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Vocabulary Learning through Audios, Images, and Videos: Linking Technologies with Memory

Munassir Alhamami (munassir7@gmail.com)
King Khalid University, Saudi Arabia

Abstract

This study investigates the effectiveness of three vocabulary-teaching methods on Saudi students' acquisition of English word meanings in their L1 using technology. Ninety-nine EFL students tried each of the three methods: (a) associating the words' meanings with relevant audios, (b) associating the words' meanings with relevant images, (c) associating the words' meanings with relevant videos, without sounds inside language leaning laboratories. The study used two instruments: a lesson treatment to examine the effectiveness of the three treatments and a questionnaire to understand students' attitudes toward the three treatments. The results of the lesson treatment showed statistically significant improvement in memorizing words' meanings that are associated with images but not for words' meanings that are associated with audios or videos without sounds. The questionnaire results revealed that the students perceive the image associative method as the most helpful, followed by the audio associative method and the video associative method respectively. The results of the treatment lead to the conclusion that the students remember the foreign language words' meanings in their L1 better when the words' meanings are associated with images. This might be because (a) strong links between the nodes that contain words' meanings and the nodes that contain images in human memory, (b) the image associative method draws the attention of the students more strongly, (c) stronger positive attitudes of participants toward the use of image associative methods in language classrooms than video or audio associative methods.

Keywords: Vocabulary & Technology; Technology & Associative Network Theories, Videos, Images, Audios, and memorizing words' meanings

Introduction

Learning the meanings of a foreign language's words is a key challenge in learning a foreign language. Wilkins (1972) writes, "Without grammar, very little can be conveyed, without vocabulary, nothing at all can be conveyed" (p. 111). Learning vocabulary is the first step to learn a foreign language. Language learners need to learn vocabulary before they learn grammatical rules, reading skills, and writing skills. Harmer (1994) writes, "if language structures make up the skeleton of language, then it is vocabulary that provides the vital organs and the flesh" (p. 153). Vocabulary is the basic element of the language. It is the

subject that foreign language teachers include in all of their language learning skill classes such as reading, writing, listening, and speaking. Vocabulary is taught in all language learning proficiency levels from beginner to advanced levels. Teachers start teaching vocabulary from the beginning and throughout their language lessons, assigning vocabulary homework activities, and testing vocabulary knowledge during the exams.

There are different examples that show the importance of learning vocabulary. For example, major international language exams such as TOEFL, IELTS, GMAT, GRE, ITEP, and CAEL include vocabulary knowledge testing in the exam tasks. Knowing words' meanings helps the students to understand the reading materials, write essays, do presentations, and understand people's conversations. As a result, language students develop different strategies to learn vocabulary meanings, and the teachers use different methods to teach vocabulary. One effective approach is translating the words' meanings into the students' L1 by finding equivalents in that language. Non-native language teachers, especially in foreign language contexts, translate the words into the students' L1 because they usually share the same mother tongue. Learning words' meanings is not an easy task. Language students have to learn large amount of vocabulary in order to become fluent in the target language, and may forget the words' meanings. Language teachers thus face the challenge of helping the students to remember the meanings.

This paper examines and compares the effectiveness of three EFL vocabulary-teaching methods on the students' acquisition of word meanings in their L1 using technology, and measures their attitudes toward these methods. It conceptualizes the effectiveness of associative learning methods by testing three important input modes that technology provides the language-learning classroom: audio, image, and video. Hegelheimer and Chapelle (2000) write that the use of texts in computer screens with glosses provide the learners with different input. However, "each of these provides learners with a variety of input modification and raises the empirical question of whether some types of modifications are more effective than others for learners." (p. 56). In this study, the first method is associating the words' meanings with relevant audios played on the computer such as associating the verb *wail* with the sound of a child crying and associating the verb *trick* with the sound of a clock ticking. The second method is associating the words' meanings with relevant images on the computer screen such as associating the verb *wail* with an image of a child crying. The third method is associating the words' meanings with relevant dynamic videos on the computer screen without sounds such as associating the verb *wail* with a video of someone crying.

Literature Review

Vocabulary is an essential part of language that students must master in order to understand a language (Carter, 1998; Liu, 2009; Nation, 2001, 2008; Tozcu & Coady, 2004). The improvement of vocabulary skills directly affects the other language skills positively because lexical items are the basic units of language, and L2 learners need vocabulary to increase

their listening, speaking, reading and writing. L2 learners are likely to improve their comprehension and production by learning new words. However, vocabulary learning has long been neglected within the field of foreign language studies, and there is a need for more studies that investigate vocabulary learning in foreign language research (Coady, 1993; Coady & Huckin, 1997; Davis, 1989; Gass, 1987; Read, 2004; Zimmerman, 1997), as well as a significant need to understand the best practices of teaching vocabulary using technology since modern technologies have been integrated into our daily life. The advancements in technology may be particularly helpful for teachers in creating strategies to increase students' mental lexical dictionaries.

Foreign language learners need to have enough vocabulary in order to adequately communicate with others. For example, language learners need to build up an adequate vocabulary in order to cope with vast reading contexts (Ma & Kelly, 2006). Thus, language learners should receive training on vocabulary learning strategies (Carter, 1998; Ma & Kelly, 2006; Tozcu & Coady, 2004). Building enough vocabulary to be able communicate in the target language is a long process (Yip & Kwan, 2006, p. 247), and difficult to achieve (Coxhead, 2000; Liu, 2009). Although the students want to improve their vocabulary and need help to develop strategies for independent language learning (Kingston, 2001), language teachers tend to think that vocabulary is not as important to learn as grammar (Tozcu & Coady, 2004). As a result, the students do not develop their vocabulary, but instead, focus more on grammar rules.

Vocabulary Knowledge

Vocabulary knowledge has different aspects. Different researchers proposed different definitions of vocabulary knowledge. In retrospect, Richards's (1976) study was probably one of the earliest studies that tried to discuss assumptions about what constitutes vocabulary knowledge. Schmitt (2014) stated that Nation's (2001) classification of word knowledge is still considered the best specification of the range of so-called word knowledge aspects to date, since it involves receptive and productive levels of mastery. Nation (2001) classified word knowledge into three categories as illustrated in Table 1.

Table 1.
Nation's Table of What is Involved in Knowing a Word

Category	Subcategories
1. Meaning	A. Form and meaning (Is the word a loan word in the L1?)
	B. Concept and referents (Is there an L1 word with roughly the same meaning?)
	C. Associations (Does the word fit into the same sets as an L1 word of similar meaning?)
2. Form	A. Spoken form (Can the learners repeat the word accurately if they hear it?)
	B. Written form (Can the learners write the word correctly if they hear it?)

	C. Word parts (Can the learners identify known affixes in the word?)
3. Use	A. Grammatical functions (Does the word fit into predictable grammar patterns?)
	B. Collocation (Does the word have the same collocations as an L1 word of similar meaning?)
	C. Constraints on use (Does the word have the same restrictions on its use as an L1 word of similar meaning?)

Note: This table is adapted from Nation (2001)

Vocabulary knowledge can be classified into two categories: passive (receptive) and active (productive) knowledge of a word (Laufer and Goldstein, 2004; Meara, 1990; Nation, 2001). Translating the meaning of foreign words into the students' L1 can qualify as active knowledge of a word (Schmitt, 1999) since students have to produce the meanings. Other researchers (e.g., Takala, 1984) believed that translating the meaning into L1 is passive knowledge of words since it demonstrates comprehension of the meaning rather than availability of the L2 word form (Laufer, Goldstein, 2004). This paper tests vocabulary knowledge by translating the meaning into L1.

Measuring different parts of vocabulary knowledge can be difficult to conduct in a single study. Laufer and Goldstein (2004) noted that most of the vocabulary tests that are based on the knowledge components model measured just one component of vocabulary knowledge in a single study. For example, Meara and Buxton (1987) and Nation (1983) tested the comprehension of meaning component of vocabulary knowledge. Laufer and Nation (1999) tested the production of meaning component of vocabulary knowledge. Arnaud (1992) and Laufer and Nation (1995) tested the vocabulary use component of vocabulary knowledge. Laufer and Goldstein (2004) stated that there are few tests that attempt to measure simultaneously several components of vocabulary knowledge as done in Read (1989) and Schmitt (1999).

The Use of Students' L1 to Learn Foreign Language Vocabulary

The use of students' L1 in foreign language classrooms has different advantages to facilitate the teaching and learning process. For example, Schmitt (1997) surveyed 600 Japanese EFL students about the most helpful strategies to learn English vocabulary. He found that the bilingual dictionary is the most helpful strategy to learn vocabulary from the students' perspective. Schmitt concluded that although many language educators have advocated the use of monolingual dictionaries in the classroom, students prefer the use of bilingual dictionaries. He encouraged researchers and educators to look for learner preferences since it is one of the most important factors for success in the learning process. Al-Nofaie (2010) examined the attitudes of Saudi teachers and students towards employing Arabic as a facilitating tool in English classes. She used questionnaires and interviews to gather the data from 30 students and three teachers of English. The results revealed both the teachers and the

students held positive attitudes toward the use of Arabic to learn English. Ramachandran and Rahim (2004) investigated the effectiveness of the translation method in teaching vocabulary to elementary level ESL learners. The participants were divided into two groups. The first group used the learners' L1 as the medium of instruction. The second group used only the target language as the medium of instruction. The results revealed that the translation method had a positive impact on learners' recall and retention of the meaning of words that they learned. The translation method group performed better. Laufer and Shmueli (1997) found that words glossed in students' L1 were better retained than those glossed in their L2. In addition, they found that words presented in lists and in sentences were remembered better than words presented in text and elaborated text. Their results suggested that students should learn new vocabulary and relate them to their L1 using bilingual lists. Moreover, Prince (1996) found that less proficient learners recall new words better using L1 translation than L2 context.

Vocabulary Learning Strategies

There are several vocabulary learning strategies (Schmitt, 1997). For example, Oxford (1990) classified vocabulary-learning strategies under six major strategy categories: Memory, Cognitive, Compensation, Metacognitive, Affective and Social. In this paper, I will discuss strategies related to memory. Oxford (1990) discussed several memory strategies to learn words with the key common feature between them that they were dependent on association such as audios, images, body movements, and physical locations. Schmitt (1997) stressed that "most memory strategies (traditionally known as mnemonics) involve relating the word to be retained with some previously learned knowledge, using some form of imagery, or grouping" (p. 211). Researchers (e.g., Oxford, 1990; Schmitt, 1997; Thompson, 1987) encouraged the use of mnemonics to learn vocabulary since it helps to remember the words. Thompson (1987), for example, classifies mnemonic strategies into five classes, namely linguistics, spatial, visual, physical response and verbal methods (as cited in Amiryousefi, 2015). Schmitt (1997) listed different types of mnemonics: (a) Images/imagery: New words can be learned by studying them with images of their meaning. (b) Related Words: new words can be linked to L2 words which the student already knows such synonyms and antonyms. (c) Unrelated words: The learner can also link words together that have no relationships by creating a story that links them together. (d) Grouping: grouping is organizing words into groups naturally without prompting such as names of animals, names of kitchen utensils, names of music instruments. (e) Word's orthographical or phonological form: the student focuses on the target word's orthographical or phonological form to facilitate recall.

There are few studies that used associative vocabulary methods. For example, Ahour and Berenji (2015) compared loci methods that depend on association and rehearsal methods that depend on repetition to know which one leads to better retention and recalling of words using 80 EFL Iranian learners. They found that the loci methods group was better in retention and recall of lexical items both in an immediate posttest and in a permanency of lexical items in long-term memory. Another example of the use of associative methodology is Asher's teaching method. Asher (1977) built his method, the Total Physical Response Method (TPR)

based on the use of physical action. TPR is on the coordination of language and physical movement. Schmitt (1997) stressed that the use of physical action has been shown to facilitate language recall.

Anonthanasap, He, Takashima, Leelanupab, & Kitamura, (2014) and Anonthanasap, and Leelanupab, (2015) proposed a new system called iMnem to learn vocabulary based on a mnemonic technique by applying phonetic algorithms for mnemonic word generation. The mnemonic word generation is achieved by three algorithms: Link system, phonetic algorithm and Levenshtein distance. The interactive visualization of the generated words with images is provided by D-Flip (Dynamic, Flexible and Interactive Photoshow). Figure 1 illustrates learning the Japanese word Teberu by English speakers. The researcher explains that the target word "Taberu" in Japanese has a similar sound with the word "Table" in students' L1. The learner provides the sentence that links the mnemonic keyword with the foreign word in their system. For Example: The Japanese word for Eat is "Taberu". Imagine You "EAT" your lunch on the "TABLE"

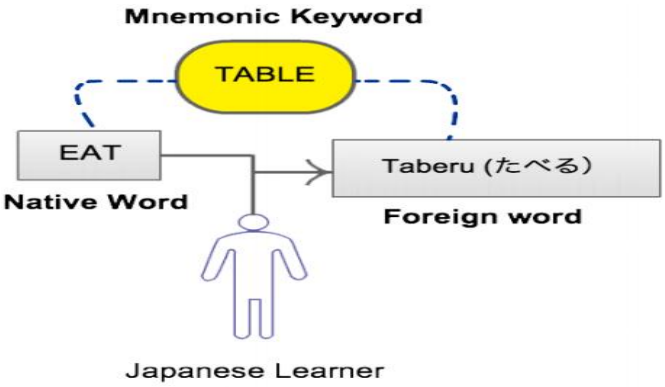

Figure 1. Learning Japanese in iMnem

Language teachers can utilize modern technologies to help students learn vocabulary effectively. There are a number of studies that show the usefulness of incorporating modern technologies in language classrooms (Al-Jarf, 2007; Carter, 1998; Liu, 2009; Nation, 2001; Tozcu & Coady, 2004; Stepp-Greany, 2002; Stockwell, 2007). According to these studies, using technology can be an effective tool to learn vocabulary. For example, Groot (2000) found that using technology can be effective to help students learn a large number of words in a short period of time at the intermediate and advanced stages of language acquisition. There are also studies that show the effectiveness of using multimedia technology to teach vocabulary in language classrooms (e.g., Al-Seghayer, 2001; Ariew & Ercetin, 2004; Chen, 2006; Chun & Plass, 1996; Kost, Foss, and Lenzini, 1999; Rusanganwa, 2012; Yanguas, 2009; Yeh & Wang, 2003).

There is a need and benefit of connecting traditional/existing methods with newer instructional technologies. There is a need for connection between theoretical learning

frameworks and modern technology practices in language classrooms in order to support the use of modern technologies in language classrooms. Modifying traditional learning methods to fit technology can help teachers in the classroom. Based on associative network theories, different learning methods have been built throughout education history such as the Pegword method, the Linkword method and the method of loci. These methods are believed to improve the students' ability to remember content, vocabulary, items, and information. There is a need for research to test the effectiveness of these associative learning methods with the use of modern technologies. CALL teaching methods should be based on sound theory, practice, and research (Chapelle, 2001).

Theoretical Framework

This paper uses associative network theories as a theoretical structure. It assumes that memory is made up a set of nodes connected by links. These nodes may represent words, images, sounds, concepts, or nothing at all (Bekerian and Levey, 2012). Linking the items in two nodes helps the person to remember the items more easily than if there are no connections. If the links between these nodes are strong, there is more opportunity to remember the items in these two nodes. In psychology, association between two pieces of information is a fundamental concept. Hebb (1949) proposed a learning theory that can be summarized in the following sentence, "cells that fire together, wire together" (Schatz, 1992, p.64). In this study, this suggests that the nodes that contain words will wire more strongly with the nodes that contain audios, images, or videos. In his book *The Organization of Behavior: A Neuropsychological Theory*, Hebb (1949) explains, "When an axon of cell A is near enough to excite cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased" (p. 63). Hebb's theory provides a way to explain how a node can "learn" to produce a desired output from given inputs by connecting them. The study investigates the relative efficacy of three methods of presentation and the results may be explained by the Hebb's theory of associative learning.

There are various different methods that use the "mnemonic device" associative strategy to increase learning. A mnemonic device translates information into a form that the human brain can retain better by associating abstract concepts with concrete ones. One of the oldest methods of this is the method of loci. It is an ancient Roman method to memorize items by associating them with physical locations. Believing that human memory could better remember information through locations, Romans memorized items by mentally or physically walking a familiar route and associating these items with specific landmarks on their journey. This belief assumed that the node that contained the information had a strong link with the node that had the required items to remember.

Another method is the Linkword method promoted by Michael Gruneberg (see Gruneberg & Jacobs, 1991). The Linkword method links a vocabulary word to a word in the students'

native language that sounds like the foreign word to be remembered. It is based on the similarity of the sounds of words in the students' language and the target language. For example, the Japanese words for shorts is *han zubon*. The students memorize it by associating *han zubon* with this English sentence: my hands upon your shorts. One other method is the peg system method, where a list of words is memorized by associating the words with numbers that have the same rhythm. For example, one ate a bun, two in shoes, three for free, four on the floor, five is alive, six on sticks, seven in heaven and so forth.

This paper proposes an associative model to fit the use of technology to learning languages based on the five human senses. Current technologies can present three main forms of output: vision, audio, and touch. Technology in the near future might also be able to present smell and taste such that the five human senses can be testable in a regular language classroom. The five forms of output can thus contain different items based on the categories of sight, hearing, touch, smell, and taste. Modern technology could therefore be used to encompass any outputs that the students can see, hear, feel, smell and taste, respectively.

Some language teachers might argue against this proposed model. They might think that only a small amount of vocabulary can be learned this way, mostly restricted to concrete words and unsuitable for abstract words which account for a large proportion of any language, and might argue that it would be difficult to find corresponding sounds, images, and videos for some of the words in a language. This is not necessarily true. Abstract words such as love, danger, and intelligence have associative images, signs, and sounds. There are several image dictionaries, such as the Oxford Image Dictionary, and teachers can utilize the Internet, such as Google Image Search, to find corresponding images. Furthermore, while it is true that it is hard to find equivalents for all words in a language, high frequency words do indeed have associative audios, images or movements.

Based on human's five senses, language learning by associating can be divided into five categories as illustrated in Table 2.

Table 2
Five Senses Associative Model

Input	Categories
Sight	Examples: image, animations, videos, printed texts, colors, diagrams, drawings, maps, signs
Hearing	Examples: narrations, environmental sounds, animal sounds, music, high pitch, low pitch
Touch	Examples: based on path of motion, based on repetition of motion, presence of muscle contraction
Smell	Examples: musky, putrid, pungent, camphoraceous, ethereal, floral, pepperminty, etc. Intensity: very weak, weak, distinct, strong, very strong, intolerable.
Taste	Examples: bitter, salty, sour, astringent, sweet, pungent, and umami.

This paper tests three forms of input that are the most common in the use of technology in education at the time of publication: images, sounds, and videos without sounds as illustrated in Figure 2. In images and videos, learners use the sense of sight and in audios, they use the sense of hearing. The rationale for focusing on memory in this study is the fact that memory is an important language acquisition factor (Ellis, 1994; Larsen-Freeman & Long, 1991; Skehan, 1998). The role that memory plays in vocabulary learning has an immediate practical value, as lexical knowledge is more prone to attrition than other linguistic aspects (Schmitt, 2000). The rationale for incorporating technology in this study is that "CALL glossing in first language (L1) or second language (L2) texts has been shown by previous studies to be more effective than traditional, paper-and-pen L1 glossing" (Taylor, 2013, p.63).

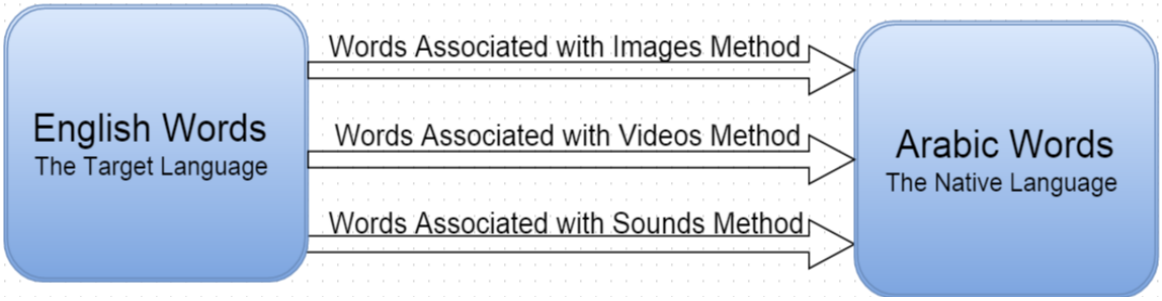

Figure 2. Illustration for the study three treatments

Research Questions

The first question is do EFL students remember English words' meanings in their L1 more when the English words are associated with audios, with images, or with videos without sounds when presented on a computer screen?
The second question is what are EFL students' attitudes toward learning English words' meanings in their L1 when the words are associated with audios, images, and videos without sounds when presented on a computer screen?

Methods

Context and Participants

In this study, the participants are 99 undergraduate EFL students in an English Department at a Saudi University, which offers a four-year Bachelor of Arts majoring in English. The students in this study are Saudi, and they share the same culture and mother language, Arabic. Their ages are between 19-25 years. The requirements to attend the English Department are passing high school and the Saudi National Exam (GEYAS) with acceptable grades. The students are not required to do any special English language test such as TOEFL or IELTS

that shows their English proficiency. From the teachers' perspectives and the researcher's observation, the students English proficiency level is low. In order to know the required sample size to conduct this experiment, power analysis was conducted in G*Power software. Running a power analysis on a repeated measures ANOVA with three measurements, a power of 0.95, an alpha level of 0.05, and a medium effect size (f = .25), the required sample size is 43.

The participants came in groups of around 10 to 15 at a time to the language laboratories. The Department has several language learning labs, which are equipped with language teaching and learning devices such as overhead projectors, computers, headphones, and smart-boards.

Figure 3. Three illustrations of how the verb *trot* was presented in the three methods

Materials and Instruments

The first instrument was the lesson treatment. The lesson contained three videos that were created using the Windows Movie Maker software to test the three associative methods with three groups in differing orders. The three videos presented the three teaching methods in different orders as illustrated in in Table 3 and Table 4. Each video contained the same 12 verbs with different input associations. The English verb appeared at the top corner on the left side and its Arabic equivalent appeared on the right side as a permanent subtitle on the top of the screen as illustrated in Figure 3. This fitted with the writing system of both languages—English starts from the left to right and Arabic starts from right to the left. The reason for choosing only verbs and not including different parts of speech was that research showed that some parts of speech are more difficult to learn than others (Laufer, 1990). This prevented any claim that the part of the speech was interfering with learning rather than the method itself.

The verbs were presented on the computer screen with their equivalents in Arabic. Four verbs and their equivalents were presented in each method. For example, the first four verbs had relevant audios. The next four new verbs had relevant images, and the last four verbs had

relevant videos. The 12 verbs were divided into three groups as shown in Table 3. The researcher also showed the participants some samples that contained verbs not included in the treatment to explain the experiment; instructions appeared before each of the three sections. The instructions were written in English and Arabic to make sure that the students understood the requirements of the experiment. Each verb and its equivalent were displayed for one minute on the computer screen. The conditions of the verbs chosen were that they were new for the students and had four letters, since longer verbs might present more difficulty than short verbs (Baddeley, Thomson, & Buchanan, 1975). To avoid the possibility that some verbs might fit more with a particular method, the same sets of verbs were shown using different methods for each the three groups as shown in Table 3. This prevented the potential for particular verbs to affect the results rather than the methods themselves. For example, some verbs might fit more with audios such as the verbs cry and shout. Table 3 shows the order of the verbs and treatments used in the three groups.

Table 3
Verbs Used in the Experiment

The First Group			The Second Group			The Third Group		
Verb	Treatment	Order	Verb	Treatment	Order	Verb	Treatment	Order
Flap	Video	1	Leap	Image	1	Trot	Audio	1
Grin	Video	1	Heap	Image	1	Wail	Audio	1
Moor	Video	1	Peck	Image	1	Tick	Audio	1
Slay	Video	1	Blot	Image	1	Bust	Audio	1
Leap	Audio	2	Trot	Video	2	Flap	Image	2
Heap	Audio	2	Wail	Video	2	Grin	Image	2
Peck	Audio	2	Tick	Video	2	Moor	Image	2
Blot	Audio	2	Bust	Video	2	Slay	Image	2
Trot	Image	3	Flap	Audio	3	Leap	Video	3
Wail	Image	3	Grin	Audio	3	Heap	Video	3
Tick	Image	3	Moor	Audio	3	Peck	Video	3
Bust	Image	3	Slay	Audio	3	Blot	Video	3
Total Number of verbs: 12			Total Number of Verbs: 12			Total Number of Verbs12		

The second instrument was the questionnaire, see Appendix A. The students were asked to rate the helpfulness of each method on a scale of one to three, with one indicating the most helpful method and three indicating the least helpful method in remembering the words' meanings. Responses from the questionnaires were analyzed and converted into percentages to indicate what the participants perceived as the most effective method. The reason for using the questionnaire was to know the students' opinions about the research methods. Knowing the participants' opinions helped to explain the results of the study.

Procedures

The 99 EFL students were randomly assigned to three groups of 33, each of which were to try the three methods in different orders in the language lab. First, the researcher started by introducing the study, and by distributing the consent form and explaining it orally. The students signed if they would like to participate. Next, the researcher introduced the treatment using a sample that did not contain the verbs in the study to make sure that the students understood what they were required to do.

Table 4.
Methods Presentation Order for the Three Groups

Groups	First Method	Second Method	Third Method
Group 1	Video	Audio	Images
Group 2	Images	Videos	Audio
Group 3	Audio	Images	Videos

Before the treatment started, the researcher distributed a test among the students to see if they already knew the meanings of the words in the treatment. Students who knew one or more words were excluded from the study. Most of them did not know the words' meanings due to their low proficiency. Each group had the treatment in different order as illustrated in Table 4 to avoid treatment order effect. The treatment for each verb lasted for one minute on the computer screen. The audio, the image or the video without sounds that were associated with the verb were repeated during the one minute. Research on vocabulary has shown the importance of repetition in vocabulary acquisition (Chen & Truscott, 2010; Elley, 1989; Joe, 1998; Stahl & Fairbanks, 1986; Webb, 2007). However, repetition is a factor that may affect learning. Several studies such as Saragi, Nation & Meister (1978) and Tinkham (1993) showed that the correlations between repetitions and learning generally were only moderate (Nation, 2001).

Next, the participants discussed with the researcher their attitudes and opinions about the three methods in the experiment in order to give them a short break after the treatment. The researcher also tried to talk to the students about their summer courses and their language learning experiences for 20 minutes. Then, the researcher distributed the questionnaire to allow the students to write their opinions about each method. After that, the researcher conducted the test. The students were tested on the vocabulary meanings by writing the meanings of the English verbs in Arabic on paper. Research shows that translation to equivalents in the students' L1 (such as English *dog* to Japanese *inu*) is a durable technique (Schmitt, 2007). The use of translation to test vocabulary learning is a reliable measure since "it allows learners to respond to vocabulary items in a way that does not draw on L2 knowledge which is not directly relevant to what is being tested" (Nation 2001, p. 351).

The reason for this is that learners might find it difficult to explain the meanings of words in the L2 because of their performance in the L2, rather than their knowledge of the tested words.

This gives the use of the L1 to test the vocabulary meanings of the L2 higher reliability. Nation (2001) stressed that "L1 translation provide a useful means of testing vocabulary, both receptively and productively, and in recall and recognition items" (p. 351). the use of the L1 to test the vocabulary meanings of the L2 is probably the one that most closely indicates whether a subject actually knew the meaning of the word while reading and listening. The meaning-translation test shows that the subject is not only capable of recognizing the word but can also assign a meaning to it without being prompted (Brown, Waring, & Donkaewbua, 2008). See Appendix B for more information about the test.

Results and Discussion

Treatments Descriptive Results

Table 5 shows the descriptive statistics for the participants' results in the three methods. The first column shows the treatment types. The second column shows the lowest achieved scores and the third column shows the highest achieved scores. This shows us the difference between the highest and lowest scores in all variables. Thus, the highest score in all variables is four and the lowest is zero. The range of all of the variables is four. The next two columns show the sum of all scores and their means in each variable or the treatment type. Memorizing the word meanings that were associated with videos achieved the lowest sum of scores (214) with a mean of 2.16. The words that were associated with audio achieved slightly higher sum of scores than the video treatment (217) with the mean of 2.19. However, the words that were associated with images achieved the highest sum of scores (256) with the mean 2.59. Some of the students scored zero in each of the three treatments, while some scored full marks in each treatment, as we can see in the following table. The mean of the three variables is varied, as we can see in the table. The mean can be considered a good estimate for predicting subsequent data points if the data is normally distributed. Since the mean is more stable than the mode and median, we can make inferences about the population from the sampling mean. The next column shows the mode of test scores. In the video treatment, three was the most achieved score by the participants, and four was the most achieved score in the audio treatment and the image treatment.

Table 5
Descriptive Statistics for Treatment Results (n = 99)

Variables	Min.	Max.	Sum.	*M*	Mode	*SD*	Variance	Skew.(*SES*)	Kurt.(*SEK*)
Video	0	4	214	2.16	3	1.41	1.99	-.23 (.24)	-1.25 (.48)
Audio	0	4	217	2.19	4	1.43	2.03	-.09 (.24)	-1.37 (.48)
Image	0	4	256	2.59	4	1.24	1.53	-.35 (.24)	-.98 (.48)

Note. *M* = Mean; *SD* = Standard Deviation; *SES* = Standardized Error of Skewness; *SEK* = Standardized Error of Kurtoses

The seventh column shows that standard deviation (*SD*). The standard deviations of the video audio, and images variables are 1.412, 1.426, and 1.237, respectively. In a normal distribution, we know that one standard deviation above and below the mean contains about 68% of the scores. Two standard deviations above and below the mean contain about 95% of the scores. Three standard deviations above/below the mean contain about 99.7% of the scores.

The last two columns show the skewness, kurtosis and their standardized errors. The data is approximately normal. The values of skewness in the data did not exceed ±2.00 and the values of Kurtosis in the data did not exceed ±7.00. However, the data showed moderate non-normality because the values of skewness and kurtosis were not zero. Researchers (e.g., Hancock & Liu, 2012; West, Finch, & Curran, 1995) suggested that any skewness greater than ±2.00 and kurtosis greater than ±7.00 shows that the distribution begins to depart substantially from normality. There is widespread consensus that violations do not seriously affect the result of one-way ANOVA repeated measures. The video variable has a negative skewness degree of -.23, the audio variable has a negative skewness degree of -.09, and the image variable has a negative skewness degree of -.35. Skewness measures the degree and direction of asymmetry, and a distribution is skewed if one of its tails is longer than the other (that is, it is not symmetrical). Since the three variables have negative skewness, the distribution is skewed to the left and the mean is less than the median. Finally, all of the variables have negative Kurtosis. Kurtosis is positive if the tails are "heavier" than for a normal distribution and negative if the tails are "lighter" than for a normal distribution.

Table 6 shows the frequency of test scores in the three treatments, the zero score was more frequent in the video treatment than the other two treatments, while the four score was more frequent in the image treatment than the other two treatments. A total of 32 students scored full marks when the words were associated with images. Comparing this with the other treatments, the video treatment had the lowest number of students who achieved full marks. The most frequent score in the video treatment was three, while the most frequent score in the audio treatment and the image treatment was four. The least frequent scores in each of the three treatments was one in the video treatment with 16 participants, zero in the audio treatment with 14 participants, and zero in the image treatment with five participants.

Table 6.
Frequency of Test Scores in the Three Treatments

Video	Frequency (%)	Audio	Frequency (%)	Image	Frequency (%)
0	18 (18.2)	0	14 (14.1)	0	5 (5.1)
1	16 (16.2)	1	24 (24.2)	1	16 (16.2)
2	18 (18.2)	2	16 (16.2)	2	26 (26.3)
3	26 (26.3)	3	19 (19.2)	3	20 (20.2)
4	21 (21.2)	4	26 (26.3)	4	32 (32.3)

Total	99 (100)	Total	99 (100)	Total	99 (100)

Treatment Inferential Results

Each of the 99 participants was exposed to the three treatments in a counterbalanced order to address any possible order effects. The dependent variable was recalling the Arabic equivalent of the English verb. The three independent variables were: verbs that are associated with audios, verbs that are associated with images and verbs that are associated with videos.

Before conducting one-way ANOVA repeated measures, I checked that the data had no significant outliers, the distribution of the data is approximately normal, and the assumption of sphericity has been met. Mauchly's test indicated that the assumption of Sphericity had not been violated, $\chi^2(2) = .325$, $p < .85$. If the data are perfectly spherical in the population, there's an 85% chance of finding the deviation from sphericity that is observed in this sample. Therefore, the sphericity assumption has been met. After the above assumptions had been met, a repeated measures one-way ANOVA was conducted.

The numerator degree of freedom for this data is 2, the denominator degrees of freedom for this data is 196, and the *F*-value for this data is 5.63. The observed *F*-value of 5.63 exceeds the critical value of *F*-distribution (3.04). We can conclude that at least two of the treatments are significantly different from one another. $F(2,196) = 5.63$, $p < .05$. The partial eta-squared ($\eta^2 = .05$) was of medium size. The mean scores for memorizing words in Arabic were statistically significantly different. There is an overall significant difference in the means of the three treatments.

To determine specific differences among the three treatments, three pair-wise comparisons were performed, adjusting the Type I error rate of 0.05 for multiple comparisons using the Bonferroni multiple-comparison procedure. The results show that there is a significant difference between the video treatment mean and the image treatment mean ($p = 0.01$) and between the audio treatment mean and image treatment mean ($p = 0.02$). However, there is no significant difference between the video treatment mean and the audio treatment mean ($p = 1.00$). Therefore, associating words with images helped students to remember word meanings significantly more than associating word meanings with videos or audio.

The image treatment mean ($m = 2.59$) was significantly higher than the mean of the video treatment ($m = 2.16$) and the mean of the audio treatment ($m = 2.19$). The mean of image treatment was significantly higher because the participants remembered words' meanings more when the words were associated with images than the other two treatments. This indicates that it is better to learn foreign language words' meanings by associating them with images. Based on the means of the three treatments, these results suggest that it is better to associate words' meanings with images, audios, and videos respectively.

The results of the present study confirm the effectiveness of a mnemonic devices learning methodology in language learning through technology by the use of images on a computer screen. Technology can be utilized to create mnemonic devices by associating different forms of output on computer screens with vocabulary. In the current study, the nodes that contain images were the most likely to retain vocabulary. This shows that there is a strong link between images and words. In human memory, the nodes that contain audios and videos are linked with vocabulary meanings less strongly than the nodes that contain images. The lack of previous published research about the mnemonic learning strategies and modern technologies present a challenge to discuss how the results of this study fit with language learning literature.

Questionnaire Results

Table 7 presents the results of participants' attitudes toward the three treatments in this study. Most of the participants found that associating word meanings with images the most helpful method. Only five participants think that image treatment is the least helpful method. Based on the participants' views, audio treatment is the second most helpful treatment in this study as we can see in Table 7. The most frequent opinion about the audio and the image treatment was "very helpful," while "helpful" was the most frequent opinion about the video treatment. Generally, the participants thought that associating word meanings with images helped them to learn new foreign language words better. This indicates that the participants prefer to learn foreign words' meanings in their mother tongue by associating them with images. The results of the questionnaire match the results of the treatment. The participants' mean scores in the three treatments match their preferences in the questionnaire. The image associative method has the highest mean score in the treatment and the highest preference in the questionnaire results.

Table 7
Questionnaire Results

	Image Treatment	Audio Treatment	Video Treatment
Very helpful	55	42	32
Helpful	39	34	35
Least Helpful	5	23	32
Total	99	99	99

Pedagogical Implications

Teaching vocabulary can be categorized into two methods: intentional and incidental. Intentional or explicit learning refers to "any activity geared at committing lexical information to memory" (Hulstijn, 2001, p. 271). It involves methods that depend on memorizing the words until learners know their meanings. The activities require that learners pay attention to the words they want to learn. Incidental learning, on the other hand, involves

activities that focus on other skills such as reading and listening. It is "learning of vocabulary as the by-product of any activity not explicitly geared to vocabulary learning" (Hulstijn, 2001, p. 271). This paper focuses on learning vocabulary intentionally by memorizing foreign language words' meanings in participants' L1 by associating them with audios, images, videos without sounds. The results of this paper show the effectiveness of incorporating technology to teach vocabulary intentionally by translating words into the students' L1 on the computer screen.

There is a general feeling that language teachers should not use the students' L1. However, this is quite a misconception, and such negative attitudes might be due to teachers not knowing the students' L1. Translation is one of the many methods to teach words' meanings, and in general, the use of the students' mother tongue is no better or worse than the use of target language synonyms and definitions, images, and real objects (Nation, 2001). In addition, the use of the students' L1 on the vocabulary tests can be considered active knowledge since supplying the meaning in the L1 still requires the language students to produce something (Laufer & Goldstein, 2004; Schmitt, 1999).

Laufer and Shmueli (1997) argued that students do not pay attention to new words in text, especially if the new words are not essential for understanding the main point. When students read for global understanding, they will often skip new words rather than focus on them. According to Schmidt (1990, 1993), noticing is prerequisite for acquiring. In order to acquire words' meanings, students must notice the words and pay attention to them. Laufer and Shmueli (1997) stressed that if focus and attention are essential for learning, better retention of new words might be achieved with less distraction, i.e., less context. A bilingual list of words will be learned better since students will pay more attention to the words than if they are in texts.

The results of this study support learning new words out of contexts since students pay more attention to the words. Students might not focus on new words if they are in context and they are reading for the general meaning of the texts. This might affect the development of their mental lexicon or mental dictionary. The results of this study indicate that associating words with images helps students to focus and pay more attention to foreign words and their meanings in their L1. However, this does not mean using words in the right contexts. Using words in context is out of the scope of this paper. This paper focuses on remembering words' meanings in the L1.

The use of the mother tongue has the advantage of being quick, simple, and easily understood. However, the translation method is usually criticized as "being indirect, taking time away from the L2, and encouraging the idea that there is an exact equivalence between words in the first and languages" (Nation, 2001, p. 85). These are true and applicable to other methods as well, such as the use of images and definitions in the L2. Nation (2001) writes that there is no equivalence between a L2 word and its L2 definition. Images and objects also take time away from the L2 practices in the classroom.

This study supports the use of electronic image dictionaries in language classrooms. Teachers should encourage their students to use image dictionaries while studying foreign language word meanings. The Internet can be a great supply of images that teachers can use in their classrooms—language teachers might use Google Image to search for relevant and interesting images to incorporate with the new words that they will discuss with their students. Furthermore, with the availability of advanced mobile phones, students can use their phones to take images or search for images that are relevant to their lessons and share them with classmates. Social media such as Flickr and Instagram are examples of effective tools to share such images between classmates.

Limitations and Future Research Suggestions

One possible limitation that might affect the study is the definition of relevance of audios, images and videos. This depends on what the researcher as a teacher believes is relevant. It is hard to draw borders for individual words in terms of relevant audios and images. During the discussions, some students mentioned that they thought some of the videos were not strongly relevant to the words' meanings. However, arguing from the ecological perspective, in classrooms, teachers may bring language learning materials based on what they think is relevant to their students based on the participants and contexts. For future research, studies might explore the treatment with participants from different contexts. There might be an effect from culture or gender on the results, as this study has a homogeneous sample in terms of L1, culture, gender, and academic background.

Future studies might also examine the effect on long-term memory. This study focuses only on short-term memory. Nonetheless, short-term memory is one of the best predictors for vocabulary and grammar achievement (Ellis, Ellis, & Sinclair, 1996; Schmitt, 2000). It allows the eventual establishment of long-term sequence information for language. However, research shows that word meanings decay faster (Brown et al, 2008; Waring & Takaki, 2003). The present study shows what method might preserve word meanings longer due to stronger links between nodes. Testing the long-term memory, however, might reveal different results. Future research might replicate the process for long-term memory in order to confirm or contradict the results of this study, and further contribute to research on language learning and technology.

Conclusion

Based on the previous successful use of mnemonic devices to remember items, this study was designed to implement mnemonic devices with modern technology in a language classroom. It used two instruments: (a) a treatment to answer the research question: do EFL students remember English words' meanings in their L1 more when the English words are associated with audios, with images, or with videos on the computer screen? (b) A

questionnaire to answer the research question: what are the attitudes toward these three associative methods? The data from the lesson treatment and the questionnaire were analyzed quantitatively, and the results showed that the use of images helped the students to remember the words' meanings in their L1 significantly better than associating the word meanings with audios and videos. There are three explanations for this result: (a) there is a stronger link between the nodes that contain the words' meanings and the nodes that contain the images, (b) students pay more attention when the words are associated with images, (c) students prefer the use of images to learn words' meanings than videos or audios as confirmed by the questionnaire results.

Using associative network theories as a theoretical structure, this paper encourages teachers to use images in their classrooms to help their students learn the target language. Human memory contains of a set of nodes connected by links. Nodes that contain images were found to be significantly connected with the nodes that contain the words' meanings in the participants' mother language. The connection between the nodes that contain videos and audios and words' meanings were not significant. This leads to the conclusion that students will remember words' meanings in their L1 better when they are associated with images rather than videos and audios.

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Appendix A: Questionnaire الاستبيان

Please, choose the right answer that shows your opinion about vocabulary learning methods.
من فضلك أختر الإجابة التي تمثل رأيك حول طرق حفظ معاني الكلمات.

---

1. I have found that associating words' meanings with audios:
لقد وجدت أن ربط معاني الكلمات بالأصوات:
A. Least Helpful (مفيد قليلاً)
B. Helpful (مفيد)
C. Very helpful (مفيد جداً)

---

2. I have found that associating words' meaning s with images:
لقد وجدت أن ربط معاني الكلمات بالصور:
A. Least Helpful (مفيد قليلاً)
B. Helpful (مفيد)
C. Very Helpful (مفيد جداً)

---

3. I have found that associating words' meanings with motions:
لقد وجدت أن ربط معاني الكلمات بالحركات الجسم:
A. Least Helpful (مفيد قليلاً)
B. Helpful (مفيد)
C. Very Helpful (مفيد جداً)

Appendix B: Test

Please, write the meanings of the following English verbs in Arabic:
من فضلك أكتب معنى الأفعال الإنجليزية التالية باللغة العربية:
Example (مثال) Play ……. يلعب

English Verbs	**معنى الفعل باللغة العربية**
1. Flap	.1
2.Trot	.2
3. Leap	.3
4. Heap	.4
5. Grin	.5
6. Wail	.6
7. Tick	.7
8. Peck	.8
9. Moor	.9
10. Slay	.10
11. Bust	.11
12. Blot	.12