at four English proficiency levels took part in the study and they were required to complete reading comprehension tests. The results indicated that glosses did not have significant influence on leaners' reading comprehension regardless of their language proficiency. Similarly, Bowles (2004) also found there were no significant differences between the computerized glosses and traditional paper-and-pen glosses on learners' reading comprehension.

In Ariew and Ercetin (2004)'s study, 84 intermediate and advanced English learners participated in the study. The results revealed that for intermediate learners, the use of annotation negatively influenced their reading comprehension, whereas for advanced learners, no relationship was found between the annotation use and reading comprehension. Likewise, Sakar and Ercetin (2005) also aimed to investigate whether multimedia glosses promote intermedia-level English learners' reading comprehension, as well as explore their preference for multimedia annotations. The findings showed that although participants were more in favor of using video annotations than audio and textual glosses, there were negative correlations between

glosses use and comprehension of the text. Visual and audio annotations, such as pronunciations and video clips, negatively influenced students' reading comprehension.

Based on the above review of literature, the previous research has shown mixed and inconclusive results about whether hypermedia glossing enhances comprehension of the text and which glossing modes learners have a strong preference to adopt. There is a real need to further investigate the role of multimedia glossing presentation in learner's comprehension of the text. Thus, the present study aims to bridge the gap and will answer the following research questions:

1. Which glossing mode is more conducive to EFL learners' text comprehension?
2. What's learners' attitudes towards the provision of different glossing modes?

Method

Subjects

Three intact classes of 77 first-year undergraduate students participated in the study. They were all from the same major and most of the students were 18- to 20- year- old. All of them adopted the same textbook and had been taught by the same lecture. They shared similar English learning experience, with around 12 years of English learning. The participants were randomly assigned to three experimental groups: textual only glossing group, textual plus audio glossing and textual plus video glossing groups.

Target Words and Materials

A total of eight reading passages chosen from CET 4, which stands for College English Test Band4 were used. Each reading passage was about 350 words. The reading materials included a great variety of topics, such as Artificial Intelligence (AI), healthy lifestyle, urbanization, etc. Every reading passage was available online and glossed with different types of media, including text, video and audio by using HTML.

In order to examine the efficacy of the three glossing modes, it was important to identify some words that were unknown to the subjects. A pilot test was conducted and 10 randomly chosen learners with similar English language proficiency as the participants were encouraged to mark all the unfamiliar vocabulary in the texts. Based on the results of the pilot test, 8-10 target words were selected from each reading passage and there were 80 annotated words in total. All the glossed words were hyperlinked and were indicated in bold and blue color.

For textual only glossing mode group, when the participants clicked the hyperlinked words, one window popped up, showing the L2 definition of the unknown words. For the group with textual plus video glossing mode, besides the same materials as shown in the textual group, learners can also watch a short video clarifying the meaning of the unknown words. And for the group with audio glossing mode, they saw the definition of the words, as well as listened to the pronunciation of the words.

Instruments

Reading comprehension tasks

Learners' reading comprehension was assessed by multiple-choice pre- and post-reading comprehension tests. The pre- and post- reading comprehension tests were the same. One month prior to the actual study, the participants were asked to do the reading comprehension tests in order to minimize the carry-over effects. And in the process of actual study, after reading each text online, participants were asked to finish the reading comprehension test again. Each reading passage was followed by five

multiple- choice questions, which both test the global comprehension and the specific details of the text. The maximum score of the reading comprehension test was 40 and one point was awarded for each correct answer.

Questionnaire and interviews

After the experiment, the participants were required to fill in a questionnaire about their opinions of these three glossing modes. The questionnaire was designed to understand their experience with online reading and their attitudes towards the usefulness of the glosses. The usefulness of the glossing mode was measured on a scale of 1 to 5, with 1 refers to 'extremely useful' and 5 refers to 'not at all useful'.

One week after the study, 15 students attended the interviews, which were intended to gather supplementary data about learners' use of hypermedia glosses while reading computerized texts.

Procedures

The research lasted for one semester, approximately three months and contained two phases. In the first phase of the study, a pilot test was conducted and one month before the actual study, participants were asked to finish the reading comprehension test and then students were asked to read the materials online where three glossing modes were provided. Moreover, after reading each passage, they were given reading comprehension tests to complete.

The second phase of the data collection included questionnaire and interviews. After the actual implementation of the study, students were allowed to experience other glossing modes which were different from what they used in the actual research process. Then they completed the questionnaire about their attitudes towards the glossing modes and 15 students were chosen to conduct one-on-one interviews in order to have a deeper understating of their opinions.

Results

Results of Reading Comprehension Tests

The results of the pre- and post- reading comprehension tests are presented in Table 1. For pre-test, it can be seen that all these three glossing groups achieved relatively similar reading comprehension test scores (text only group, $M = 17.40$; text plus video group, $M = 17.35$; text plus audio group, $M = 17.31$). However, when it comes to post-test, the text plus video group ($M = 25.23$) outperformed the other two groups. In order to determine whether the differences were statistically significant, a 3 (Glossing mode) × 2 (Time: Pre-test and Post-test) mixed-design ANOVA was carried out. Results indicated only a significant main effect for time, $F(1, 74) = 147.124$, $p < .005$, $\eta^2 = .665$. There was no significant main effect for glossing modes and no significant interaction between Time ad glossing types. The results indicated that all these three annotation types facilitate participants' reading comprehension, but no significant differences were found among these three groups.

TABLE 1
Means and Standard Deviations for Reading Comprehension Pre-, Post-tests.

Glossing modes	Reading Comprehension					
	Pre-test			Post-test		
	N	*M*	*SD*	N	*M*	*SD*
Text only	25	17.40	4.08	25	23.60	4.10
Text + video	26	17.35	4.27	26	25.23	4.56
Text + audio	26	17.31	4.98	26	24.69	3.90

TABLE 2
Production Mixed-ANOVA for Glossing Mode and Time.

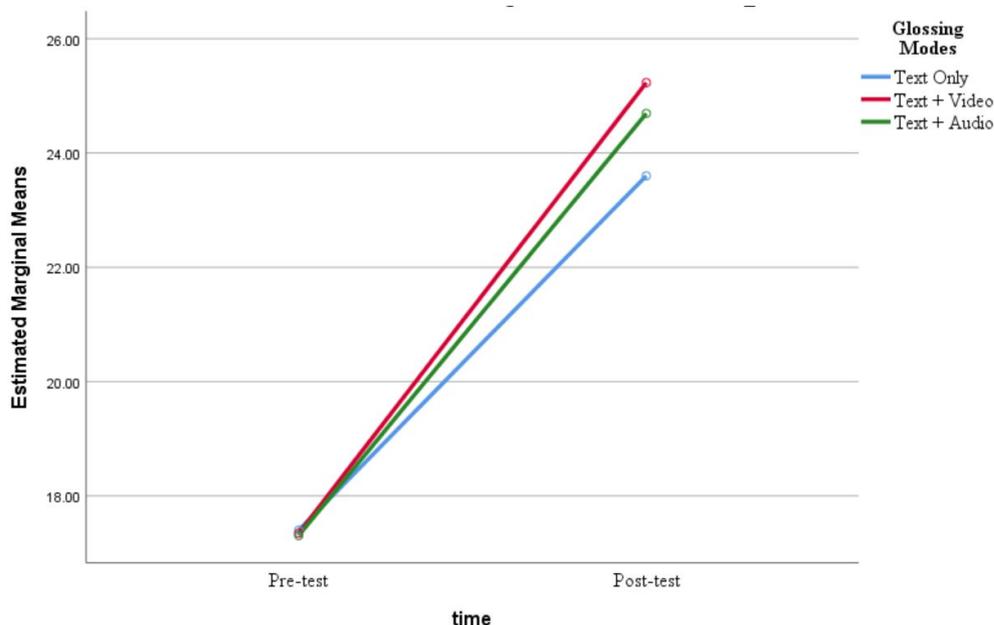| Source	df	SS	MS	F	p
Glossing Mode	2	16.178	8.089	.335	.717
Time	1	1971.073	1971.073	147.124	.000
Time× Glossing Mode	2	18.999	9.499	.709	.495

Figure 1. Estimated marginal means for reading comprehension part.

To sum up, the reading comprehension results showed that students who had access to glossing presentations, no matter text, video or audio, achieved significant higher scores in post-test than in the pre-test. However, the total differences among these three groups were not statistically significant.

Results of Questionnaire and Interviews

The subjects were given a questionnaire to complete and required to rate the usefulness of glosses for reading comprehension on a scale of 1-5 (1 = extremely useful, 5 = not at all useful). The results of the questionnaire are illustrated in Table 3.

TABLE 3
Results of the Questionnaire

Glossing mode	Extremely useful (%)	Very useful (%)	Useful (%)	Simply useful (%)	Not at all useful (%)
Text only	12.5	30	29.5	28	0
Text +audio	6	34	28	22	10
Text+ video	60	20	12	8	0

As Table 3 shows, there appeared to be a consensus on the usefulness of text plus video glossing mode since the majority of the participants (80%) considered it as 'very useful' or 'extremely useful'. and none of the participants viewed text plus video glossing as 'not at all useful'. When it comes to text only glossing mode, 42.5% of the participants regarded the text only glosses 'extremely useful' or 'very useful'. But regarding text plus audio glosses, there does not seem to be consensus because 10% participants rated it as 'not at all useful'.

Most of the participants who had interviews also expressed a strong preference for the glossing mode that gave them access to video animations. One student in favor of video glosses maintained that this mode was more vivid and interesting, and it was easier for her to clarify the meaning of the words, thereby helping her better understand the main ideas of the text. Another student also emphasized that he saw this mode as a more useful way to comprehend the text because of the authentic materials that it provides.

With regard to the usefulness of text glosses, which provided L2 definition of the unknown words, the interviewees mentioned that it was convenient and easy for them to know the words' meaning by this way, without slowing the reading pace. One student said "Using the text glosses is a new way for me, because when I met unknown words before, I sometimes skipped the words or just guessed it from the context. But sometimes my guessing was wrong. But with the help of hypermedia textual glosses, I can easily get the meaning of the unknown words".

A relatively smaller number of learners viewed the provision of audio glossing mode useless. As stated by one student, "Since my English skills were not very good enough, especially for my listening skills, the function of providing audio glossing was limited and it did not help me understand the text better".

To sum up, from the questionnaire and interview data, participants were in favor of using text plus video glosses and text glosses. And most of the participants showed a strong preference for video annotations.

Discussion

Research Question 1: *Which of the glossing mode (i.e., textual, video and audio) is more conducive to text comprehension?*

With regard to research question one, the results of the present study revealed that all three kinds of hypermedia gloss presentations greatly facilitate EFL learners' comprehension of the text. The results are in consistent with previous studies, showing that the provision of hypermedia glossing modes is effective to learners' text comprehension (e.g., Davis, 1989; Lomicka, 1998; Yanguas, 2009). Akbulut (2007) stated that the provision of glosses facilitated learner's reading comprehension due to the advantages that glosses provided. The use of glosses does not interrupt reading process and made the reading process smother and easier (Ko, 2005). In multimedia leaning environments, the presentation of annotations also facilitates the interaction between the learner and the reading materials, which promotes individualized and autonomous learning. Hence it enables students to have autonomy over their own reading process, learn at their own pace, as well as take advantage of the multimedia glosses, thereby promoting reading comprehension.

However, there were no significant differences among three groups on reading comprehension. One reason is that reading is a complex process, which "involves the smooth interaction between top-down processing (understanding schema, propositions) and bottom-up processing (recognizing or understanding individual vocabulary) and neither alone is sufficient" (Chun & Plass, 1996). So as to facilitate reading comprehension, not only bottom-up processing is important, but also top-down processing is crucial. Bottom-up processing can be enhanced by vocabulary-level glosses and top-down processing, including using background information is also needed. Lysenko and Abrami (2014) further stated that the improvement of comprehension skills contains but is not merely constrained to word recognition, other sources, including syntactic complexity, semantic information have been also considered important for reading comprehension. So in order to facilitate learners' reading comprehension, learners should also master some reading strategies, such as finding the main points of each passage, making a summary of a text, posing questions based on the text and finding some clues addressing those questions and making inferences from the text and so forth (Hock & Mellard, 2005).

Secondly, Ercetin (2003) also mentioned that reading hypermedia texts is unlike reading traditional paper-based materials because hypermedia creates "flexible information environments". So reading in

CALL environments is likely to present some challenges to readers and good understanding of the text in a multimedia environment is more than the effective combination of top-down and bottom-up skills. Other skills that allow learners to manage the new environment are also needed, such as the skills to interpret visual information (e.g., videos, pictures, tables) and audio information (Lemke, 1998), the skills to decide when to read the annotations (Venezky, 1994), the skills to distinguish the relationships between text and videos (Bolter, 1998; Hedley, Hedley, & Baratta, 1994) and the skills to navigate through complicated and constantly changing reading environment (Leu, 1999).

Research Question 2: *What's learners' attitudes towards the provision of the different glossing modes?*

Regarding research question two, the questionnaire and interview data revealed that participants were much more in favor of using text plus video glosses than text only and text plus audio glosses. This finding is consistent with findings in several studies that have found that no matter advanced or intermediate leaners expressed a marked preference for video glosses (AI-Seghayer, 2001; Ercetin, 2003). Learners agreed that glosses saved their time and made the reading process easier and smoother. The addition of video animations to the text is beneficial for text comprehension, because video animations can build a mental image, arouse great curiosity that leads to intense concentration, as well as combine a great variety of modalities, including vivid pictures, sounds and text (AI-Seghayer, 2001). A great many subjects also hold strong opinions that the provision of video annotations made the reading process interesting and motivated them to read the text.

Conclusion and Limitation

The study compared the effects of three glossing modes on learners' reading comprehension. All the groups exposed to glossing modes demonstrated significant gains in the comprehension of the texts. But the results are not clear-cut and no significant difference was found among these three glossing modes.

The study provides pedagogical implications both for EFL teachers and curriculum designers. Firstly, the provision of video glossing mode not only allows learners to completely understand the meaning of the unknown words, but it also makes reading more enjoyable for EFL learners and may lead to the desire to use it in their future learning practice. So for both software designers and English language teachers, they should take learners' enjoyment into consideration and when they design learning materials, some video glossing modes can be added to make students enjoy the reading process. Secondly, this study concluded that multimedia glosses facilitated learners' reading comprehension and students found hypermedia useful for their reading comprehension. However, since reading itself is a complicated task and reading in the hypermedia environments is more challenging, L2 learners need to be trained in some reading skills, such as deciding when to use multimedia glossing modes, interpreting textual, visual and verbal information, making connections between the provided information (Ercetin, 2003). And it is also of great significance to teach students some useful reading strategies, including making a summary, drawing inferences, questioning. So it is quite important to make L2 learners familiar with multimedia experience as well as train them in some relevant reading skills and reading strategies.

Some limitations should be recognized in this study. First, in the present study, only multiple-choice questions were used to assess reading comprehension, so the results may differ if other assessments are used, such as written recall test. So future studies are encouraged to include more assessment methods. Second, the textual glosses were provided in L2 only, so different findings may be produced if the glosses contain unknown words' definitions in L1. Moreover, other factors, including individual differences in language proficiency, learning styles or strategies, prior knowledge, may be also linked to learners' glossing use and reading comprehension, so it is suggested that future practice can take these factors into consideration.

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