A Study of the Impact of Input Modification by Using Glosses on Vocabulary Acquisition and Retention

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ABSTRACT

Recently, electronic texts have become dominant in the academic world. This study examined the impact of three different combinations of electronic gloss components on vocabulary retention. More specifically, it tried to determine which of the combinations of electronic gloss components (only definition; definition + translation; and definition + translation + picture) had a greater influence on vocabulary recall. Participants consisted of 120 foreign language learners of English enrolled in a language program at an Iranian Language Institute. 60 learners attended elementary courses in four classes and 60 others were intermediate level learners forming four other classes. The participants received 5 hours of classroom instruction per week in a computer lab. They also completed two screening vocabulary tests: one immediately after the class and a delayed test after three weeks. The results showed a significant difference between the three experimental groups who received different types of glosses and control group who did not receive any types of glosses on both immediate and delayed tests. In addition, there was a significant difference among the three experimental groups who received different kinds of glosses. These findings confirm the results of the previous studies on the beneficial role of glosses on L2 vocabulary acquisition, and they point to the pedagogical advantages of using electronic glosses in language programs.

1. Introduction

Foreign language learners encounter two fundamental problems in their efforts to master the target language they have chosen or happen to be learning. In foreign language learning, it is far from easy to obtain suitable and enough language input, both in and outside of language institutions. This shortage creates the need to build a system that helps to increase the language input potential of the learners in as consistently effective way as possible that will allow them to develop the acquisition and retention of functional language and beyond. Since the appearance of computer-assisted language learning (CALL), both teachers and scholars have tried to discover ways in which computer technology can be of use in foreign language classes. Until now, many researches in this regard have been conducted (Makoto, 2006; De, Ridder, 2002; Jeong, 2001; Groot, 2000; Ellis, 1994; Dunkel, 1991). As Jones (2000) puts forward, accessing many current electronic resources provides enough opportunities for making texts more comprehensible to learners. One of the ways in making texts more comprehensible to readers is using computerized glosses or annotations.

Many researchers such as Knight (1994), Laufer (1997), and Yoshii and Flaitz (2000) consider vocabulary learning an important part of each foreign language learner's life. Vocabulary learning still brings about problems for many foreign language learners in spite of the recognized importance of it for researchers and language learners. They tend to forget newly learned words quickly and they have difficulty using them in either speaking or writing; However, the advent of CALL has provided a new means for learning vocabulary. With computers and Internet becoming more and more popular, many CALL programs and online materials have inundated the area of language teaching and learning. These CALL programs provide FL/L2 learners with a variety of learning activities (Jing-hua, 2009).

One of the means of facilitating vocabulary learning and reading comprehension is glossing (e.g., Davis, 1989; Hulstijn, 1992; Jacobs, Dufon, & Hong, 1994; Ko, 2005; Watanabe, 1997). As Richards and Schmidt (2010) contend, glossing in second language learning refers to providing a summary of words' meaning in a text usually found as notes in the margin or between the lines of the text. Research has shown that combining multiple forms of media such as text, sound, pictures, animated pictures, and video can aid vocabulary learning and facilitate reading comprehension (Chun & Plass, 1996a, 1996b, 1997; Al-Seghayer, 2001; Lomicka, 1998; Davis, 1998). Among studies done on glossing as a means of vocabulary learning, some found that marginal glossing has a positive effect on vocabulary learning (e.g., Hashemian & Fadaei, 2012; Ko, 2012; Rott, 2007; Rott, Williams, & Cameron, 2002), whereas some argued that it does not necessarily lead to vocabulary learning as it does not encourage differencing or word meaning retrieval (Huang & Lin, 2014). As Groot (2000) implies, there seems to be no feasible alternative to intentional learning of many words with the aid of authentic L2 material. Groot referred to the fact that vocabulary in L1 is mainly learned incidentally and gradually over longer periods of time and that for L2, this time factor is not attainable at the same level, while the L2 learner needs a large number of vocabulary words or phrases for instant use.

Although the above studies are a good start to exploring the effectiveness of electronic glosses in foreign language learning, additional empirical studies regarding the impact of glosses on vocabulary learning and reading comprehension are still needed (Kamil & Lane, 1998; Ben Salem, 2006). The main objective of the present study is to explore ways of learning FL vocabularies that may lead to better reading comprehension and longer retention, while providing more learner independence. The principal objective of this research will be how different annotations influence L2 vocabulary learning and reading comprehension in incidental, intentional, and interactive orientations. The results could contribute to the improvement of instruction in the teaching and learning of foreign languages in general and the teaching and learning of English as a foreign language in particular. The study investigates the impact of glossing on vocabulary learning by utilizing a computerized reading text in which the target phrases are highlighted and hyperlinked to definitional enhancements. The study focuses on the extent to which the participants in learning conditions, while having control over the learning environment in their own ways, will achieve in the same way or very differently in terms of comprehension, and most importantly in terms of retention of English vocabulary, first by the end of the activity and then some time later. In short, the study aims at uncovering how the acquisition of English new vocabularies may be affected, comparing when participants intentionally learn and memorize the highlighted vocabulary items to when they incidentally acquire new items when reading an academic text for comprehension.

The major significance of the present study lies in the fact that it investigates different ways of presenting vocabulary items to readers in a computerized environment with added help devices in an attempt to find out which of the learning modes of vocabulary through reading would lead to better comprehension and longer retention of the target items. This study intends to expand the understanding of the application of multimedia learning from the psycholinguistic, teaching and testing perspectives. It will investigate how text-picture, text-translation, and text-picture-translation glosses have an impact on L2 learners' vocabulary learning in three learning orientations. Therefore, the current study attempts to answer the following questions:

1. Does access to different gloss types affect vocabulary learning in both elementary and intermediate levels?

2. Does access to more gloss features result in higher scores in vocabulary tests in both elementary and intermediate levels.

3. Is there a difference between immediate and delayed vocabulary scores in vocabulary tests?

2. Review of Literature
2.1 Theoretical Framework for the Study
Dual-Coding Theory

Theory of Paivio's dual-coding (1986) explains how verbal and nonverbal information is processed. Research has shown that words that are associated with actual objects or images are better acquired and recalled (Clark & Paivio, 1991). This theory postulates that there are two cognitive

subsystems: verbal and nonverbal. While the verbal subsystem is specialized for processing language (text and audio), the nonverbal subsystem is for processing and representing nonverbal objects or events (pictures, animations, or video). The two subsystems are linked to each other through referential connections (Ben Salem, 2006). Associational processing refers to the connections within the verbal and nonverbal subsystems. The links between the two subsystems are referred to as referential connections. Paivio (1991) claims that pictures are thought to be more likely than words to activate the verbal and nonverbal subsystems upon processing.

2.2 Empirical Studies

Many researchers believe that vocabulary acquisition is the most critical part of second language learning (Knight, 1994). It is contended that, in order to develop linguistic abilities, second-language (L2) readers must achieve a specific level of vocabulary threshold (Brisbois, 1995; Geva & Clifton, 1994; Jimenez, Garcia, & Pearson, 1996; Kim, 1995; Lomicka, 1998). The impact of multimedia glosses on vocabulary acquisition and reading comprehension has been of great interest to researchers in second language learning (Chun, 2006). Most of the conducted studies are based on testing the design principles proposed by the Generative Theory of Multimedia Learning (Mayer, 1997, 2001). The multimedia principle which suggests that people learn better when they are exposed to both verbal and pictorial information rather than either alone is one of these principles that has received the most attention in second language learning. A number of studies have examined this principle by exposing second language learners to computerized texts that incorporate verbal and pictorial glosses. Khezrlou, Ellis, & Sadeghi, (2017) contend that, electronic multi-glossing is effective in aiding vocabulary learning even if the learners did not make intentional attempts to learn the words.

Despite the fact that these studies have given consistent evidences to the impacts of multimedia on vocabulary learning, uncertain results have been acquired for reading comprehension. One issue with the current research that limits generalizability of discoveries is the level of control given to the learners regarding their interaction with the available multimedia information. In a few studies, learners are permitted to choose the kind of multimedia (e.g. Chun & Plass,

1996a, 1996b; Plass, Chun, Mayer, & Leutner, 1998) so that they utilize the accessible text aides considering their needs, though in others they are compelled to access both verbal and pictorial data (e.g. Plass, Chun, Mayer, & Leutner, 2003; Yanguas, 2009) due to the fact that it is less demanding to build referential associations when the verbal and visual data is provided at the same time (Mayer, 2005).

Laufer (1997) contends that learners who have a resource knowledge of 3000 word families or 5000 lexical words can accomplish a reading score of 56%, the individuals who have a knowledge of 4000 word families or 6400 lexical words can accomplish a reading score of 63%, while an expansion to 6000 words families or 9600 lexical words will bring about a score of 77 %.

This critical amount of required vocabulary is difficult to instruct in class as it would take the time required for learners to learn other different skills, for example, listening, reading, speaking, and writing (Groot, 2000). Hence, language learners need to establish useful procedures to afford newly introduced words (Harley, 1996). Customarily, some of these procedures involve the utilization of dictionaries and marginal glosses inserted in certain language textbooks. Yet these two techniques are not very advantageous for learners who need to stop and interfere with their reading process and dismiss the content to find and recognize the meaning of new words. Moreover, in order to have the capacity to utilize the dictionary proficiently, students require special preparation, because availability of several meanings for a single word can sometimes be troublesome (Nation, 2001) and confusing (Luppescu & Day, 1993). Stahl (2003) believes that most of the times, there are troublesome words in the dictionary definition that makes the definition itself more difficult to understand.

In line with generative theory, the dual coding theory asserts that learning turns out to be surprisingly better when the data is gotten through two channels (verbal & visual) to develop meaning (Paivio, 1986; Clark & Paivio, 1991; Mayer, 1997; Mayer & Sims, 1994). Words that are related with real things or pictures are easily learned and better retained (Clark & Paivio, 1991). Various studies have been done to investigate the effect of different glosses that use different media, on vocabulary acquisition and retention among second language learners (Al Seghayer, 2001; Chun

& Plass, 1996a; Davis & Lyman-Hager, 1997; Lyman-Hager, Davis, Burnett, & Chennault, 1993; Kost, Foss, & Lenzini, 1999). For example, the effectiveness of glossing on reading comprehension of second language readers was examined by Lomicka (1998). She examined whether glosses paved the way or hindered reading comprehension among students of French. Three groups with different conditions were examined: full glossing (L1 translation, L2 definitions, pronunciations, images, references, and questions), limited glossing (L1 translation and L2 definitions), or no glossing. The study outcomes showed that text comprehension in a computerized text can be promoted when it is fully glossed. Lee (2015) in his studies concluded that the electronic glossing condition resulted in the greatest gains of vocabulary. The electronic glossing condition was also the most efficient in light of the cognitive load framework, showing the highest instructional efficiency.

Researchers Chun and Plass (1996a, 1996b, 1997) explored the impact of text-picture and text-video glosses on vocabulary maintenance among English speaking learners of German language, discovered positive effect of glosses. The outcomes demonstrated that words glossed with both text and pictures helped learners remember more vocabulary than words explained with just text or text and video. Kost et al. (1999) revealed a positive effect of pictorial glosses, their study demonstrated that learners who utilized a blend of text and picture gloss while reading a text, outperformed who utilized just either textual gloss or the pictorial gloss. The results of another study by Chen & Yen (2013) concerning vocabulary acquisition suggested that glosses were effective in aiding vocabulary retention for both short-term and long-term memory for medium and high-proficiency participants. However, format did not significantly affect both test scores.

In a study like those of Chun and Plass (1996a, 1996b, 1997), Al-Seghayer (2001) studied the effects of video glosses versus still-image glosses among ESL learners at an American college. A program presented three sorts of glosses to the learners. The first had literary definition and an audio section in which a local speaker articulated the target word. The second type of gloss included pictures alongside the definitions, while the third kind of gloss was video clips alongside the textual definitions. The outcomes demonstrated that words that were explained with text and picture and those with text and video were learned better than words with simply text definitions. Also the findings illustrated that words with text and video explanations were remembered better than words with text and pictures. Results obtained from Al-Seghayer's studies were opposite to those of Chun and Plass (1996a, 1996b, 1997) whose outcomes illustrated that still pictures consolidated with definitions are more viable for remembering than videos accompanied by definitions.

Despite the fact that researchers have explored some of the combinations of media that included fundamentally text, picture and video, it still stays ambiguous which mixture is helping more in vocabulary acquisition and reading comprehension. Definitely, more research is required in this field to analyze the viability of various combinations of media on reading comprehension and word retention. The present study intends to fill this gap by exploring the research questions mentioned in introduction section.

3. Method
3.1 Design
The study has three experimental groups and one control group. It has two posttests with between-subject and within-subject analysis. It has an immediate and delayed posttest but not a pretest. The study explores and describes the performance in vocabulary learning of intermediate and elementary learners of Iran in a Computer Lab in an Institute. Therefore, the study utilized a quasi-experimental design because of not having pretest. The type of electronic gloss and teaching orientations provided with the texts were deemed as the independent variables. There were three combinations of electronic gloss components: a) definition; b) definition and picture; and c) definition, picture and translation. The dependent variable included participants' scores on the immediate vocabulary test and the delayed vocabulary test.

3.2 Participants
Participants in this study were Iranian students of intermediate and elementary level English enrolled in English courses at Jahad Daneshgahi Institute of Maku. A total number of 120 participants took part in the study: 80 females and 40 males. Sixty intermediate and sixty elementary level ESL students studying at an Iranian institute took part in the study. Learners were of mixed L1 backgrounds (Turkish, Kurdish and Persian),

and constituted eight intact ESL classes. Data collection took place in a computer lab and each session was a regularly scheduled part of their language course. Based on the students' self-expression, they were similar in their experience with and attitudes toward using computers as a pedagogical tool in the ESL classroom.

The age range of the participants at the elementary classrooms was 12 to 16, whereas the age of the participants at the intermediate classes ranged from 14 to 18. All participants were English language learners who had an interest in continuing their English learning programs. The researcher could access to participants' grades or overall performance in class while the study was conducted. The nature of the study was explained to the participants and they were informed that all the information collected during the study would be kept confidential; their scores would not be shared with anybody and would not affect their final grades.

3.3 Materials and Instruments
Reading passages

The researcher selected several reading passages from an English textbook (Select Readings) used by the participants to use in this study. It proved hard to come up with accurate pictures that would represent certain words that needed to be glossed, such as abstract concepts or action verbs that may usually be found in existing reading texts. Kost, Foss, and Lenzini, (1999) faced the same problem when they were annotating the target words of their text. So, they deleted several sentences from the text and replaced some words with others that were easier to gloss with pictures. However, in this study the passages remained intact to preserve their originality as course texts. The reason for selection of the passages out of this textbook is that it is used as the reading course book in these classes. To select the words to be glossed in the passages, five volunteer students read the passages and highlighted the words that proved unknown or difficult to them to understand. Then, the researcher chose the words that were selected three or more times by five students as the target words to be glossed.

Immediate Vocabulary Tests

Immediate vocabulary tests were designed by the researcher to measure the effect of the three different combinations of electronic gloss components on vocabulary retention. The researcher designed the vocabulary test to measure the effect of each type of gloss on word retention and find out

whether students who had access to gloss outperformed students in the control group who had only a reading passage The tests included 10 multiple choice questions. Participants received one point for each correct answer and no points for an incorrect answer. The maximum score possible was 10.

Delayed Vocabulary Test

The delayed multiple-choice vocabulary tests were also designed by the researcher and were identical to the immediate tests but with the items in a different order. They were administered two weeks after the intervention. The delayed multiple-choice vocabulary tests allowed the researcher to determine whether or not the participants were able to recall the learned words two weeks after the intervention.

Foreign Language Annotator Program

The Foreign Language Annotator (FLAn) Program (Thibeault, 2014) was used to present unfamiliar words by means of hypermedia links in three formats of definition, definition- picture and definition-picture-translation. The program can be available without any Internet connection requirement. The screen layout is in accordance with pre-specified design principles. The screen consists of two frames. The left screen is devoted to the reading passage with the title at the top, and the right screen is allocated to the glosses. In the definition gloss type, when participants click on a hypermedia link, the right screen supplies a text definition of the word (figure 1).
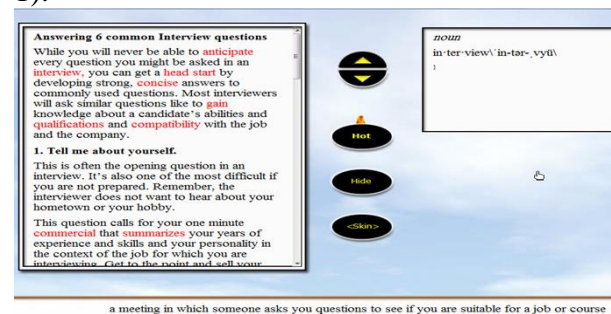

Figure 1: A Screen Shot of Reading Condition 1: Definition (D)

In the definition-picture type, participants were able to see a text definition of a word along with a picture as a result of clicking on the word (figure 2).
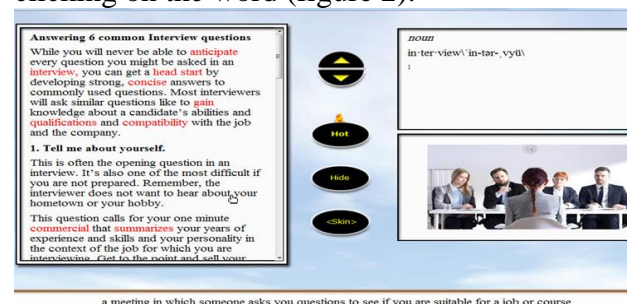
Figure 2: A Screen Shot of Reading Condition 2: Definition + picture (DP)

And, in the definition-picture-translation format, the participants click on a highlighted word, and can see on the right screen a picture that illustrates the word and definition and translation of the word (figure 3).
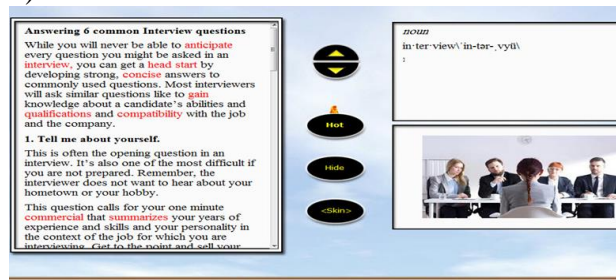

Figure 3: A Screen Shot of Reading Condition 3: Definition + picture + Translation (DPT)

3.4 Procedure

The present study was conducted in Maku Jahad Daneshgahi Institute's computer site that holds 17 computers. Four intermediate groups each consisting of 15 English language learners and four elementary groups each having 15 English language learners took part in this study, which totally comprised 120 participants. The groups were homogenous because the learners were screened before entering a certain class in Jahad Daneshgahi Institute. After the researcher made certain that the participants are a homogenous sample, they were randomly assigned to one of the four groups in each level; three gloss groups (D, D+P and D+P+T), and a control group. On the day of exposure to the research treatment, participants in the three gloss groups received instructions for each gloss conditions. They were taken to the lab and demonstrated how to use the Flan program before they began to read. All groups could have access to the texts through Flan program on computer screen. Participants were tested individually and they worked through the text at their own pace. Definition gloss group read the computerized written passages having access to the definitions of the glossed words in English. Pictorial plus definition gloss group read the computerized written passages with access to the pictures and definitions of the glossed words. Definition, pictorial and translation gloss group read the computerized written passages with access to the pictures, translation and the definitions of the glossed words. Control group read the computerized written texts without having any access to the definitions, pictures or translations of the words.

During the teaching sessions, the participants had access to reading passages at computer site. As it was mentioned above, the participants in each group worked through the passages under different conditions during four different sessions. The gloss groups could consult glosses by clicking the mouse pointer over the colored words. When the participants clicked on the colored words, the program showed a definition in English (textual gloss group), a picture and definition (pictorial gloss group), or a combination of glosses (textual plus pictorial plus translation gloss group) on the right hand of the screen. Participants in the control group read the texts without having any access to glosses. After completion of the reading task in different conditions by the participants, the teacher-researcher asked them to answer immediate multiple choice vocabulary test at the end of the session. A soft copy of the test which consisted of ten multiple choice questions was provided for each participant on the screen. The participants answered the questions on the answer sheets which were provided on screen towards the end of the reading task. The annotated words in the reading texts were the focus of the tests. However in three types of orientations namely incidental, intentional and interactive the learners received different types of teaching. In incidental groups, the learners were informed that after instruction there would be a vocabulary test. But in intentional groups, the students were aware of the posttest and a list of new words which were the target of tests, were given to them. In interactive groups, a mix of traditional method of teaching and glosses were used to teach new words.

After two weeks, the delayed vocabulary post-test was given to the subjects, in the same way as for the immediate posttest. It differed from the immediate posttest in that it was administered two weeks after the reading. It used the same 10-item multiple-choice vocabulary test that was employed for the immediate posttest. The objective of this test was to assess the level of retention of the vocabulary learned with the initial reading in the project, and to measure the degree of divergence or convergence such as loss, maintenance, or increase in the quantity of the vocabulary items acquired, between the immediate and delayed posttests. The posttests were intended to record the impact of the glossed reading task on the subjects at

these two different points in time. This assures a better level of accuracy in the measurement of variation in retention over the specified times. Both posttests were graded in the same way with the same rubric and grade allocations.

4. Findings

The software used to perform the statistical analyses was the SPSS Version 23.0. All statistical analyses used the .05 level of significance. In the present study, a series of Two-way ANOVAs were run to analyze the effect of two treatments namely, glosses and orientations, on vocabulary learning and retention. A series of One-way ANOVA tests were also performed to examine if there existed any significant differences among the three gloss groups regarding vocabulary learning. Analysis of variance procedure was followed by Duncan Post hoc test. This test was run to reveal the level of significant differences among groups. To evaluate the hypotheses pertaining to the effects of gloss type and orientations on the vocabulary tests (immediate and delayed), several analyses were conducted.

4.1 Two-way ANOVA results for immediate vocabulary test by gloss and orientation type at elementary level

In order to compute statistical significance, the data were submitted to a two-way ANOVA with gloss types and teaching orientations as between group variables. Table 1 shows the results of the two-way ANOVA.

Table 1: Between-Subjects Factors

		Value Label	N
Glosses	1	D	45
	2	D+P	45
	3	D+P+T	45
	4	C	45
Orientations	1	INT	60
	2	INC	60
	3	INTER	60

Table 2: Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	410.728a	11	37.339	39.702	.000
Intercept	8918.272	1	8918.272	9482.720	.000
Glosses	388.861	3	129.620	137.824	.000
Orientations	1.478	2	.739	.786	.457
Glosses * Orientations	20.389	6	3.398	3.613	.002
Error	158.000	168	.940		
Total	9487.000	180			
Corrected Total	568.728	179			

a. R Squared = .722 (Adjusted R Squared = .704)

A two-way ANOVA was conducted that examined the effect of glosses and learning orientations on vocabulary learning and retention. As it is shown in the table above, there is a statistically significant

interaction between the effects of glosses and learning orientations on vocabulary learning, $F(6, 168) = 3.613$, $p = .002$. We can see from the table above that there is no statistically significant difference in vocabulary scores between different orientations ($p = .457$), but there are statistically significant differences between different glosses ($p < .002$).
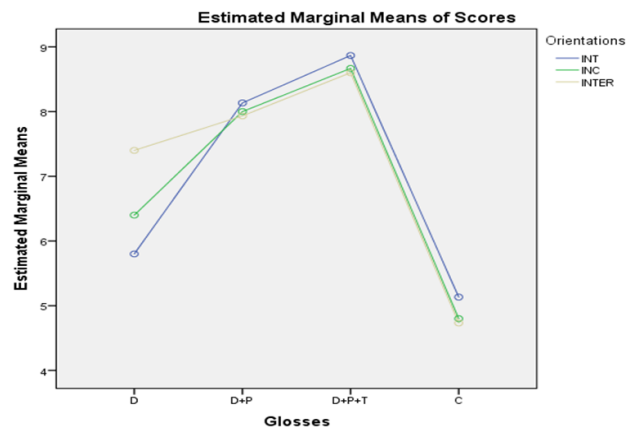

Figure 4: Profile plot

We can see from figure 4 that the lines do not appear to be parallel (with the lines actually crossing). Then we might expect there to be a statistically significant interaction.

Table 3: Comparison of Subject's Immediate Test Means Using Duncan Post Hoc Tests

Gloss type / Orientation	D	DP	DPT	C
INT	5.80±.67Ba	8.13±.74Ca	8.87±.83Da	5.13±.91Aa
INC	6.40±1.1Ba	8±1.06Ca	8.67±.81Ca	4.80±.94Aa
INTER	7.40±1.2Bb	7.9±1.03Ba	8.60±.91Ca	4.73±1.16Aa

(The non-similar Capital Latin letters in each row and non-similar lower-case letters in each column indicates a significant difference at the 5% error level between the treatments.)

As it can be seen in table (3) there is a meaningful difference between the four gloss types with intentional orientation. But there isn't a significant difference between two types of glosses namely, (Definition + Picture) and (Definition + Picture + Translation) with incidental orientation. In addition, there isn't a significant difference between (D) and (DP) glosses with an interactive orientation; however, there is a meaningful difference between control group and three experimental groups. Regarding orientations, there isn't a meaningful difference among three types of orientations in the first and fourth columns.

4.2 Two-way ANOVA results for delayed vocabulary test by gloss and orientation type at elementary level

Table 4: Tests of Between-Subjects Effects
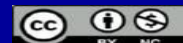
Dependent Variable: Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	237.911ᵃ	11	21.628	28.536	.000
Intercept	7018.756	1	7018.756	9260.348	.000
Glosses	196.667	3	65.556	86.492	.000
Orientations	8.811	2	4.406	5.813	.004
Glosses * Orientations	32.433	6	5.406	7.132	.000
Error	127.333	168	.758		
Total	7384.000	180			
Corrected Total	365.244	179			

a. R Squared = .651 (Adjusted R Squared = .629)

In order to examine the effect of glosses and learning orientations on delayed vocabulary tests another two-way ANOVA was conducted. As it is shown in the table above, there is a statistically significant interaction between the effects of glosses and learning orientations on vocabulary learning, $F (32.433, 127.333) = 7.132, p = .000$. We can see from the table above that there is statistically significant difference in vocabulary scores between different orientations ($p = .004$), and there are statistically significant differences between different glosses ($p < .000$).
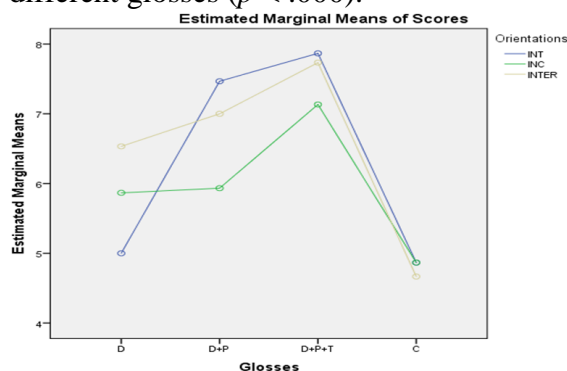

Figure 5: Profile plot

It can be seen from this figure that the lines do not appear to be parallel (with the lines actually crossing). Then we might expect there to be a statistically significant interaction.

Table 5: Comparison of Subject's Delayed Test Means Using Duncan Post Hoc Tests

Gloss type / Orientation	D	DP	DPT	C
INT	5±1.0ᴬᵃ	7.47±.83ᴮᵇ	7.87±.83ᴮᵇ	4.87±1.06ᴬᵃ
INC	5.87±.74ᴮᵇ	5.93±.79ᴮᵃ	7.13±.91ᶜᵃ	4.87±.91ᴬᵃ
INTER	6.53±.91ᴮᶜ	7±.84ᴮᵇ	7.73±.88ᶜᵃᵇ	4.67±.61ᴬᵃ

According to table (5) there isn't a meaningful difference between (D) gloss type and control group(C) with intentional orientation. But there is a significant difference between (D) and (DP), (DPT) glosses with intentional orientation. In addition, there isn't a significant difference between (D) and (DP) glosses with an incidental orientation; however, there is a meaningful difference between control group and three experimental groups in both incidental and interactive orientations.

Regarding orientations, there isn't a meaningful difference among three types of orientations in the second and fourth columns but there is a meaningful difference among three types of orientations in the first column.

4.3 Two-way ANOVA results for immediate vocabulary test by gloss and orientation type at intermediate level

On the data gathered from immediate vocabulary tests in intermediate level, a two-way ANOVA was conducted that examined the effect of glosses and learning orientations on vocabulary learning.

Table 6: Tests of Between-Subjects Effects

Dependent Variable: Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	318.378ᵃ	11	28.943	38.921	.000
Intercept	6746.689	1	6746.689	9072.388	.000
Glosses	284.467	3	94.822	127.509	.000
Orientations	7.144	2	3.572	4.804	.009
Glosses * Orientations	26.767	6	4.461	5.999	.000
Error	124.933	168	.744		
Total	7190.000	180			
Corrected Total	443.311	179			

a. R Squared = .718 (Adjusted R Squared = .700)

As it is shown in the table (6), there is a statistically significant interaction between the effects of glosses and learning orientations on vocabulary learning, $F (6, 168) = 5.99, p = .000$. We can see from the table above that there is no statistically significant difference in vocabulary scores between different orientations ($p = .009$), but there were statistically significant differences between different glosses ($p =.000$).
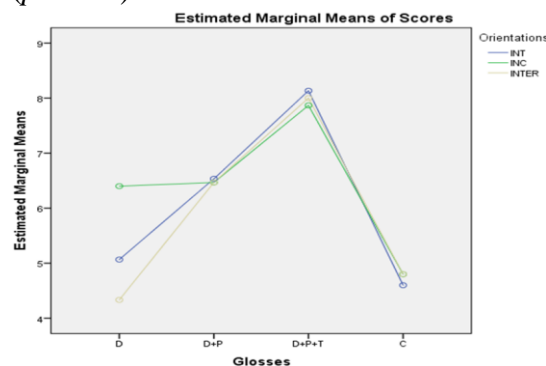

Figure 6: Profile plot

The graph above demonstrates that the lines do not appear to be parallel (with the lines actually crossing). Then, we might expect there to be a statistically significant interaction.

Table 7: Comparison of Subject's Immediate Test Means Using Duncan Post Hoc Tests

Gloss type / Orientation	D	DP	DPT	C
INT	5.07±.79ᴬᵇ	6.53±.83ᴮᵃ	8.13±.74ᶜᵇ	4.60±.82ᴬᵃ
INC	6.40±1.12ᴮᶜ	6.47±.99ᴮᵃ	7.53±.74ᶜᵃ	4.80±.94ᴬᵃ
INTER	4.33±.90ᴬᵃ	6.47±.83ᴮᵃ	8.00±.65ᶜᵃᵇ	4.80±.86ᴬᵃ

As it is shown in table (7), there isn't a meaningful difference between (D) gloss type and control group(C) with an intentional orientation. But there is a significant difference between (D) and (DP), (DPT) glosses. In addition, there isn't a significant difference between (D) and (DP) glosses with an incidental orientation, however, there is a meaningful difference between control group and three experimental groups with an incidental orientation. Regarding orientations, there isn't a meaningful difference among three types of orientations in the second, third and fourth columns but there is a meaningful difference among three types of orientations in the first column.

4.4 Two-way ANOVA results for delayed vocabulary test by gloss and orientation type in intermediate level

Table 8: Tests of Between-Subjects Effects

Dependent Variable: Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	463.000a	11	42.091	48.169	.000
Intercept	7144.200	1	7144.200	8175.924	.000
Glosses	423.578	3	141.193	161.583	.000
Orientations	15.833	2	7.917	9.060	.000
Glosses * Orientations	23.589	6	3.931	4.499	.000
Error	146.800	168	.874		
Total	7754.000	180			
Corrected Total	609.800	179			

a. R Squared = .759 (Adjusted R Squared = .744)

The data gathered from delayed vocabulary tests were analyzed by a two-way ANOVA that examined the effect of glosses and learning orientations on vocabulary learning and retention. As it is shown in the table above, there is a statistically significant interaction between the effects of glosses and learning orientations on vocabulary learning, $F (6, 168) = 3.931$, $p = .000$. We can see from the table above that there is statistically significant difference in vocabulary scores between different orientations ($p = .000$), and there are statistically significant differences between different glosses ($p < .000$).
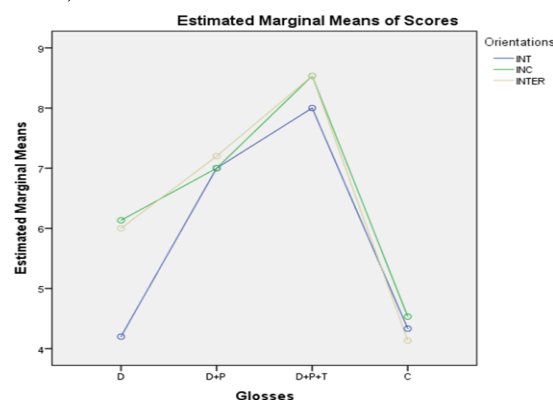

Estimated Marginal Means of Scores

Figure 7: Profile plot

We can see from this figure that the lines do not appear to be parallel (with the lines actually crossing). Then we might expect there to be a statistically significant interaction.

Table 9 : Comparison of Subject's Delayed Test Means Using Duncan Post Hoc Tests

Gloss type / Orientation	D	DP	DPT	C
INT	4.20±.86Aa	7.00±.1.06Ba	8.00±.75Ca	4.33±.90Aa
INC	6.13±1.24Bb	7.00±.75Ca	8.53±.99Da	4.53±.99Aa
INTER	6.20±.65Bb	7.20±.77Ca	8.53±.91Da	4.13±1.12Aa

Table (9) shows that there is a meaningful difference among all gloss types and control group(C) with incidental and interactive orientations. But there isn't a significant difference between (D) and control group (C) with an intentional orientation. In addition there isn't a significant difference. Regarding orientations, there isn't a meaningful difference among three types of orientations in the second, third and fourth columns.

5. Discussion

Different gloss types, especially text-picture, text-translation, and text-picture-translation, can influence L2 vocabulary learning. They can be applied in EFL classroom settings where there is little information on how these dual glosses can pave the way for improved vocabulary learning. In addition, different learning orientations including incidental, intentional, and interactive in vocabulary learning in multimedia environment have never been investigated in two different levels. The impact of electronic glossing in dual formats on L2 vocabulary acquisition in incidental, intentional, and interactive learning orientations remains unclear. Thus, the present study investigated the effects of different modality computer-assisted vocabulary glosses using a sample of students in both elementary and intermediate levels. In addition, the present study investigated the time effect between immediate and delayed vocabulary tests to see the short term and long term effects of the treatment. The study of only short-term retention in some research (e.g., Al-Seghayer, 2001) does not allow us to know the extent to which L2 learners are able to retain the words learned incidentally and intentionally by means of glossing. Thus, more research into the retention of acquired words via glosses is needed.

Concerning the first research question, results of the present study indicate that the students using glosses (definition, picture,

translation) outperformed those who were in control group, and there was a significant difference in the performance of gloss groups and that of control group on both immediate and delayed vocabulary tests at both elementary and intermediate groups. As far as vocabulary learning and retention is concerned, the three gloss groups significantly outperformed the control group and some significant differences among experimental groups were detected. These findings are not surprising and are in agreement with the previous findings that have shown vocabulary learning to be affected by the glosses. Then the first null hypothesis is not supported. The finding of this study regarding the first research question confirmed the previous findings (Al-Seghayer, 2001; Chun & Plass, 1996; Yeh & Wang, 2003; Yoshii & Flaitz, 2002). The results of their studies suggested that a combination of textual and pictorial glosses was more beneficial to the learners in vocabulary learning, possibly due to the fact that they received two modes of input (Ellis, 1994), namely verbal and visual.

Several studies (Davis & Lyman-Hager,1997; Jacobs, Dufon, & Fong, 1994) are consistent with the findings, regarding the facilitating function of glosses in vocabulary learning, and they support the explicit instruction of vocabulary learning. This is because annotations draw learner attention to target words, supporting the notion of "consciousness-raising" and "input enhancement" (Nagata, 1999). Chen (2002) studied L1 and L2 glosses with 85 college freshmen students learning English as a FL in Taiwan. Participants were assigned to one of three conditions in which they received either an L1 (Chinese) gloss, L2 (English) gloss, or no gloss. Participants were asked to read a 193-word English text with 20 glossed words. Results indicated that the L2 gloss group outperformed the no gloss group, but there was no significant difference between the L1 and L2 gloss groups. In this study also a comparison of the means across groups shows that the three experimental groups performed generally better than the control group. Regarding the effect of learning orientations, however, there is little difference between intentional, incidental and interactive in the experimental groups.

Regarding the second research question, results showed that participants who had access to the combination of definition, picture and translation glosses outperformed participants who had access to definition-only or picture+definition glosses. Investigating the effect of types of glosses on vocabulary learning, all groups exposed to different combination of glosses outperformed the control group in vocabulary tests. Also a significant difference between the three gloss groups was found in the vocabulary tests. So the second null hypothesis is not approved. These results do not support the findings of the previous studies that have shown learning vocabulary items not to be affected by the inclusion of glosses (Chun & Plass, 1996; Lomicka, 1998; Kost et al., 1999; Bowles, 2004).

The effects of text-only, picture-only, and a combination of text and picture glosses on incidental vocabulary retention were compared by Yoshii and Flaitz (2002). The results indicated that participants who had access to the combination of text and picture glosses outperformed participants who had access to text-only or picture-only glosses. This finding supports the previous study conducted by Plass, Chun, Mayer, and Leutner (1998) who investigated the effect of different types of glosses according to the students' preferred mode on text comprehension and learning of the new words. The results of their study provided justification for the generative theory of multimedia learning (Mayer, 1997), an earlier version of Mayer's cognitive theory of multimedia learning (Mayer, 2005b).

Yeh and Wang (2003), and Yoshii (2006) investigated the effect of different types of multimedia glosses on incidental vocabulary learning. They concluded that providing different types of glosses was effective in the learning of target words. Along the same lines, the present study indicated that all multimedia gloss groups outperformed the control group and a meaningful difference existed between gloss groups and control group in learning target words.

Considering the third hypothesis that immediate and delayed tests will not affect scores in vocabulary tests, it can be inferred from the obtained results that students on the immediate vocabulary test outperformed students on the delayed vocabulary test regarding all the different gloss groups at elementary level. However, the opposite is true at intermediate level, i.e. students performed better on delayed tests in comparison to immediate tests.

It is worth mentioning that a significant decrease in means from the immediate vocabulary scores to the delayed vocabulary scores is not a surprising result since participants had only one chance to read the passages and glossed vocabularies. Coady (1993) argues that there is only a 5-15% probability that a new word could be learned after a single exposure. Coady's argument may explain the results of Hulstijn (1992), who found that students who were exposed to new vocabulary only once had a low rate of recall.

6. Conclusion

The findings of the present study demonstrate that all glossed groups acquire new vocabulary in a foreign language significantly better than the control group. Secondly, regarding vocabulary learning, the combination gloss group significantly outperforms the other two gloss groups and control group. The results of this study also reflect the fact that utilizing computers and multimedia glosses can be influential in language teaching in general, and L2 incidental and intentional vocabulary learning in particular. The findings of the present study have implications for the design of multimedia presentations (glosses) for vocabulary learning. In this regard, cognitive accounts of learning in multimedia environments have much to offer for the design of learning materials and classroom practices. Presenting definitions of words with their associated pictures simultaneously may force a presentation mode on the reader. Yet, this seems to enhance cognitive processing of multimedia information. Therefore, material developers as well as teachers who are interested in developing their own or supplementary materials on the basis of their students' needs should take the contiguity principle into account.

This study has some limitations. First, the assessment of participants' vocabulary learning was measured only at the recognition level with multiple-choice items. A combination of multiple-choice items, along with recognition and production vocabulary tests might have yielded different outcomes for the vocabulary tests. Results could also have been different if the participants' tasks on the vocabulary tests had been matching words and pictures. Second, only short-term retention was studied. It would be interesting to investigate the impact of different combinations of electronic gloss components on long-term retention. Finally, this study specifically examined the effect of three types of glosses. Further research investigating other potential glosses such as videos or gifs, or a combination of several of them together, might yield a different picture of the glosses impact on language learning.

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