A COMPARISON OF THE EFFECT OF TEXTUAL, AUDIO AND TEXTUAL-PICTORIAL AND AUDIO–PICTORIAL ANNOTATIONS ON ENHANCING READING COMPREHENSION AMONG IRANIAN EFL LEARNERS

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Abstract

This study aimed to investigate the interaction between L2 readers and the reading text equipped with four different annotations or glosses including text-only, audio-only, text-picture and audio-picture annotations. The participants in the study were selected from four intact classes consisting of 100 students studying English at intermediate level in Kish Institute of Science & technology (*olom va fonon*), in Iran. After they were given a reading comprehension text, the four experimental groups were given the same reading comprehension texts with different annotations. Then, they were asked to take the same reading test as posttest.

The results of the study demonstrated that text-only and audio-only were more effective than other kinds of annotation. The results suggested that providing the new words whether in audio or text annotation during reading comprehension can help students to comprehend reading in an effective way. Educational implications suggest that provision of different kinds of glosses is beneficial for L2 students although they need some scaffolding for utilizing glosses in a beneficial way.

Key words: textual annotation; audio annotation; textual-pictorial annotation; audio-pictorial annotation; reading comprehension

1. Introduction

One of the most inspiring questions posed in the field of foreign language (L2) teaching by Alderson (1984) was whether the obstacle that readers encountered when reading in L2 was a reading problem or a language problem. Consequently, many studies have explored the extent to which first language (L1) reading proficiency and L2 linguistic competence affect L2 reading comprehension. The results suggest that both factors influence L2 text comprehension (Taillefer & Pugh, 1998). In addition, empirical studies reveal that reading skills are

transferable, interdependent, and universal across languages (Goodman, 2003; Tang, 1997). In other words, what readers master when reading in their LI can be transferred to their L2 reading (Cummins, 1991). However, this transfer happens under one condition: readers' L2 linguistic knowledge has to reach a certain threshold. Otherwise, their limited control over their L2 will interfere with the transfer of L1 reading skills (Clarke, 1980).

Researchers have identified vocabulary knowledge as one of the significant features of the required threshold for L2 linguistic abilities (Brisbois, 1995). This seems to be true with both adult (Koda, 1993; Ulijn & Strother, 1990) and younger learners (Schoonen, Hulstijn, & Bossers, 1998). The question is, thus, "What is the level of this vocabulary threshold?" Laufer (1989) found that if the lexical coverage of academic prose was 95% or above, the likelihood for L2 readers to comprehend the text was significantly high. Other studies revealed that for unassisted reading for pleasure, L2 readers needed to know about 98% of the running words in the text (Groot, 2000; Nation, 2001). In sum, the threshold of L2 vocabulary knowledge that allows L2 readers to be able to comprehend authentic materials successfully is between 95-98% depending on the types of texts.

Such high demand for vocabulary knowledge causes a critical problem for L2 readers. The way L2 readers acquire words is different from that of native speakers. LI readers acquire words incidentally in their natural environment.

Researchers have been encouraging the use of authentic texts to teach L2. Krashen (1992) contends that extensive exposure to authentic materials increases vocabulary development as well as reading comprehension among L2 readers. However, authentic materials are written to convey information, not to illustrate the meanings of unknown words. Hence, they contain many low-frequency words unfamiliar to L2 readers. Contextual inference of unknown words is not helpful either since it is possible only when the context is well comprehended, and often context is not very rich. Therefore, the Matthew effect (Stanovich, 1986) occurs; that is, only learners who have reached the threshold of vocabulary knowledge benefit from the extensive exposure to authentic materials.

What happens to readers whose L2 linguistic competence has not reached the required threshold? Various methods are used to help ease this lexical burden for L2 learners while encountering authentic L2 reading materials. One of the most widely used tools is the dictionary. However, dictionary use can be distracting and often learners spend more time reading texts using dictionaries than reading texts without them. In addition, a study by Luppescu and Day (1993) revealed that dictionaries seemed to have a confusing effect on

readers in many cases. When more than one meaning was provided, some L2 readers were unable to select the right meaning of the word.

Apparently, L2 readers need special training in dictionary skills (Nation, 2001). The other two options to help L2 readers overcome the high demand of vocabulary knowledge so that they can read authentic texts successfully are to syntactically simplify the texts and to provide glosses – meanings of words – in the margins of the texts. A study by Ulijn and Strother (1990), however, disclosed that syntactic simplification had no effect on reading comprehension. Furthermore, changing the structure of the texts makes them inauthentic and probably less coherent, which can affect L2 readers' text understanding.

Therefore, the second option - the provision of vocabulary glosses - seems to be a better choice because it does not affect textual structure and so maintains the authenticity of the texts. Unlike dictionaries, glossing provides accurate targeted meanings of unknown words that may be difficult or impossible to guess from the context, so authentic texts can be used. According to Nation (2001), glossing allows L2 readers to follow the text with very little interruption. Moreover, it increases L2 learners' independence since they do not have to rely on teachers to provide meanings for unknown words (Stewart & Cross, 1991).

Despite the wide use of marginal glosses in L2 texts and the high acceptance of glosses among L2 teachers and L2 learners, empirical studies yield conflicting results regarding the effects of glossing in printed texts on L2 vocabulary recall (Hulstijn, Hollander, & Greidanus, 1996; Ko, 1995) and on L2 reading recall (Luo, 1993; Roby, 1991).

The current generation of computer technology amplifies this line of research. The use of multimedia technology such as audio, image, video, and animation in the design of glossing expands the provision of vocabulary meanings that match individual learning preferences. Nevertheless, empirical research regarding the effects of hypermedia glossing on vocabulary acquisition and reading comprehension, especially with L2 readers, is still at the beginning stage (Kamil & Lane, 1998). Similarly to the research about glosses in printed texts, the studies about the provision of glosses in hypermedia environments yield inconclusive results (Chun & Plass, 1996; Laufer & Hill, 2000). Moreover, there was little evidence regarding whether or not readers use glosses or how readers actually use them to enhance their reading comprehension despite the overwhelming preferences of users. The inconclusive results in empirical studies and the availability of hypertext and multimedia technology point to the need for more research on the utilization of glosses in L2 reading. The current study was an attempt to pursue this line of research.

On the other hand, second language (L2) learners at all levels are faced with the difficulty of learning vocabulary. For example, Nation (2000) suggests that a native speaker of English knows about 20,000 word families. This poses a challenging task for English as a Second Language (ESL) learners. However, vocabulary learning has long been neglected within the field of Second Language Acquisition (SLA).

Recent years have seen increased interest in L2 vocabulary research. One influential debate over the years is between incidental and intentional vocabulary learning. The distinction between the two learning conditions has been attributed to learning task, learner attention and the pedagogical context of the learning process (Read, 2004). Both approaches have been argued to contribute to the incremental learning of L2 vocabulary (Hulstijn, 2001).

L2 research has argued in favour of incidental vocabulary learning through reading (Nation, 2001). As Jacobs et al. (1994) states, this conforms to L2 learners' reports that vocabulary learning happens, in most cases, accidentally during reading or listening. However, L2 incidental vocabulary learning tends to be incremental and slow.

Annotation or gloss has been used as a standard feature in L2 reading materials to facilitate comprehension in which L2 vocabulary learning comes about as a by-product (Jacobs, Dufon & Fong, 1994). As an instructional intervention, an annotation draws learner attention briefly away from reading, and focuses it temporarily on the form and meaning of the annotated word, thus enhancing vocabulary learning and overall reading comprehension. This echoes the interactionist view of SLA (Long, 1996) and the depth of processing hypothesis.

The effects of text annotation on L2 vocabulary learning and reading comprehension have been examined by studies which produced mixed findings (Watanabe, 1997). According to Al-Seghayer (2001), different from the traditional marginal annotation, multimedia annotations can present vocabulary information in multiple modalities, such as audio (sound) and visual (text, picture and video).

Studies have examined the effects of different types of annotations on incidental L2 vocabulary learning, in particular, the use of picture annotation and video annotation coupled with text annotation (Al-Seghayer, 2001). These studies support dual-coding theory (Paivio, 1990) and confirm the cognitive theory of multimedia learning (Mayer, 2001) that maintains how meaningful learning engages learners in both verbal and visual cognitive processing systems. According to Yoshii (2000), dual annotation of text and picture or text and video are unanimously argued to be better than single annotations in facilitating incidental L2 vocabulary learning.

Studies in audio annotation have mainly engaged the use of pronunciation of the target words, and their findings are inconsistent (Yeh & Wang, 2003). Audio is a different sensory modality from visual modality, such as printed text and pictures, because audio is processed by the auditory working memory while printed texts and picture are processed by the visual working memory; thus it should be treated separately as to its effect on learning. Studies of audio annotation should include not only the pronunciation, but also the definition or meaning of the target words.

Furthermore, research suggests that the addition of an audio element to dual annotations does not seem to have a definite effect on L2 vocabulary learning (Yeh & Wang, 2003). One possible explanation is that the information delivered simultaneously through different modalities (audio, verbal).

Previous studies examined the effects of annotations on L2 vocabulary learning and reading comprehension. These studies have supported the effectiveness of annotations in facilitating L2 vocabulary learning. However, no study in second language acquisition has examined audio annotation in combination with text as a dual multimedia annotation type. To bridge this gap, the present study focused on this issue by comparing four types of annotation including audio-only, text-only, audio-picture, and text-picture annotation in their effects on L2 reading comprehension in Iranian EFL context.

2. Review of related literature

2.1. Picture annotation

Visual aids have long been assumed to be beneficial in second language learning. Tuttle (1975) argued that “foreign language students can benefit from many types of visual material… the still or flat picture can prove to be a rich resource in the foreign language classroom” (p. 9). The use of imagery representation of foreign words by actual objects was also claimed by Kellogg and Howe (1971) to be facilitative to children’s vocabulary acquisition in a foreign language.

Subsequently, a number of researchers have explored the effect of visual stimuli on L2 vocabulary learning and reading comprehension. Kellogg and Howe’s (1971) study compared written words and pictures as cues for oral acquisition of Spanish vocabulary by children. The pictures yielded faster learning of new words than the written stimuli and the effect was retained for longer as indicated by greater recall of words shown in pictures. Terrel (1986, cited in Kost et al., 1999) proposed that combining the form and visual representation of unknown

L2 vocabulary helped learners to acquire concrete ideas and references. In reviewing the techniques used in learning L2 vocabulary, Oxford and Crookall (1990) acknowledged the effectiveness of visual imagery and maintained that "[M]ost learners are capable of associating new information to concepts in memory by means of meaningful visual images, and that visual images make learning more efficient" (p. 17) and "the pictorial-verbal combination involves many parts of the brain, thus providing greater cognitive power" (p. 17).

In annotation studies, picture annotation has been used to clarify the meaning of those unknown words second language learners encounter in reading. According to dual coding theory, the way learners comprehend pictures differs greatly from that of comprehending textual information (Paivio, 1971). In other words, text is processed by the verbal cognitive subsystem, while a picture is processed by the non-verbal cognitive subsystem. Research has compared L2 vocabulary learning from text annotation, picture annotation, and a combination of text and picture annotation

2.2. Audio annotation

It is worth noting that little research has been done in audio annotation. Audio annotation gives pronunciation, sample sentence, definition or meaning of a target word in spoken form. It has never been studied separately from other annotation modes, but mostly as an additive component. The only format in which audio annotation has been studied is the pronunciation of target words. Findings on audio annotation are rather mixed and uncertain. On the one hand, Svenconis and Kerst (1995) suggested that the use of audio could significantly improve vocabulary learning, especially when coupled with a second technique such as semantic mapping. On the other hand, Chun and Plass (1996a, as cited in Yeh & Wang, 2003) challenged the effect of audio annotation. In addition, it seems that the addition of an audio component to other annotations is not effective (Yeh & Wang, 2003); instead it distracts learners' attention.

Chun and Plass (1996a) challenged the positive effect of audio annotation. In their study, an audio component was added to three different annotations types (text, text-picture, and text-video); that is, a German native speaker pronounced each target word. Of the three successive studies, participants from study 1 and 2 were asked to report their use of retrieval cues for vocabulary learning. Among the reported cues of text, picture, video and sound, sound was used the least as a retrieval cue, as shown by the percentage of correct answers on vocabulary test, 2.2% and 4.3% for sound cue in the immediate and delayed post-tests for study 1, and 0.6% in the immediate post-test for study 2. The authors suggested that the audio

component was not useful in learning vocabulary since it showed very limited importance as a retrieval cue.

In comparison to the use of word pronunciation in the above two studies, Yeh and Wang (2003) investigated the audio annotation in which a native speaker read the word, spelled the word and read the sentence that embedded the word. Three types of vocabulary annotation were examined: text annotation, text-picture annotation, and textpicture-audio annotation. Analysis of the participants' (82 Chinese EFL learners) performance on the posttests indicated that the text-picture annotation was the most effective for vocabulary learning, and the text-picture-audio annotation was the least effective.

Yeh and Wang (2003) offered three possible reasons for the relative ineffectiveness of text-picture-audio annotation. The first reason was L1 processing mechanism transfer – as claimed by Chen (1998, cited in Yeh & Wang, 2003), Chinese EFL learners used more visual strategies than English native speakers and were therefore less skillful in using the provided audio information. This was confirmed by high preference of visual learning style over low auditory learning style by the participants in the questionnaire data. Thus, Chinese students did not effectively process the information provided by the audio annotation. The second reason resided in the fast speech rate of the audio annotation. Coupled with the visual learning style of Chinese students, the fast speech rate distracted the participants and exceeded their listening proficiency. Finally, the combination of text, picture and audio failed to give participants enough time to process the available information.

2.3. Textual or pictorial glosses

Kost, Foss, and Lenzini (1999) conducted a study with English-speaking college students studying German (L2). The participants were divided into three groups reading a text in three different types of glosses: textual, pictorial, and both textual and pictorial. In a two-week delayed test, participants in the textual group and the pictorial group had a greater vocabulary loss than those in the combination group. However, participants in the combination group outperformed those in the textual group only in the picture recognition test, and they outperformed those in the pictorial group only in the word recognition test. The researchers concluded that accessing information triggered by pictures was more effective over time than retrieving information triggered solely by words.

In another study, Karbalaei, Sattari and Nezami (2016) compared the effect of text-picture and audio-picture multimedia annotations in second language vocabulary recall among

Iranian EFL learners. The results demonstrated that audio-picture annotation is more effective than text-picture annotation in facilitating immediate L2 vocabulary recall.

In addition, Huang (2014) studied the effects of multimedia annotation through the discourse scheme and summary writing through the grounding theory (Chang, 1997) on text comprehension. The results indicated that both multimedia annotation and summary writing had significant positive effects on learners' reading performance.

In summary, studies regarding glossing in printed texts lead to the following conclusions. With respect to L2 vocabulary learning, glossing leads to better performance than no-gloss condition (Hulstijn et al., 1996; Jacobs et al., 1994; Rashkovsky, 1999). Moreover, L2 readers' word retention lasts at least one to two weeks (Ko, 1995; Kost et al., 1999; Watanabe, 1997). In regard to L2 text comprehension, research suggests that glossing has a more positive effect on text recall than no-gloss condition (Davis, 1989; Jacobs, 1994; Leffa, 1992; Rashkovsky, 1999).

Regarding the effects of different types of glosses, there is a tendency that the given-meaning gloss has a more positive effect than the inferred-meaning gloss on both L2 vocabulary learning and L2 text comprehension (Mondria, 1996, cited in Groot, 2000; Watanabe, 1997). In addition, the combination of textual and pictorial glosses tends to have a better effect on L2 vocabulary learning than either textual or pictorial gloss only (Kost et al., 1999). Furthermore, the difference between the effects of using L1 glosses and the use of L2 glosses on L2 vocabulary learning was not conclusive (Jacobs et al., 1994; Ko, 1995). As for text comprehension, both the effects of L1 and L2 glosses on L2 readers' text recall were not significantly different. These results, however, were based mainly on recall and recognition tests and other types of measurements may yield different results.

3. The study

3.1. Research questions

The present study aimed to evaluate how textual and audio glosses affect reading comprehension, and whether textual-pictorial glosses and audio-pictorial glosses can play a significant role in enhancing reading comprehension. Finally, it sought to discover the effect of textual, pictorial, textual-pictorial, audio-pictorial glosses on L2 reading comprehension.

Based on the objectives of the study, the following questions were raised for further investigation:

1. Do textual glosses play any role in enhancing reading comprehension among Iranian EFL learners?
2. Do audio glosses play any role in enhancing reading comprehension among Iranian EFL learners?
3. Can textual-pictorial glosses enhance reading comprehension among Iranian EFL learners?
4. Can audio-pictorial glosses enhance reading comprehension among Iranian EFL learners?
5. Is there any significant difference among the effect of textual, audio, textual-pictorial, audio-pictorial glosses on L2 reading comprehension among Iranian EFL learners?

3.2. Participants

The participants in the study were selected from four classes including 100 students studying English in Institute of Science & Technology (Kish, Iran). Participants had a mean age of 24 and were at intermediate level as determined on the basis of their scores on the PET proficiency test. Those participants placed between one standard deviation above and below the mean were regarded as the main participants. Finally, 77 students were selected for the main procedure and data analysis based on the research question. Then they were randomly assigned into four experimental groups including the text-only group, the audio-only group, the text-picture annotation group, the audio-picture annotation group and the control group. Some of the students were excluded because of their absence during the implementation of one of the tests. Finally, 63 students were placed in the respective experimental groups and 14 in the control group.

3.3. Instruments of the study

General English Proficiency Test: The PET proficiency test was utilized as the instrument for assessing the participants' level of proficiency in English. This test comprised 30 multiple-choice of vocabulary, grammar, and reading comprehension items. The researcher piloted the test with 24 students of the same level and similar characteristics to those of the participants of this study. It should be mentioned that the reliability of PET proficiency test estimated by KR-21 (Kuder-Richardson) formula turned out to be .71, which is sufficient reliability.

Reading Material and Target Words: The reading text, "European Settlers of Australia," was selected based on three criteria including text length, syntactic complexity, and content. In terms of length, the text has 449 words (including the title). ESL students at the intermediate

level are comfortable with reading texts of this length and syntactic complexity. It consists of short, uncomplicated sentences and simple past tense is used throughout the text. There is an average of 6.8 sentences in each paragraph, and an average sentence contains 10.8 words. The percentage of simple sentences in the text is over 80%. With regard to the content, it seems reasonable to assume that EFL students knew more or less the same amount of general information about the European colonization of Australia and have comparable background knowledge of the reading text (i.e., since none has been to Australia and its history is foreign to all participants). The content of the text does not require any specific culturally-related knowledge.

The text selected for reading tells of the story of the European colonists in Australia in the 1800s. The text was given to experienced EFL instructors who teach intermediate reading/writing classes and was confirmed to be appropriate for intermediate EFL students. The 20 target words were all nouns. They were selected for frequency. Based on the word frequency corpora of Francis and Kucera (1982), the 20 target words have a mean of 12.7 per million words.

The reading text was modified into four different forms: a text-only annotation, an audio-only annotation, a text with text-picture annotations, and a text with audio-picture annotations. The 20 target words were highlighted in the selected texts.

Multiple-choice Reading Comprehension Test (RC): The reading comprehension text was comprised of 10 multiple-choice questions. For each question, the participant was asked to choose the best answers out of the four given options. The questions and choices were given to experienced EFL instructors for validation. The questions were confirmed to be easy to understand and reflective of main idea of the reading text.

Word Recognition Test (WRT): A correct choice received the score of 1 and an incorrect choice received the score of 0. The possible maximum score was 20 points (1 point x 20 words).

All the instruments can be found in Appendices.

3.4. Procedure

The reading passages used for the purpose of this study were designed by the researcher to help intermediate EFL students with vocabulary learning in order to comprehend reading better. The passages used in this study provided students with annotations for unknown words via four different modes including a text-only annotation, an audio-only annotation, a text with text-picture annotations, and a text with audio-picture annotations. The annotations were used to assist the learning of unknown words and understanding of the reading text.

In the reading passages provided for the four experimental groups, four different versions were used for the reading text. In the text-only group, the students were just provided with the definition of the unknown words in the margin as text-only annotation. Regarding the audio-only group, the students were provided with the audio file that described the unknown words during reading comprehension. In the text-picture group, a textual definition of the words together with a picture that describes the word was used. In the audio-picture annotation group, the students could see a picture that depicts the meaning of the word and hear an audio clip that explains the meaning of the word.

The study was conducted during the participants' regular class times, and required two consecutive 50-minute sessions. After selecting the main participants, the four classes were considered as the experimental group and one class was regarded as the control group. Then, all students in all groups were asked to answer the reading comprehension test as pretest. Afterwards, in the reading passages provided for four experimental groups, four different versions were used for the reading text. In the text-only group, the students were just provided with the definition of the unknown words in the margin as text-only annotation. Regarding the audio-only group, the students were provided with the audio file that described the unknown words during reading comprehension. In the text-picture group, a textual definition of the words together with a picture that describes the word was used. In the audio-picture annotation group, the students could see a picture which depicts the meaning of the word and hear an audio clip which explains the meaning of the word.

3.5. Results and findings

Research question 1: Do textual glosses play any role in enhancing reading comprehension among Iranian EFL learners?

Table 1. Mean gain scores for vocabulary knowledge among samples in textual gloss and control group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain score	Textual	16	2.31	.793	.198
	Control	14	.86	1.231	.329

As it is evident from Table 2, there is a significant difference between gain score in textual group and control group in Iranian EFL context (t=-3.788; P= .001). In other words, as shown in Table 1, the participants scored higher (M=2.31, SD=.793) when they were exposed

to textual glosses during their reading than when they were not exposed to any kind of gloss (M=.86, SD= 1.231).

Table 2. Independent sample test for gain score in vocabulary knowledge for samples in textual and control group

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Gain total	Equal variances assumed	3.897	28	.001	1.455	.373	.690	2.220
	Equal variances not assumed	3.788	21.676	.001	1.455	.384	.658	2.253

Research question 2: Do audio glosses play any role in enhancing reading comprehension among Iranian EFL learners?

Table 3. Mean gain scores for vocabulary knowledge among samples in audio gloss and control group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain score	Audio	15	3.60	.910	.235
	Control	14	.86	1.231	.329

As it can be observed from Table 4, a significant difference was reported between gain score in audio group and control group in Iranian EFL context (t=2.884; P= .007). Based on the results in Table 3, the participants scored higher (M=3.60, SD=.910) when they were exposed to audio glosses during their reading than when they were not exposed to any kind of gloss in the control group (M=.86, SD= 1.231). In other words, audio glosses could play a significant role in learning new vocabulary while reading the text.

Table 4. Independent sample test for gain score in vocabulary knowledge for samples in audio gloss and control group

		t-test for Equality of Means						
		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Gain total	Equal variances assumed	2.884	29	.007	1.202	.417	.349	2.054

	Equal variances not assumed	2.849	26.267	.008	1.202	.422	.335	2.068

Research question 3: Can textual-pictorial glosses enhance reading comprehension among Iranian EFL learners?

Table 5. Mean gain scores for vocabulary knowledge among samples in textual-pictorial gloss and control group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain total	Textual-pictorial	17	2.06	1.088	.264
	Control	14	.86	1.231	.329

As shown in Table 5, the students learned new words better when they were exposed to textual-picture annotation (experimental group) than the time they were not exposed to (Control group) (Mean=2.06 and .86, respectively). As evidenced in Table 6, the "t" value of 2.849 was found to be significant at .001 level. In other words, textual-pictorial glosses could play a significant role on increasing adult EFL learners' vocabulary knowledge.

Table 6. Independent sample test for gain score in vocabulary knowledge for samples in audio gloss and control group

		t-test for Equality of Means						
		t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Gain total	Equal variances assumed	2.884	29	.007	1.202	.417	.349	2.054
	Equal variances not assumed	2.849	26.267	.008	1.202	.422	.335	2.068

Research question 4: Can audio-pictorial glosses enhance reading comprehension among Iranian EFL learners?

Table 7. Mean gain scores for vocabulary knowledge among samples in audio-pictorial gloss and control group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain total	Audio-picture	15	2.07	1.163	.300
	Control	14	.86	1.231	.329

Based on the results in Table 7, we can say that the students learned new words better when they were exposed to audio-picture glosses (experimental group) than when they were not exposed to them (Control group) (Mean=2.07 and .86, respectively). Thus, there is a significant difference between gain score in the audio pictorial group when they were exposed to audio-picture glosses during reading and the group who did not receive any kind of gloss (t=-2.715; P= .012) (Table 8). In other words, audio-pictorial glosses could play a significant role in increasing adult EFL learners' vocabulary knowledge.

Table 8. Independent sample test for gain score in vocabulary knowledge for samples in audio-pictorial gloss and control group

		t-test for Equality of Means						
		T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Gain total	Equal variances assumed	2.720	27	.011	1.210	.445	.297	2.122
	Equal variances not assumed	2.715	26.561	.012	1.210	.446	.295	2.124

Research question 5: Is there any significant difference among the effect of textual, audio, textual-pictorial, audio-pictorial glosses on L2 reading comprehension among Iranian EFL learners?

In order to answer the fifth question, the vocabulary gain score of textual, audio, textual-pictorial, audio-pictorial gloss group and control group were computed and then ANOVA was used to see whether there was any significant difference among the four groups in gain score. The results of data analysis (ANOVA) in Table 9 indicate that there is a statistically significant difference between textual, audio, textual-pictorial, audio-pictorial glosses and control group in the results of gain score because the obtained F value of 12.695, was found to be significant at .001 level (P=.000). In other words, the fifth null hypothesis (There is no significant difference among the effect of textual, audio, textual-pictorial, audio-pictorial glosses on L2 reading comprehension among Iranian EFL learners) is rejected.

Table 9. Results of ANOVA for mean posttest scores of samples in textual, audio, textual-pictorial, audio-pictorial gloss and control group

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	55.452	4	13.863	12.695	.000

Within Groups	78.626	72	1.092		
Total	134.078	76			

Now, in order to see where the difference stands, the post-hoc Scheffe test (Table 10) showed that the audio-only group performed significantly better than the textual group (Mean=3.60 vs. Mean=2.31) and the textual group outperformed the other groups. In conclusion, the audio group was the best group in terms of performance based on gain score. As a result, audio-only annotation was recognized to be the most effective method for learning new words during reading comprehension.

Table 10. Post hoc Scheffe Test

Group	N	Subset for alpha = .05		
		1	2	3
Control	14	.86		
Text picture	17		2.06	
Audio picture	15		2.07	
Text	16		2.31	
Audio	15			3.60
Sig.		1.000	.978	1.000

4. Discussion

The results indicated that text-only gloss, audio-only, text-picture, and audio-picture gloss or annotation could help second language learners improve their reading comprehension. Regarding the difference between the effect of four types of gloss, the audio-only group performed significantly better than the textual group and the textual group outperformed the other groups. As a result, audio-only annotation was recognized to be the best method for learning new words during reading comprehension text.

The results of this study could support the modality effect of the cognitive theory of multimedia learning (Mayer, 2001). Text annotation and audio annotation are both verbally-presented information; thus both kinds of annotation contain a combination of verbal and non-verbal information. Based on the modality principle (Baddeley, 1999; Mayer, 2001), text annotation and picture annotation will be processed by the visual channel, while audio annotation will be processed by the auditory channel. Therefore, in text-picture annotations, the simultaneous register of both text and picture caused the visual channel to be overloaded. This led to information processing that was, at least initially, carried out solely in the visual working memory. Thus, the cognitive resources available in the visual working memory had to be divided between textual and pictorial information, whereas the auditory (phonological) working memory was left unused.

In comparison, in audio-picture annotations, the audio was registered by the auditory channel and processed in the phonological working memory, while the picture was registered by the visual channel and processed in the visual working memory. This combination allowed cognitive resources in both working memories to be used. In other words, more cognitive resources were utilized in audio-picture annotations than in text-picture annotations.

The results of the present study confirm those studies which have reported the superiority of a combination of audio and picture in comparison to a combination of text and picture when presenting new knowledge (Mayer & Anderson, 1991; Mayer & Moreno, 1998; Moreno & Mayer, 1999). According to the modality principle, audio-picture annotation simultaneously engages both the visual working memory and auditory working memory, while text-picture annotation involves only the visual working memory; therefore, audio-picture annotation enables more application of available cognitive capacity and should consequently lead to more content recall. The results from this study indicate the superiority of audio-picture annotations over text-picture annotations and the superiority of audio-only over text-only. However, previous studies have reported on the preference of visual learning styles over auditory learning styles among Asian students (e.g. Ye & Wang, 2003). For this study, the visual information presented via audio-picture annotation might act as better retrieval cues, in comparison to the information presented via text-picture annotation, to help the participants when taking the comprehension tests.

5. Final conclusions and implications for the future

In conclusion, the results of the study demonstrate that audio-only and audio-picture annotation are more effective than text-only and text-picture annotation in enhancing reading comprehension. The findings of this study suggest a number of implications and extensions for the classroom. First, the present study was conducted in an English language institute under the normal constraints of classroom teaching.

This study provided the much-needed information on the effect of four types of annotation on second language reading comprehension. By comparing text-only, audio-only, audio-picture and text-picture, it shed light on the use of different dual annotations for L2 learning. The present study has established that audio-only annotation is superior over text-only annotation in facilitating L2 vocabulary learning while reading and the superiority of audio-picture over text-picture annotation in enhancing reading comprehension. This contributes to the extension of the cognitive theory of multimedia learning to second language learning by verifying both the modality effect and split-attention effect.

Although this study has made some contributions to gloss or annotation research in second language acquisition, some questions such as the effects of different annotations, dual annotations on L2 vocabulary learning through reading and incidental and intentional vocabulary learning conditions on L2 reading comprehension as measured by different tasks still remain unanswered.

In addition to the contributions and implications for the field of second language acquisition, especially in the area of multimedia annotation research, this study carried important pedagogical implications. First of all, the study provides some insights for material designers into choosing the right combination of modalities in facilitating L2 vocabulary learning through reading. As confirmed by this study, the use of audio-only and audio-picture combinations facilitate L2 vocabulary immediate recall in a more effective manner than text-only and text-picture annotation. In designing materials, this finding could be taken into consideration when making decisions about presenting information in different modes. This could also inform language teachers and administrators in making decisions about the most effective programs to enhance L2 vocabulary learning and reading comprehension.

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Appendix A

Vocabulary Knowledge Scale (VKS)

Directions: For each word, there are three choices of how much you know about the word, please **circle** the one that fits you most. If you choose III, please written down the meaning of the word.

1. **shepherd**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

2. **placard**

I I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

3. **prairie**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

4. **phantom**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

5**. noose**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

6. **herd**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it

means_____

7. **twig**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

8.**damsel**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

9. **colonist**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

10. **saddle**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

11. **labyrinth**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

12. **cornet**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

13. **armor**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

14. **bayonet**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

15. **beak**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

16. **barrel**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

17. **accordion**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

18**. satchel**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

19. **goblet**

I. I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

_____

20. **mansion**

I .I don't remember having seeing this word before

II I have seen this word before, but I don't know what it means

III I have seen this word before, and I think it means

Appendix B: Reading Text

The European Settlers of Australia

During the early 1800s, European people began to settle in Australia. They lived along the coast. Most of them thought that the inland of Australia was a **prairie**. In fact, a mountain range separates the coast from the inland. The mountain range is called the Great Dividing Range. To the new settlers, it seemed like a **labyrinth** of unexplored valleys and mountains. Burke and Wills successfully crossed the Great Dividing Range in 1830.

After that, European settlers started to settle beyond the mountains. Most of them were **shepherds**. They raised animals for meat. They wore old clothes, ate simple foods, and lived in small houses. Sometimes the native people attacked them. Other times, animals such as emus attacked them with sharp **beaks**. They didn't have **armor** to protect themselves.

Banjo Patterson was one of the most famous early settlers. He was a songwriter. He wrote Australia's most famous song: Waltzing Matilda. The song is about a young traveler. With nothing to do, the young man sat under a tree, put his **satchel** on the ground and played his **accordion**. Then he saw a **herd** of cows and decided to steal one to eat.

At that time, life was hard and people hated stealing. The owner of the cow reported the loss to the police. A local policeman caught the young traveler. The policeman took away the young man's **saddle** and horse, and put him in prison. He used his **cornet** to call for a meeting at the center of the town. After the meeting, the young man was made to stand on a **barrel**. The policeman put a **noose** around the young man's neck and killed him.

Most Australian songs are not that sad, but Waltzing Matilda tells the stories of the early **colonists** in the first part of the 1800s in Australia. By the 1850s, however, life for these early settlers became better. Gold was discovered in the colony of Victoria. As a result, thousands of new settlers came and made Australia their home. Many of them became rich through the gold rush. In many stories of that time, a **damsel** had nothing better to do than to be beautiful. She just drank from a golden **goblet**, looked pretty for handsome young men and lived in a big **mansion**.

More people came to Victoria for gold. The early settlers were afraid of the newcomers.

They organized soldiers to keep order. At times, the newcomers walked on the streets and waved **placards** as a sign of protest. On the placards, they drew pictures of **phantoms**. Sometimes they threw **twigs** at the soldiers. However, the soldiers, each armed with a **bayonet**, easily ended the protests.

Appendix C: Word Recognition Test (WRT)

For each underlined word, please circle the correct meaning from the four choices.

1. Most of these settlers were shepherds.

a. a person who travels in the forest

b. a person who takes care of sheep

c. a person who digs gold for a living

d. a person who buys and sells sheep

2. To the new settlers, it seemed like a labyrinth.

a. a group of scattered houses

b. a set of connecting roads on a map

c. a confusing set of connecting paths

d. a group of animals living together

3. The policeman took away the young man's saddle.

a. a small bag

b. a leather seat

c. a handgun

d. a musical instrument

4. Most of them thought that the inland of Australia was a prairie.

a. a large area of wetland

b. a large area of grassland

c. a large area of desert

d. a large area of forest

5. They didn't have armor to protect themselves.

a. wooden weapons

b. metal tools

c. wooden housing

d. metal clothing

6. The young traveler put his satchel on the ground.

a. a small bag with a shoulder strap

b. a wine glass with a base and a handle

c. a leather seat used to ride horses

d. a long sharp knife used by soldiers

7. In many stories of that time, a damsel does nothing all the time.

a. an unmarried girl

b. a housewife

c. a young soldier

d. a rich man

8. They drew a picture of a phantom on the wall.

a. a horse

b. a ghost

c. a person

d. a sheep

9. The policeman put a noose around the traveler's neck.

a. a long necktie

b. a long metal chain

c. a rope tied in a circle

d. a thin piece of cloth

10. The newcomers threw twigs at the soldiers.

a. a tree branch

b. a wood chip

c. a small stone

d. a smelly plant

11. She drank from a golden goblet.

a. a drinking glass

b. a water bowl

c. a table spoon

d. a metal plate

12. The policeman used his cornet to call for a meeting.

a. a box-shaped musical instrument that you play with hands

b. a whistle used by policemen to get people's attention

c. a musical instrument that you play by blowing into it

d. a big bell used to inform people of the time in the past

13. The traveler saw a herd of cows.

a. a number of people living together

b. a number of animals living together

c. a number of travelers on the desert

d. a number of policemen at the station

14. The colonist arrived in Australia in 1800s.

a. a person who writes songs for travelers

b. a person who takes care of sheep

c. a person who settles in a new country

d. a person who fights for his country

15. The young girl lived in a mansion.

a. a large house

b. an old castle

c. a tall tower

d. a small cottage

16. Each soldier is armed with a bayonet.

a. a handgun used by policemen to protect people

b. a long and sharp blade fixed at the end of a gun

c. a whistle used by policemen to get attention

d. a knife used by soldiers to kill animals

17. A gold digger waved a placard at the soldiers.

a. a flag people wave in public to get attention

b. a sign people hold in public in a demonstration

c. a piece of cloth people use to cover their heads

d. a cotton scarf people wear in cold weather

18. The young man was made to stand on a barrel.

a. a large tree trunk for people to stand on it

b. a wooden bench for people to sit on it

c. a large container with two handles

d. a large container with flat top and bottom

19. Emus attacked the settlers with sharp beaks.

a. the long and sharp knife used by hunters

b. the hard pointed part of a bird's mouth

c. the sharp blade at the end of a gun

d. the pointed horn of a large animal

20. The young traveler played his accordion under the tree.

a. a whistle used to get attention

b. a big bell used to tell people time

c. a box-shaped musical instrument

d. a musical instrument like a trumpet

Appendix D

Multiple-Choice Reading Comprehension Questions

Based on the reading passage, please circle the best answer for each question:

1. When the European settlers arrived in Australia in the 1800s, they had a misunderstanding about the inland of Australia. What is the misunderstanding?

A. They thought the inland of Australia was a large forest.

B. They thought the inland of Australia was a large prairie.

C. They thought the inland of Australia was a large mountain.

D. They thought the inland of Australia was a large lake.

2. Which of the following is mentioned as one of the dangerous things the early settlers had to face?

A. bad weather of the inland

B. thieves who steal cows

C. bayonets of the newcomers

D. animals with sharp beaks

3. The early settlers did NOT have which of the following?

A. old clothes

B. metal armor

C. small houses

D. animal meat

4. The main character in the song “Waltzing Matilda” is a _____.

A. shepherd

B. soldier

C. songwriter

D. traveler

5. According to the passage, the character in the song did NOT have _____.

A. a small bag

B. an accordion

C. a horse and saddle

D. a sharp blade

6. What did the policeman use to call for a meeting at the center of the town?

A. an accordion

B. a cornet

C. a whistle

D. a goblet

7. How did the main character in the song die?

A. He was killed by a stone.

B. He was killed by a gun.

C. He was killed by a noose.

D. He was killed by a bayonet.

8. In many stories about the European settlers after the1850s, a character is often used to describe the life at that time. Who is that character?

A. a young woman

B. a settler's wife

C. a young soldier

D. a young shepherd

9. What did the newcomers do to show their dislike of the soldiers?

A. They moved away from the center of the town.

B. They walked on the streets and waved signs.

C. They threw small stones at the soldiers.

D. They used bayonets to fight the soldiers.

10. What pictures did the newcomers draw on the placards?

A. pictures of prairies

B. pictures of satchels

C. pictures of ghosts

D. pictures of animals