

CHAPTER TWO LITERATURE REVIEW

2.1 The effects of different glosses on incidental vocabulary learning in printed text

Studies of the effects of glosses in printed texts found that glosses can contribute to incidental vocabulary learning. Jacobs, et al. (1994) found that learners who had access to glosses learned vocabulary better than those who didn't on the vocabulary translation task as an immediate posttest. Their participants are American students learning Spanish as L2 in a fourth semester course. Watanabe (1992) studied the effects of glossing on the vocabulary learning of students of English as a second language and found that glossing increased vocabulary learning (as cited by Jacobs, et al. 1994).

Hulstijn, et al. (1996) worked with Dutch students who learned French as an L2. There are three experiment conditions in their study: (1) marginal glosses in English (L1) (2) dictionary access, and (3) text only. The result showed that marginal glosses (L1) were more effective than bilingual dictionary use or the text-only condition.

Hulstijn (1992) looked at the effectiveness of a multiple-choice approach and a single-synonym approach in a within-subject design. He found that there is a higher retention effect for the multiple-choice procedure than for the single-synonym procedure. Though, Watanabe's (1997) experiment showed contradictory results. He

compared the four gloss types: (1) appositives (2) single marginal glosses (3) multiple-choice marginal glosses and (4) text-only. He found that subjects in both single and multiple-choice gloss conditions outperformed those in the appositive and text-only conditions. The single gloss group scored higher than the multiple-choice group, but the difference was not significantly different.

Grace (1998, 2000) found sentence-level L1 translation were highly effective for incidental vocabulary learning. Gettys, et al. (2001) further compared the sentence-level L1 translation with basic dictionary form L1 glosses. The basic dictionary gloss group yielded significant higher scores than the sentence-level translation gloss group on the vocabulary posttest.

The above-mentioned studies not only confirmed the effectiveness of glosses on incidental vocabulary learning but also compared the effectiveness of different types of textual glosses. In addition to textual information, studies also supported the effectiveness of using visual stimulus in glosses on incidental vocabulary learning.

Oxford and Crookall (1990) confirmed the positive effects of visual imagery on L2 vocabulary learning by stating that "...visual images make learning more efficient."

Kost, et al. (1999) investigated the effects of pictorial and textual glosses and a combination of the two on incidental vocabulary growth of 56 German students in the

USA. The combination of text and picture helped learners achieved the best scores among the three groups.

2.2 The effects of different glosses on incidental vocabulary learning in multimedia environment

The advantages of computer-mediated text are summarized by Leffa (1992). He stated that “students get higher comprehension scores, develop better word-recognition skills, and are more motivated to learn when they use a computer (p. 66).” As to its influence on incidental vocabulary learning, he said, “acquisition of the foreign language may occur as a by-product of comprehension, not only because learners are getting meaning from the text, but also because they get it at a more comfortable speed (p.67).” Taylor (2006), when reviewing studies comparing CALL L1 glosses with paper-based L1 glosses, stated that CALL L1 glosses provided fast access for learners, encouraged more positive anticipation of reading in L2. Besides, CALL L1 glosses can be an important motivational component in the CALL lab environment. In this section, the literature of gloss uses in multimedia environment will be reviewed.

Lyman-Hager, Davis, Burnett, & Chennault (1993) conducted a study to examine the impact of a multimedia program on vocabulary acquisition and confirmed that multimedia program is more effective than traditional text when learning words

incidentally. The researchers studied two groups: one composed of participants who read an excerpt from a story, *Une Vie de Boy*, via computer, and the other composed of participants who read the story from a conventional printed text. Both groups had access to glosses. The computer group had access to multimedia annotations, while the traditional text group had access to a traditional book with glosses bearing definitions identical to those available to the computer group. Immediately after reading the story, participants were asked to write a recall protocol and, a week later, to take a vocabulary test. The results demonstrated that students who worked with the multimedia program showed a better ability to retain vocabulary than those who worked with the non-computerized text.

Chun and Plass (1996) examined the effects of multimedia annotations on L2 vocabulary learning. There were both production and recognition tests in the study. The pictorial and written test items paralleled the way the information was presented. The participants were 160 university students learning German as a second language. The researchers employed a within-subject design. All the participants used the same version of the program named *CyberBuch*. There are three annotation types available: (1) text definition, (2) text + picture, and (3) text + video. The researchers found that the combination of text and picture glosses was the most effective among the three gloss types.

Plass et al. (1998) examined the effects of gloss types in a multimedia context investigating whether learners are more likely to learn target words when they received both verbal (textual) and visual (picture) glosses than when they received one mode or none. The participants were 103 American university students who were studying German as a second language. The text contained 24 target words of which 12 had text and picture gloss options, and the other 12 had text and video options, all the textual cues being provided in L1. The vocabulary posttest required the learners to supply L1 translation for each target word. The researchers found that the performance was the best when the learners selected both visual and verbal modes of glosses, moderate when they selected only one mode, and worst when they selected none. The results also showed that the selection of text and picture was better than that of text and video for learning the words incidentally.

Al-Seghayer (2001) investigated the difference between video-mode annotations and static-picture annotations. Participants read a narrative English text with three gloss conditions: printed text definition alone, printed text definition coupled with still pictures, and printed text definition coupled with video clips. The participants were 30 ESL intermediate level students in the USA. The overall results showed that the words presented under the printed text definition coupled with video clips produced the best results among the three groups.

In Al-Seghayer's (2001) study, it was found that performance on the text-plus-video was significantly better than that on the text-plus-picture condition, indicating that the video condition is more effective than the picture condition. It was also found that the performance on the text-plus-video condition, and the text only condition was significantly different, showing that the former is more effective than the latter. The results of the study are consistent with Paivio's (1986) dual coding theory, but they differ from the results obtained by Chun and Plass (1996). The difference in results obtained in this study and those obtained by Chun and Plass (1996) may be attributed to the mother tongue of the participants, the target language, the type of visual aids and the type of tests, as explained by the researcher.

The variety of modality cues can reinforce each other and are linked together in meaningful ways to provide an in-depth experience. Among the possible factors that may explain these results obtained by Al-Seygher (2001) were the following: video better helps learners build a mental image, curiosity increases concentration, and video's combination of modalities (dynamic image and sound) facilitate recall.

Yoshii & Flaitz (2002) looked at the effects of three multimedia annotations on incidental vocabulary learning: text only, picture only, and text plus picture. 151 beginning and intermediate ESL learners studying in the USA participated in the study. Results showed that the combination of text plus picture group outperformed the other

two groups on immediate vocabulary tests and delayed vocabulary tests on all three test types: picture recognition, word recognition, and definition supply test. No significant interaction between proficiency level and annotation type was found. The time of test did not alter the relative effect of a given annotation type. The picture cues were as effective as the textual cues for the immediate and delayed retention of word meanings. However, when it comes to the “definition supply test,” the text-only group outperformed the picture-only group. In this study, the pictures were not able to convey the full meanings of the words as effectively as the textual cues on immediate tests. Besides the slight gain over picture-only group on the definition supply test, the text-only group scored the lowest of the three groups on all other measures. The results of the study; therefore, encourage the use of pictures as alternatives or as accompaniments to textual cues. The text-only group scored the lowest for all of the delayed tests indicating the consistent disadvantage of the textual cues compared to the picture and the combination cues. However, the differences among the groups for the delayed tests were smaller than those of the immediate measures. There was no significant interaction between annotation type and proficiency level both for the immediate and delayed tests.

Yeh & Wang (2003) explored the effects of three multimedia vocabulary annotations: text, text plus image, and text plus image plus sound. The subjects were

82 university students learning English in Taiwan.

Analyses of the participants' performance on the posttest indicated that the version of text + picture annotations was the most effective for vocabulary learning. An ANOVA analysis revealed that the effectiveness of the three versions on vocabulary acquisition was significantly different. Besides, the text + picture group outperformed text + picture + audio group, which means that text plus a still picture was the most helpful. The researchers also examined the correlation between the three versions of the courseware and learning styles. The results showed that to users with mixed learning styles, text + still picture annotations were the most effective among the three. The transfer of L1 processing mechanism, the fast speech rate of the recorded annotation and the time limit for completing the task might explain the comparative ineffectiveness of the third version of the courseware (text+ picture + audio).

Their results are generally consistent with previous studies (Chun & Plass 1993, 1996; Kost, et al., 1999). The relative ineffectiveness of text + picture + auditory annotation may be attributed to the influence of the L1 and the rate of speech of the audio annotations. The questionnaire showed that Chinese ESL/EFL learners preferred visual stimuli over auditory stimuli. Two pedagogical implications can be drawn from the study. First, it is suggested that English instructors employ a dual

presentation mode as often as possible for vocabulary learning. Second, Chinese EFL learners would benefit from raised phonological awareness of the correspondence between spelling and pronunciation.

Gettys, et al. (2001) compared two techniques of accessing the semantics of the unfamiliar words: one through basic dictionary form and the other through sentence-level L1 morphological equivalents of L2 words. 22 native speakers of English studying Russian participated in the study.

The results show that reading with the help of the dictionary form is more beneficial for learning words. That is, they demonstrated a significantly greater overall retention of vocabulary. But the question of whether this glossing technique benefits or impedes general comprehension is still open. Questionnaires collected from subjects show that most students preferred the technique that gave them access to sentence-level equivalents to the dictionary forms. Besides, most students characterized the process of reading with on-line gloss as a very pleasant experience that encouraged more reading. Four assessment parameters were used to measure the effectiveness of these approaches: the rate of global comprehension of L2 text, the ability to capture details, vocabulary retention and gain, and the amount of time spent by the students on reading the text.

Nagata (1999) studied the effectiveness of single-gloss version glosses and

multiple-choice version glosses. The study used a Japanese courseware program, Banzai Reading. The participants were 26 learners of Japanese studying in Japan. Generally speaking, the results indicated that the multiple-choice glosses are more effective than the single glosses for recalling the target vocabulary and grammatical items.

Analyzing the correctly recalled target words in each frequency level, it is found that there is a tendency to recall the target words better when they were presented more frequently. One month after the experiment, the students took the retention tests. The results of the t-test showed that there was no significant difference between the two groups on the vocabulary test, while the difference on the grammar test was statistically significant at the 0.05 level, favoring the multiple-choice group. These results illustrate that a one-day lesson is not sufficient to establish long-term memory. Overall, the results of the empirical study with Banzai Reading indicate that a procedure in which multiple-choice glosses are augmented by immediate feedback regarding errors can achieve better pedagogical effects than a single-gloss procedure.

Table 2. 1 Summary of the Studies about Multimedia Glosses

	Purpose	Participants	Results
Chun& Plass(1996)	Compare the effects of three gloss types (1)text definition (2)text+ picture (3)text+ video.	160 university students of German	Text+ picture were the most effective gloss type.

Plass et al (1998)	Compare the effects of four conditions (1)verbal glosses (2)visual glosses (3)verbal+ visual glosses (4)no glosses.	103 university students of German	(1)Verbal+ visual glosses were most effective. (2)Text+ picture glosses were more effective than text+ video glosses.
Nagata (1999)	Studied the effectiveness of two gloss types (1)single-gloss version (2)multiple-choice version.	26 learners of Japanese	Multiple-choice glosses were more effective than the single glosses.
Al-Seghayer (2001)	Compare the effects of three gloss types (1)text definition (2)text+ still pictures (3)text+ video.	30 intermediate ESL students	The printed text definition with video clips produced the best results.
Gettys, et al. (2001)	Compared two conditions: reading with the help of (1)basic dictionary form (2)sentence-level L1 morphological equivalents of L2 words.	22 native speakers of English studying Russian	Reading with the help of the dictionary form was more beneficial.
Yoshii& Flaitz (2002)	Compare the effects of three gloss types (1)text only (2)picture only (3)text+ picture.	151 beginning and intermediate ESL learners	Text+ picture group outperformed the other two groups.
Yeh& Wang (2003)	Compare the effects of three gloss types (1)text (2)text+ image (3) text+ image+ sound	82 ESL university students	Text+ image glosses were the most effective.

The existing multimedia annotation literature (summarized in Table 2.1) shows that computerized glossing does indeed have an impact on vocabulary acquisition in

particular, and reading comprehension in general. Learners showed a better ability to retain vocabulary when they work with a multimedia program. Picture aids facilitate vocabulary learning when they are combined with textual information. As to what type of visual aids being more effective, the results seem inconclusive.

The two empirical studies which compared effects of different types of visual cues, graphics and videos, were summarized in Table 2-1.

Table 2. 2 Comparison of Two Studies: Chun and Plass (1996) and Al-Seghayer (2001).

Study		Participants	Text	Design	Gloss type	Word type of target words	Assessment	Delayed	Others	Result
Chun & Plass (1996)	Study 1	English speakers; second-year German students at university(N=36)	762 words	within-subject	audio+ text(German)+ pictures or videos	15words(verb, noun)	production: indicate (provide)English equivalent for a German word	2weeks later	(1)preview video as advance organizer (2)pictures were of higher quality than videos	
	Study 2	(N=103)			audio+ text(English)+ pictures or videos	36words(verb, noun, adj)		NA		picture> video
	Study 3	(N=21)					recognition: choose German word(out of 6) that corresponds to picture, video, or text	1week later		no difference
Al-Seghayer (2001)		different linguistic backgrounds; intermediate ESL at university(N=30)	1300 words	within-subject	audio+ text(English)+ pictures or videos	21words(9adj, 6verb, 6noun)	recognition(21 words, four alternatives in English); production(6words, define in English)	NA		video> picture

As to learners' attitude, studies of glosses in a multimedia environment showed that learners like reading with on-line glosses, which also encouraged more reading.

2.3 Theoretical base for multimodal presentation

In addition to empirical studies, theories also support the multimodal presentation of glosses. In the related literature, the dual-coding theory, the generative theory and the binding concept are usually used to explain why additional pictorial cues can enhance incidental vocabulary learning. Besides, the cognitive load that visual aids help to relieve for our brain also provides a theoretical base that encourages researchers and teachers to use different types of glosses in their studies and in their teaching.

2.3.1 Dual-coding theory

The Dual Coding Theory (Paivio, 1971, 1990) provided a theoretical base for studies using multimedia forms of glosses. The theory posits that human memory consists of two subsystems, one verbal and one visual. The visual system processes and stores more-concrete information, such as images, sounds, and feelings. The verbal system processes and stores language and other abstract information. They are two independent yet interconnected systems in human memory and cognition. From the theory, we can predict that additional pictorial cues will help learners make associations between pictures and words, and thus can make learning more effective

and efficient (Oxford & Crookall, 1990). That is, information is better remembered when dual rather than single coded, because when one memory trace is lost the other remains available. Moreover, pictures are better remembered than words because pictures are more likely to activate the image-to-word referential connections, so they can be coded both visually and verbally (Clark & Paivio, 1991; Mayer & Moreno, 2002; Mayer & Sims, 1994; Paivio, 1986; Sadoski, Paivio & Goetz, 1991).

Underwood (1989) suggested that a commonplace principle of human learning is visual memory. We remember images better than words; hence we remember words better if they are associated with images.

Studies have also supported this theory. The series of studies conducted by Chun and Plass (1993, 1996), Plass, et al. (1998), Kost, et al. (1999), Yoshii (2001), and Al-Seghayer (2001) consistently evidenced the effectiveness of dual presentation types of vocabulary annotations (text+ visual aids) on vocabulary learning. Kost et al. (1999) also supported the effectiveness of dual annotation –textual and pictorial glosses on vocabulary. Their results supported earlier studies because students who received both textual and pictorial glosses performed better in immediate recognition tasks than the other two groups (picture-only or text-only glosses).

Yoshii's (2001) study presented similar results: text+ picture was the most effective type for immediate and delayed tests among text-only, picture-only, and

text+ picture annotations. Finally, Al-Seghayer (2001) focused on the effectiveness of still-picture and video visual aids and compared findings with those of Chun and Plass' (1993, 1996) studies. Text+ video annotations were the most helpful among text only, text+ still picture, and text+ video clip annotations.

2.3.2 Generative theory

Generative theory, which is proposed by Mayer (1997), is based on Wittrock's (1990) generative theory and Paivio's (1986) dual-coding theory. The theory assumes that learners of a second/foreign language have two separate verbal systems (L1 and L2) and a common imagery system. Translations of words via simultaneous verbal and visual presentation would not only link the two verbal systems, but this storage in the second verbal system would also have an additive effect on learning (Paivio & Desrochers, 1980). In order to meaningfully comprehend a text in a multimedia format, learners must select relevant pictorial and/or linguistic information from it, organize the input into coherent visual and verbal mental representations, and then integrate the newly constructed representation with others by constructing referential connections between the two.

2.3.3 Terrel's binding concept

With regard to high-imagery concrete vocabulary learning, Kellogg and Howe (1971) found that foreign words associated with images or actual objects are learned

more easily than those without such additional information. Terrell (1986) found that combining an unknown L2 word with a visual representation bypasses a direct translation and facilitates vocabulary learning. He (1986) maintains that the binding of form (unknown L2 vocabulary) to meaning (visual representations) is the most effective way for learners to acquire concrete ideas and references. The process of comprehending pictures differs greatly from that of comprehending texts, as they employ different representations of knowledge. Texts are symbolic representations of information which are processed sequentially, whereas pictures are analog representations of information which may be mapped directly onto the mental model. This is due to the fact that both visual images and the mental model represent content matter in the same fashion, i.e., both utilize analogies (Chun and Plass 1997).

Supporting Terrell's binding concept, learners also showed a positive attitude toward pictorial glosses over textual glosses. A participant in Lomicka's (1998) study praised the availability of pictorial annotations within a multimedia text: "These pictures are GREAT 'cause then I associate a picture with a word and hence I'm not translating. I'm just going straight from images. So that really helps figuring out meaning" (48).

Underwood (1989) suggested that we "remember images better than words, hence we remember words better if they are strongly associated with images" (p. 19).

Other research suggests that foreign words associated with aural or written translations and images are learned more easily than are those accompanied by pictures or text alone (Baltova, 1999; Guillory, 1998; Jones & Plass, 2002; Oxford & Crookall, 1990; Plass, et al. 1998). For example, Oxford and Crookall (1990) suggest that the combination of pictures and text accesses more parts of the brain, thereby leading to greater depth of processing than when text is processed alone. Oxford and Crookall (1990) summarized that:

Most 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. (...) Moreover, the pictorial-verbal combination involves many parts of the brain, thus providing greater cognitive power.

Baltova (1999) examined the effects of viewing a French video with either French audio and French subtitles (bimodal format), or English audio and French subtitles (reversed format) on students' vocabulary learning. She found that students learned significantly more vocabulary when they viewed the audio-visual material with both French subtitles and French audio present than in the reversed format where they viewed the video with English audio and French subtitles.

2.3.4 Relieving cognitive load

Gettys, et al. (2001) referred to computerized glosses as a means of aiding second language reading by performing most bottom-up functions, thus relieving the working memory and attention from the burden of cognitive overload and allowing

more of the reader's attention to go toward top-down processes. On-line glossing then, which provides fast and easy access to the meanings of unknown words, makes up for insufficiently automatic bottom-up processes and deficiencies in processing capacity, and thus allows the reader to attend to top-down processes. Presumably, the faster and more efficiently the lower-level functions are performed, the closer their performance is to the real time performance rate, the more the higher-order functions will benefit.

2.4 The value and effect of visual information for vocabulary learning

Omaggio (1979) conducted the first empirical study on the impact of pictures on reading comprehension with beginning college French students. She found that pictures produced a significant improvement in reading comprehension in French.

More recent research has narrowed the focus to include studies on the effects of visual imagery on L2 vocabulary acquisition. In a critical analysis of L2 vocabulary learning techniques, Oxford and Crookall (1990) stated that most learners are capable of associating new information to concepts in memory by means of meaningful visual images that make learning more efficient. Visual imagery is known to help learners package information more efficiently than they could if using just words alone. Moreover, the pictorial verbal combination involves many parts of the brain, thus providing greater cognitive power (p. 17).

A study by Snyder and Colon (1988) investigated the influence of both audio and

visual aids on facilitating second language acquisition. Two groups were taught for 7 weeks under two different conditions. One was exposed to a standard curriculum with audio-visuals limited to overhead transparencies, audiotapes with accompanying fill-in pictures, and slides. The other group was exposed to a curriculum enriched with more audio-visual aids, such as additional overhead transparencies, audio tapes and slides, as well as one bulletin board for reviewing material, and another for students to bring in materials from home, pictures from magazines, cut-out dolls to identify and reinforce names for parts of the body, and picture flash cards. After testing both groups on the material covered, it was found that the group provided with additional audio-visual aids performed significantly better in vocabulary retention.

Kost, et al. (1999) carried out a study comparing the effects of pictorial and textual glosses on incidental vocabulary growth for foreign language learners.

Participants were asked to read a passage under one of three glossing conditions: textual gloss alone, pictorial gloss alone, and text combined with pictures.

Performance on both production and recognition tests of 14 words was better for those who were allowed to use a combination of text and picture. The theoretical explanation for such results, the authors argue, is that processing information requires different degrees of cognitive effort. The two different representations allow plotting of the picture into one mental model and thereby provide a “stronger bond” than the

plotting of the words (p. 94).

As to the efficacy of video in the domain of L2 vocabulary acquisition, Neuman and Koskinen (1992) state that captioned video with sound provides a semantically enriched context where the visual and the audio lend meaning to the printed words on the screen. Their study compares learning vocabulary through watching television, through reading and listening to a document, and through listening alone. The results indicated that words were learned and retained best from watching television.

Brown (1993) used a videodisc to evaluate the effects of word frequency and saliency, or importance. In terms of frequency, the author examined two issues: whether the particular context in which the word appears makes a difference, and whether the general frequency of a word in the language permits accurate prediction if the word is going to be learned or not. With respect to word saliency, the author considered two issues: (a) whether giving the word to be learned an emphasis in the program would lead learners to acquire it, and (b) whether presenting the concept in the instructional material but delaying presenting the word associated with it until it appeared in an exercise or gloss would lead learners to acquire that word. Brown found that there was a relationship between word learning and the general frequency index of words learned, but that the specific frequency of words in the videodisc program was not as significant as their general frequency. In terms of word saliency,

she found that word learning was facilitated when concepts were activated by a visual image prior to the presentation of the corresponding word in written form. Brown ascribed this finding to the fact that evoking the concept in the form of an image before the word-form appeared made the vocabulary easier to remember.

Duquette and Painchaud (1996) compared listening to a dialogue with and without visual aids in order to determine which would better allow learners to guess the meaning of new words. Participants listened to a dialogue on the subject of driving a car under two conditions. Under the first condition, they listened to a dialogue while a videotape played. Under the second condition, they listened to the same dialogue with only an audiotape. Results indicated that the learners in the video group made gains on 8 unfamiliar words out of a total of 40, whereas the audio- only group learned only 3. The authors speculated that the “match between prominent visual cues and linguistic ones allows for the inference of unfamiliar words” (p. 158).

One study that undertook to compare the effect of video clips and static pictures on comprehension and retention of a written passage was carried out by Hanley, Herron, and Cole (1995). Their study showed that a video clip is a more effective organizer than a picture. Twenty-eight college students of French, divided into two groups, took part in the study. Group One was shown a short video clip with French narration. Group Two was presented the same narrative with the teacher reading it

aloud while presenting four still pictures of the context. The students in Group One performed significantly better on a comprehension and retention test than those in Group Two. The authors contended that the video clip proved to be more effective in aiding comprehension and retention because video aids in “conceptualizing language,” that is, linking language form to meaning (p. 63).

Multiple studies demonstrate that both dynamic video and still pictures are more effective than instructional modes that lack imagery.

Davis (1989) noted the advantage of hypertext annotations when readers have access to vocabulary information such as pronunciation, video, text, and graphics.

Martinez-Lage (1997) also suggested that in addition to the huge amount of information provided by hypertext annotations, CALL also offers two other advantages for vocabulary learning: images can assist viewers to reject or confirm their previous hypothesis about a word, and they have additional opportunities to interact with the text.

General observations can be made about the literature pertaining to the use of video and pictures to teach new vocabulary. It is important that selected pictures and video segments depict meanings precisely and do not contain too much information. In other words, they should be simple illustrations. The effects of videos and pictures on L2 vocabulary acquisition seemed more effective than other modes of presentation,

particularly audio. This may result from the fact that students can visualize what the word means and relate the words to actual objects.

The literature unanimously support the use of multimedia to enhance L2 vocabulary acquisition because it is a single interactive presentation environment for diverse instructional resources including printed texts, photographs, slides, dynamic audio, and dynamic video. The varied and interactive nature of multimedia instruction makes reading, listening, and speaking both engaging and enjoyable.

Additionally, the immediacy of access and student independence make learning more efficient and effective. Finally, the combination of media enhances learning because words are dually coded resulting in referential connections that are constructed between the verbal and visual systems.

2.5 The role of animation as an aid in learning in general

Gagne and Driscoll (1988) created a basic model of learning and memory. This model is revised by Zhu and Grabowski (2006) to show how animation can work as an aid to both dual-coding and information processing, as shown in Figure 1. Humans can process visual and verbal information at the same time from the environment.

Animation is said to be more likely to be dual coded as both visual and verbal knowledge because of its dynamic qualities (Lin, 2001). Animation can gain learners' attention and thus ensure selective perception. Besides, animation helps to facilitate

encoding and retrieval processes by connecting information and providing alternative retrieval pathways (Gagné, 1985).

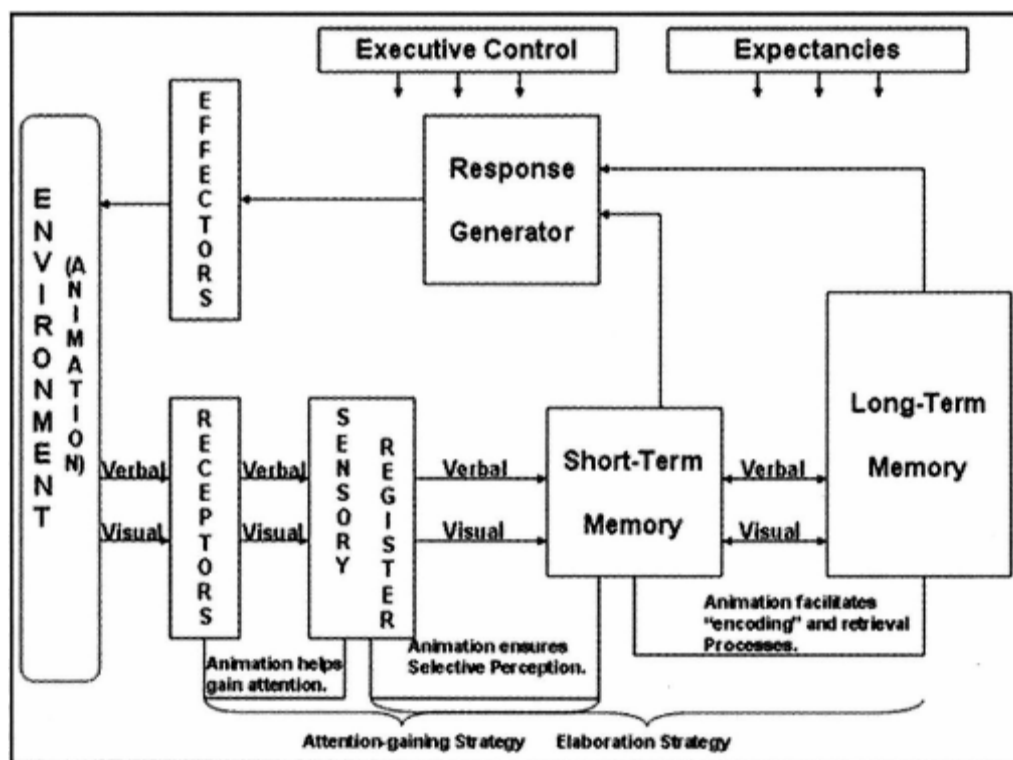


Figure 1: A model of animation, dual-coding and information processing.

(Gagné, R. M. & Driscoll, M. P. 1988, cited in Zhu, L. & Grabowski, B. 2006: 333)

As to empirical studies, Zhu and Grabowski (2006) investigated the instructional effects of two web-based animation strategies compared with static graphics on achievement of college-level students with high and low levels of prior knowledge. They found that the participants in the static graphics groups performed equally as well as those in the animation strategies group. Though this finding adds to the literature that supports the power of static graphics over that of animation, this overall finding continues the debate about the value of animation versus static visualization.

Rieber (1990) reviewed 13 empirical studies of animation's effects on Computer-Based Instruction and found that 5 of them revealed significant effects for the animated treatment. Park and Hopkins (1993) summarized 25 studies of the effects of dynamic versus static visual displays. Among the 25 studies, 14 showed significant effects for dynamic visual displays. Anglin, Vaez, and Cunningham (2003) summarized the results from 42 studies consisting of at least one animation treatment. They found 21 out of 45 comparisons showed significant animation effects. Besides above-mentioned studies, there are still some studies conducted after 2000 yielded significant effects for the animation treatment under certain circumstances (Blankenship & Dansereau, 2000; Catrambone, 2002).

From those experiments conducted in different subjects areas, the mixed results informed us that the effects of animation needs to be further investigated. The present study sought to add to the literature that examined its effects on foreign language learning, especially on incidental vocabulary learning.