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Learning vocabulary in a foreign language: A computer software based model attempt

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Abstract

This study aimed at devising a vocabulary learning software that would help learners learn and retain vocabulary items effectively. Foundation linguistics and learning theories have been adapted to the foreign language vocabulary learning context using a computer software named Parole that was designed exclusively for this study. Experimental design with control and experimental groups which were formed of English learners at a university program was used and quantitative and qualitative data collection methods were employed. Quantitative data collection instruments were the pre-test, the computer software- Parole, the immediate post-test and the delayed post-test. Both of the post tests were the reimplementation of the pre-test at two different times. The qualitative data collection instruments were the semi-structured interviews done with students after the implementation of the study. The proposed model was successfully implemented and results of the quantitative statistical analyses showed at the end of the study that the software is an effective vocabulary learning model and tool that could be used to learn vocabulary in English; that words are learned more effectively and permanently using this model and that users who used the model for longer durations learned words more effectively and permanently.

Keywords: Vocabulary learning model, vocabulary learning software, computer assisted vocabulary learning

1. Introduction

Due to the growing body of research in the last decades teaching vocabulary has created a heated debate among researchers (Baumann, et.al. 2003; Graves, 2006; Nation, 2001; Meara, 2002). In the center of the discussion is whether words should be taught in context or in isolation or whether incidental vocabulary learning leads to better word power compared to methods where learners engage in deliberate word learning activities. Hulstijn (2001) addressed this problem with the question; "L2 teachers feel uncertain about how to guide their students. Should they require their students to learn words intentionally, perhaps even by rote, or should they believe the rumours that intentional learning is not conducive to language learning?" (p.258). Before discussing the important aspects of vocabulary teaching that constitute the foundation of the vocabulary learning model in this study it is necessary to look at the discussion on the incidental and intentional vocabulary learning. This is important as the model in the study used computer software that is based on decontextualized, intentional vocabulary learning.

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Additionally, particularly web-based learning and other tools available in CALL have become the fastest growing areas in language teaching. CALL can create an independent learning environment for foreign language learners where students can acquire and practise a new language (Butler-Pascoe, 1997). Computer provides an opportunity for learners being less dependent and gives them more freedom to experience learning on their own in a natural or semi-natural settings (Oliva & Pollastrini, 1995). It is a widely accepted fact that CALL provides interactive and communicative support for learning and teaching language skills.

Another area that needs to be discussed within the scope of this study and for drawing a comprehensive framework of the vocabulary learning model used in the study is the cognitive aspect of vocabulary learning with focus on encoding and retrieval processes of learned vocabulary items. More multi-disciplinary research with respect to language learning is needed to be able to develop a better understanding about how vocabulary is learned and remembered. Works of Atkinson and Shiffrin (1968), Baddeley (1986), Bialystok (2010) and Craik and Lockhart (1972) have helped teachers and researchers gain deeper insight in this matter. The relationship between vocabulary learning and memory is one of the main focus points of the model presented in this study.

As a teacher of English observing my students struggling with learning and recalling new vocabulary led to the idea of finding additional efficient ways of vocabulary learning that will assist learners in the process of learning new vocabulary. Thus, the idea of creating Parole, a new vocabulary learning model that is based on the cognitive aspect and principles of vocabulary learning emerged from this motive of helping learners of English to find a new way of learning vocabulary items. CALL technology was used in developing this model to make it easily accessible for students during the study. The study tested the hypothesis that whether students using the *Parole* software for learning vocabulary learnt more words compared to students who do not use the software and whether students who use the *Parole* software for learning vocabulary retain more words compared to students who do not use the software. Finally, the study explored whether there are any correlations between time spent in the *Parole* software and vocabulary retention.

1.1. Theoretical background

1.1.1. Teaching vocabulary: Is it incidental or intentional?

One of the ways of enriching a learner's vocabulary is incidental vocabulary learning which is defined by Laufer (1988) as the random acquisition of words merely through reading texts and listening activities. In the framework of the Input Hypothesis Theory, Krashen (1989) held that like L1, L2 vocabulary was subconsciously acquired. It was proposed that this kind of lexical growth could be achieved through engaging students to extensive reading activities through which they are involved in the processing of meaningful and contextualized input (Brown, 1994; Elley, 1989; Krashen, 1989; Nation, 1990). The relationship between vocabulary acquisition and reading ability has also been validated by the studies of Nagy, Herman, and Anderson (1985), Nation and Coady (1988), Stoller and Grabe (1993).

Although incidental vocabulary learning can be very effective and the words can be retained for a long time there are some shortcomings that can be summarized with questions asked by Laufer (2005): How many exposures to a word are needed before the learner can recall or recognize the meaning of a word, how much reading has to be done to ensure this number of repetitions of the new vocabulary and how realistic is it to expect L2 learners to read the necessary amount of text (p. 227)? While acknowledging the importance and necessity of vocabulary acquisition through extensive reading and guessing meaning from context, some educationalists draw attention to the importance of making L2 learners aware of their vocabulary learning process and teaching them vocabulary explicitly (Hulstijn,

1997; Sökmen, 1997). Coady (1993) states that explicit teaching of basic vocabulary at an early stage of acquisition is necessary. He suggested that learners should first receive explicit instruction in 3000 most common word families. Similarly, in their study Hazenberg and Hulstijn (1996) concluded that L2 speakers of Dutch need a minimum initial threshold level of some 10,000 words to cope with academic reading requirements in first-year university studies in the Netherlands. Evidence from other studies that compared deliberate and incidental learning show that deliberate learning results in more learning compared to incidental learning (Barcroft 2009; Hulstijn 1992; Hulstijn, Hollander & Greidanus 1996). In a study that compared contextualized vocabulary and decontextualized word lists, the decontextualized condition resulted in better retention rates (Qian, 1996). Another study that challenges incidental vocabulary learning was conducted by Zahar et al. (2001) which was based on the word acquisition rates. In their study on vocabulary learning through reading a story the authors concluded that learning 2000 words from input would take 29 years. Studies on the rate of vocabulary retention and the amount of time invested in incidental vocabulary learning were reported by Waring and Takaki (2003) and Webb (2007). Laufer (2003) challenged the idea of reading being the major source of vocabulary learning in her article where she reported three experiments in which word-focused tasks resulted in higher learning scores. Reviewing the results of the studies and discussions it would be wrong to say that one way of vocabulary learning is better than the other. In spite of encouraging results in favor of one or another method supplementing incidental learning with intentional learning is recommended (Pigada & Schmitt, 2006). Similarly, Paribakht and Wesche (1997) argue that contextualized vocabulary learning through reading is effective but that reading plus instruction is superior (pp. 195–196). Just as it is impossible to conclude that direct instruction is responsible for all the words acquired by learners, it is similarly unrealistic to claim that incidental learning is the best and only way of vocabulary growth in an L2 setting.

1.1.2. Teaching vocabulary with CALL

Due to advances in educational technology and increased global contact, academic communities have been affected considerably which inevitably had a great effect on language teaching and learning (Warschauer, 2000). As a result of the impact of these changes in language teaching, teachers are becoming more familiar with terms such as education technology, science and technology, the Internet, hypermedia, multimedia, satellites, simulation, educational games, electronic networks, new methods of generation and transmission of visual and graphic information, virtual library, CALL and computer sciences applied to education (Hubbard & Levy, 2006). Although the primary activity remained to be called CALL, acronyms such as CALT (Computer-assisted language testing), and CASLR (Computer-assisted second language research) were created to cater for the growing interest and need for specialization in the field. Computer-assisted second language research (CASLR) tasks require learners to work on the target language interactively with a computer program or with other people through the medium of the computer. CASLR tasks may appear to the learners to be a regular part of instruction or assessment, or they may be introduced to learners as research tasks (Chapelle, 2001).

Vocabulary teaching practice has also been affected and studies have shown that the CALL approach has several advantages (Abraham, 2008). Boers, Eyckmans and Stengers (2004) provided evidence of the benefits of using hyper texts such as pictures, figures, graphs, sounds etc. in helping learners comprehend authentic texts in L2. It is also stated that electronic vocabulary learning is widely acknowledged as a suitable method for supporting learners while reading academic texts in a foreign language (Nation, 2001). CALL liberates learners as it presents information in a non-linear way while paper-based texts can only be approached linearly. Gorjian (2008) evaluated the general value of software programs in terms of reading comprehension and vocabulary. In a CALL study Abraham (2008) focused on the effect of extended use of computers on reading achievement, rate and reading

comprehension. Similarly, some other studies such as Kang and Dennis (1995); Somogyi (1996); Tozcu and Coady (2004) support that computer technologies increase the probability of vocabulary acquisition.

1.1.3. Teaching vocabulary from a cognitive point of view

Cognitive linguistics is one important interdisciplinary branch of cognitive science, and is closely related to cognitive psychology and linguistics. It is also an approach to language, which views language as a kind of cognitive action, and studies the formation, the meaning, and the rules of language with cognition as its departure (Chen, 2009). In modern approaches to comprehension and vocabulary learning the focus has shifted from product to process. Text comprehension is seen as a process where the reader actively constructs meaning. The reader builds a mental representation of the textual meaning based on information in the text and on the activation of complementary knowledge resources (Johnson-Laird, 1983; van Dijk & Kintsch, 1983). In the cognitive approach taken in this paper the encoding and retrieval processes will be discussed in relation to vocabulary retention. Retrieval refers to the process of "accessing stored information" (Givens, 1984).

Since the short term memory and multi store approach were discussed by Atkinson and Shiffrin (1968) countless studies have been conducted and research has been done on memory and how it worked. Baddeley and Hitch (1974) drew attention to a problem with the Short Term Memory Model arguing that although Atkinson and Shiffrin (1968) suggested that STM should be regarded as a single unit, under certain conditions it was possible to do two different tasks simultaneously and therefore introduced the term *working memory*. Baddeley (1997) also argues that words presented in visual form would be processed differently compared to words presented in auditory form. This has great impact on how vocabulary needs to be taught as it means that in order to ensure better encoding, the same word could be represented in different forms and thus stored in different memory systems that would make recall and retrieval easier for the learner. The retrieval practice effect is also central to the discussion as the very act of retrieving information from memory strengthens retrieval routes to memory. Hence, testing one's memory to recall the L2 word form or its meaning (retrieval practice) is beneficial to long-term retention (Baddeley, 1997; Ellis, 1995; Nation, 2001).

The multi store system brings about the importance of elaboration. A number of studies on L2 vocabulary (Laufer & Shmueli, 1997; Prince, 1996) refer to elaboration as a possible effective learning strategy. Prince (1996) argued that "effective learning of words requires a stage in which the word is in fact isolated from its context and submitted to elaborative processing" (p. 489). Laufer and Shmueli (1997) referred to the importance of elaborative processing in more detail, pointing out that, linking the new word with other words associated with it in terms of form, meaning, or context, provides an opportunity for deeper or more elaborate processing of the target word, which in turn leads to the formation of a more persistent trace and consequently better memory performance. Additionally, the Levels of Processing model of memory which holds that 'deep' processing of information (including vocabulary) has an effect on retention. In this model, deep processing is processing that involves semantic elaboration (Craik & Tulving, 1975). In mental imagery, associating a lexical item with a mental image makes the item more memorable. Dual coding is also related to elaboration (Paivio, 2006; Sadoski, 2005). Damasio (1999) states that the brain is not a computer and continues as the following; "recall is not simply a matter of clicking the proper icon to call up the desired document from the brain's hard disk. Memories must literally be remembered, put together again from pieces found in various parts of the brain. The brain does not file Polaroid pictures. Memory depends on several brain systems working in concert across many levels of neural organizations" (p.108).

How the concepts mentioned above affect retention of vocabulary is a broad topic that cannot be discussed in detail considering the scope of the study. However, it is important to mention them as they constitute the foundation of the software devised to help learners encode and retrieve information.

2. Method

2.1. Participants

The study was conducted with 77 students who were registered in the English program of the Department of Foreign Languages at TOBB University of Economics and Technology (TOBB ETU), Ankara. The students were enrolled in various faculties and departments and their departments were not taken into account within the scope of this study. There were 41 students in the experimental group and 36 students in the control group. Students in the program had to sit a placement test and classes were formed according to the results of this test. Thus, it was assumed that the students in the same class have the same level of English proficiency and the control and experimental groups were formed based on this assumption which relies on the results of the placement test. This assumption was confirmed when the study started in the 3rd semester of the academic year as the average achievement of the experimental group was 78.7 %, while the average achievement of the control group was 77.9 %. As this study is based on using computer software that requires internet access, it is important to note that all students enrolled at TOBB ETU are given a laptop and there is wireless internet access everywhere on campus.

2.2. The software Parole

The software is based on the concepts mentioned earlier to serve as a tool that helps learners to work on a list of vocabulary items and encode them into their memory by allowing every individual to do it in their own way based on preferences. It is designed to encode information at different levels which will facilitate retrieval.

Music is one of the components of the software as it is a powerful tool for encoding information into memory. According to Levitin (2006), music activates regions throughout the brain and makes remembering words easier if encoded with music. Jensen (1996) states that music functions as a carrier and that the melody of the music acts as the vehicle for the words themselves (p.37). Similar findings about the function of music were reported by Samson and Zatorre (1991) who found that the different role of each temporal lobe in memorizing songs provides evidence for the use of dual memory codes. Their findings indicated that the verbal code is related to left temporal lobe structures, while the melody code could depend on either or both temporal lobe mechanisms.

The *Parole* software relies heavily on using visuals while working with words based on evidence mentioned earlier about the effect of using visual input. A Sylwester (1995) claim that information encoded in more than one neural network is more likely to be remembered (p.96). In studies of Baddeley et al. (2009), studying working memory visual input is indispensable for the information to be encoded in long term memory (44 - 59). The importance of making associations has been stated also by Mesulam (2004).

A method that was revisited during the design stage of the software was the Keyword Method. There has been substantial research related to intentional vocabulary learning (Griffin & Harley 1996; Thorndike 1908) and it has been found that a large amount of vocabulary can be quickly learnt and retained for a long period of time through mnemonic techniques such as the keyword technique (McDaniel, Pressley & Dunay, 1987). Vocabulary learnt in this way is not easily forgotten. The use of the L1 and pictures to provide the meaning for words is generally more effective than the use of L2 definitions (Nation, 2001). Research shows that such learning not only results in explicit knowledge but

also results in implicit knowledge, which is the kind of knowledge needed for normal language use (Elgort, 2011). These principles are strongly research-based and include the use of spaced retrieval explained in Pyc and Rawson (2007), mnemonic techniques, reordering of the word cards to avoid serial learning and the L1 and pictures to represent the meaning of the words (Laufer & Shmueli 1997). Hulstijn (1997) argued that mnemonic techniques, including the keyword method, were a useful supplement to other approaches to vocabulary learning. He also provided practical guidelines for using mnemonics and rehearsals in learning words. Learners benefit from training in the application of these principles, but very few teachers seem prepared to make such strategy training a regular part of their vocabulary program (Nation, 2001). The software relied on using music and visuals for encoding of information, in this case new words, and also encouraged learners to use the keyword method through interfaces designed for this purpose.

2.2.1. The software interfaces

The software was designed with a team of two software programmers and the researcher. The students had to log in with their password and choose the default language (for instructions in the main study board) as English or Turkish at the start-up page. The layout of the main study board consisted of boxes which the students had to fill in. Figure 1 below shows the main study board with randomly selected words that were not included in the study on the left side.

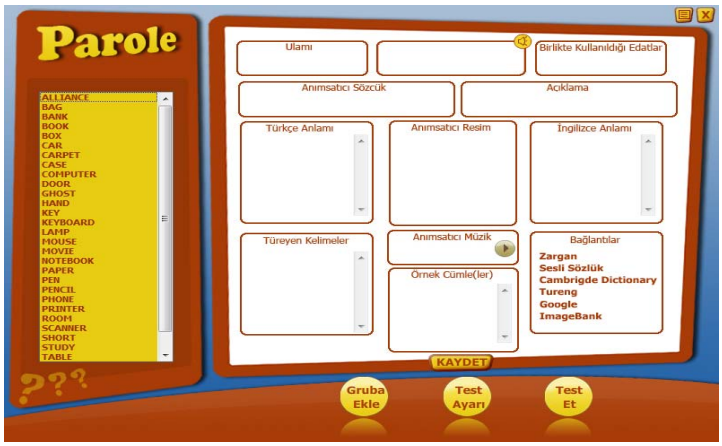

Fig. 1. The main study board of Parole.

The students could choose which word to study and clicked on that word to transfer it onto the main study board. Because the level of the words was higher than their level, there was another box with links where the students could get access to online monolingual and bilingual dictionaries in case they wanted to check the meaning of the words. Students could write the Turkish translation of the word looking it up in the bilingual dictionary or the English definition of the word by looking it up in the monolingual dictionary. They could listen to the pronunciation of the word by clicking the sound icon on the board. There was one box for writing the word category of the word and another box for writing words that the word is used together with. This could be a preposition, a phrase, an idiom or a collocation. Students could fill in the word category box if they wanted to as they had access to dictionaries to find information about the words. There was another box for writing sample sentences containing that word. These could be their own production as well as sample sentences taken from the dictionaries. It is important to note that filling in all boxes was not compulsory but encouraged during the training as this is done to provide

the students as many alternatives as possible for encoding a word while they are working with their words.

The box for the visuals could be used either for a random visual that the students thought reminded them of the target word or they could use it to strengthen the relationship between the target word and keyword by pasting there a visual related to the keyword. The students were directed online to websites where they could get free visuals related to their search or they could go into their own files for visuals. Students could also add a piece of music that would remind them of the target word to each target word separately and save it for further use. They could only use music in their own files and downloading music was not allowed due to copyright issues. The music could be played in the background or stopped with a button while the student was working with a target word. Figure 2 shows a screenshot taken when a student was adding music to the study board.

Fig. 2. Screenshot of adding sound/music to a studied word.

There were two boxes allocated for using the Keyword method. One box for writing the keyword that has a similar pronunciation to the target word and one box for writing the relationship that the students drew between the target word and the keyword. The sound icon played a crucial role in using the two boxes effectively as the students had to listen to the correct pronunciation of the word to be able to use the right keyword.

In conclusion, a fully completed study board for one vocabulary item consisted of the word itself in the center of the board, the word's collocations, the word's category, a keyword that has a similar pronunciation, a reminding explanation of the connection between the word itself and the keyword, translation of the word in Turkish, definition of the word in English, a visual that serves as a reminder of the word, a sound/music that serves as a reminder of the word, sample sentences containing the word, related words and links to dictionaries and other useful websites. Figure 3 shows a the fully completed board for the word 'alliance'. In this particular case the language of the interface was chosen as Turkish but the students were free to choose either English or Turkish when logging in.

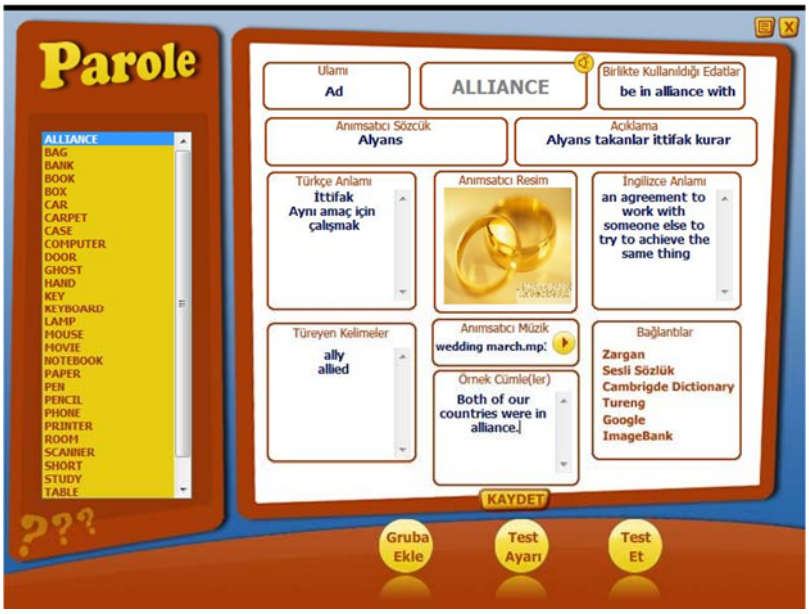

Fig. 3. Screenshot of fully completed board for the word 'alliance'.

2.2.2. Other properties of the software

The students could group the words under categories that they define after studying. This enables them to make their own groups based on different criteria such as word category, meaning, unit, level of difficulty etc. The students could also click the test button and add the word to the test list. The test is a pop up window that is active when the student enters the program and asks the definition of the word that has been added to the test list by the user. The students could choose how they wanted to be tested; by the keyword, by the picture, by the music, all of them etc. If the student selected to be tested by the visual for a certain word, only the visual that the student had added to the study board for that target word would pop up and the student had to write the target word in the given space.

There was also a timer in the software that monitored how many times the user logged in and stayed for active how long in the program. This was not necessary for the users but was crucial for the experiment as conclusions could be drawn based on the score of the student in the post tests and the duration of study in the software.

2.3. Data collection and analysis

The study was based on quantitative and qualitative data, with a pre-post-test design where the post test was administrated twice as immediate and delayed post-tests. The pre-test showed the mean scores of both groups at the beginning of the study and the post-test mean scores are used in order to determine whether the study justifies the research questions. Qualitative data were collected by interviewing students who represent a specific group of students (high scorers, average scorers and low scorers) to have a realistic sample of the group. Qualitative data was as important as quantitative data in this study as qualitative data provided an in-depth account of students' perspectives on the software tested.

The pre-test that was administered after the piloting and validity/reliability check procedures was a 100 item multiple choice test. There was an item corresponding to every word on the list given to the students. The pilot study was conducted with 61 students from the same university and other than the control and experimental groups and the pre-test was tested for validity and reliability. The pilot study

results were used for item analysis and the pre-test was finalized after the items of the test were changed, improved or deleted based on the item analysis results. The pre-test was then given to both the control and experimental groups prior to the experiment. The pre-test revealed that the means of the control group was 10.61 and the means of the experimental group was 09.85. Taking these mean scores into account and as the differences in the mean scores were not statistically significant, it was concluded that both groups were equal at the beginning of the experiment.

2.4. Implementation of the study

After determining the experimental and control groups, the students in the experimental group were given a two-hour training on how to use the software. The students in the control group were given a document listing methods of learning vocabulary in order to assist them during the study. The experimental group students signed a document of confidentiality stating that they will not disclose any information including their passwords for the software with 3rd parties. The CD-ROM for the software was only given to the instructors and the program was set up in the students' computers under their instructor's supervision.

The target words in the study were selected from the units that had not yet been covered in the students' course books. Both the experimental and the control groups were studying the same series of books designed for preparation for a standardized international test. An even distribution in terms of word categories was aimed at and partially achieved due to limitations in the course book units. The word list consisted of 35 nouns, 37 adjectives, 22 verbs and 6 adverbs.

The Parole experiment lasted 8 weeks. Students in the control group were exposed to target vocabulary during their lessons as they progressed in the units of their course books. Students were expected to acquire vocabulary implicitly in the course of their study. Students in the experimental group studied the target words on *Parole* where they had to put deliberate effort in learning the given words through the software. Both groups had access to the full list of the target vocabulary; the control group was given a list of the target 100 words while the experimental group could see the word list when they logged in the software *Parole*. The students in the experimental group could study the words in random order on the main study board. They could browse the list on the main interface and choose which word they wanted to study. They could start studying a new word or revisit a previously studied word for revision. There was no time limit and the timer feature of the program was not visible to students. It was only used by the researcher to determine the total time a student spent using the program.

An immediate post-test was administered to both groups at the end of the experiment which lasted 8 weeks and a delayed post-test was administered to both groups 12 weeks after the immediate post-test. Five students (two females and three males) were interviewed and the interviews were transcribed. Participation to the interviews was on voluntary basis, and two ensure a good representation, students with the higher, average and lower scores were included. As the interviews were not compulsory the number of the interviewees was not high however, though not generalizable the analysis of the interviews still provided in-depth information about the students' perspectives about using the program.

3. Results and discussion

The results of the pre-test, immediate post-test and the delayed post tests are compared using mixed between – within group ANOVA. Results are shown in table 1. As for the interpretation of MANOVA results Wilks Lambda values were reported since homogeneity of covariance assumption was met and the sample sizes were not equal within each cell. The Wilks' Lambda data shows that the difference in scores of the experimental and control groups based on the time variable (pre-test, immediate post-test, delayed post-test) is significant F (2, 74) = 182.59, p <.05., $\eta 2$ = .83. It can also be said that the effect size is significantly high. To summarize, according to the data presented in Table 1, the difference in the scores within the experimental and control groups at three different times is significant.

Table 1 also shows comparison of the scores between groups based on the time variable. The results of the ANOVA indicated that the difference between the scores of the experimental and control groups at different times (pre-test, immediate post-test, delayed post-test) is significant F (1, 75) = 57.03, p <.001. , η2= .43. It can also be seen in Table 1 that the effect size is significantly high explaining the 43% of the variance in group scores. To summarize, according to the data presented in the table the difference in the scores between the experimental and control groups at three different times is significant.

Table 1. Analysis of variance on students' performance scores in different times

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Time	37232.16	1	37.232	57.03	.000	.43
Error	48960.55	75	652.81			

The results presented in Table 1 validate two research questions of the study because it is shown that students who used the software for learning vocabulary learned more words compared to students who did not use the software and that students who used the software for learning vocabulary retained more words compared to students who did not use the software.

During the implementation phase of the study, the experimental group had the opportunity to encode information through multiple channels like visuals, sound, music, verbal cues etc. Vocabulary learning and retention was more effective as a result. The multiple channels present in the software provided an enriched environment for students which resulted in better learning and retention. As discussed earlier in this paper this finding is supported by other researchers' works like in Baddeley (1997) who argued that words presented in visual form and auditory form were processed differently in the brain and the act of retrieval strengthens the long terms memory of a particular word. The model also made it possible for students to elaborate on the words they studied through various memory paths as supported in Laufer and Shmueli (1997); Prince (1996) and Sadoski (2005). Since the rat experiments of Rozenzweig (1972), the positive effect of enriched learning environments in learning has been widely accepted. Several studies validated the fact that enriched environments and information encoded through multiple channels resulted in better learning (Aldag & Sezgin, 2003; Mayer & Anderson, 1991, 1992; Pavio, 2006). Kennedy (2006) pointed out that language processing involves many senses; including vision and that enriched environments promote neuronal development. The results of this study support those researchers in that they showed that students learned and retained more words using a model that incorporated multiple memory pathways like visuals and sound. These components provided an enriched environment for students to interact with while learning new vocabulary.

In order to test the 3rd research question of the study the correlation between length of study and student scores needed to be evaluated. The immediate post-test scores of 36 students in the experimental group were analyzed to see the correlation between length of study (in hours) and post test scores (number of words learned) during the experiment. The result r = .80 ($p<0.001$) shows a strong positive correlation. It can be concluded that the longer students use the software the more words they can learn.

In relation to the same research question retention was tested against the duration variable to see whether studying for longer periods on the software leads to better retention. The delayed post test scores of 36 students in the experimental group were analysed to see the correlation between length of study

(in hours) and delayed post test scores (number of words remembered) during the experiment. The result $r = .79$ ($p<0.001$) shows a strong positive correlation. It can be concluded that the longer students use the software the more words they can remember.

The students were interviewed and the interviews were recorded and transcribed. As the number of the participants was low, data saturation was not achieved and specific codes and themes emerged only partially. The findings cannot be generalized to the whole population but data gathered is shared here as anecdotal data about the model. The comments of the students who were interviewed after the immediate post-test also supported the findings of the experiment. In relation to the efficiency of the software two high scoring students reported that the software helped them to a great extent in both learning and remembering words. Student A said "…studying each word in isolation seemed like a waste of time at the beginning. But once I click on the 'save' button I know that I will not forget it. It is permanent." Student A further reported that the strongest point of the model was that it was not boring and that the words were lasting. Student B reported that the model makes the words permanent and added "…The feature I liked most is that it is customized. For the same word I can choose a picture or sound completely different from that of another friend and we both score high in the test. I think that is a great feature." Both of the low scoring students reported that they did not spend much time in the software due to external factors and that they think this is the reason why they scored low in the tests. Low scoring students said that it needs a lot of time investment to deal with one word in the software and therefore they found it boring at times. Student D reported that the features of adding visuals and music were good but still she found it difficult to work in the program because working with one word alone was time consuming. Student D added "If I invest that much time in a word with any method I will learn that word anyways." Student E challenged this idea when he said "… we try all sorts of methods anyway like word lists etc. and we forget afterwards. Here at least we don't forget what we study, so on the contrary we actually save time". Student E added that the software saved time because once she learned the word she did not need to revise it very often. Student C said that he did not like all parts of the main study board and therefore was discouraged to use the software for longer periods. All students agreed that it was possible to achieve a high level of learning and retention if sufficient time is spent in the software. This is supported also by quantitative data. There was a consensus on the efficiency of the software both in terms of the number of words learned and retained.

4. Conclusions

Designing software that would encompass all the important aspects of vocabulary learning is a challenging task and it would be wrong to say that it has been achieved in this study. As the title suggests, this study was an attempt to incorporate foundation principles of vocabulary learning, cognitive linguistics and CALL into software that could serve as a model for vocabulary learning in a foreign language. As Wood (2001) pointed out, close collaboration of educators and software designers is needed to design comprehensive tools that would help learners in the process of learning a new language.

This was an attempt to test a question that I have asked myself both as a researcher and teacher and I believe that this study will lead to further studies in this thread. The strongest points of the software are its compatibility to the multi store model of Atkinson and Shiffrin (1968), expanded later by Baddeley (1974) and the studies of Paivio (2006) on the dual coding process and importance of elaboration. It was also based on brain based learning principles and their implementation in teaching contexts (Jensen, 2000; Sylwester, 1995) as well as the use of keyword method. Ashcraft (2005) stated that formal mnemonic devices rely on a pre-established set of memory aids and considerable practice on the to-be-remembered information. Informal mnemonics such as the ones you invent yourself are

less elaborate, more idiosyncratic and personalized. The software is in line with this statement as every student could create their own unique mnemonics to remember the words on their list. In spite of the criticisms (Hall et al., 1981, Pressley, 1985) the keyword method incorporated in the software proved to be useful for the students. It is worth mentioning what Sökmen said in 1997; "There is a need for programs which specialize on a useful corpus, provide expanded rehearsal, and engage the learner on deeper levels and in a variety of ways as they practice vocabulary. There is also the fairly uncharted world of the Internet as a source for meaningful vocabulary activities for the classroom and for the independent learner" (p. 257). Although software products have improved tremendously in the past decade finding meaningful vocabulary activities meeting the criteria Sökmen (1997) mentioned is still a challenge.

I know from my own classroom experience that self-generated and provided mnemonics helps students remember and that elaboration is useful and necessary. Further studies are needed to establish the validity of software based on these principles. As using educational software in the foreign language classroom is becoming more and more popular the need for studies supporting the educational and pedagogical aspects of them grows. In conclusion, as no vocabulary learning technique or method can solely be accounted for efficient vocabulary learning, teachers need to supplement activities for vocabulary with various techniques and methods. Using vocabulary software proved to be a useful tool within the scope of this study.

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Yabancı dilde bilgisayar yazılımı ile sözcük öğrenimi: Bir model denemesi

Öz

Bu çalışma yabancı dilde sözcük öğretimi ile ilgili olarak alandaki bazı eksikliklerin gözlemlenmesi üzerine yapılmıştır ve öğrencilerin daha etkin şekilde sözcük öğrenebilmeleri için bir model önerisini kapsamaktadır. Bu kapsamda, temel dilbilim ve öğrenme teorileri temel alınarak yabancı dilde sözcük öğrenimi bağlamına aktarılmış ve bu araştırmaya yönelik olarak *Parole* adı verilen bir bilgisayar yazılımı geliştirilmiştir. Çalışmada deney ve kontrol gruplu deneysel bir desen kullanılmıştır. Nicel veriler ön test, çalışma için geliştirilen bilgisayar yazılımı, son test ve gecikmeli son testler ile toplanmıştır. Nitel veriler çalışma bitiminde örneklem içerisinden seçilen öğrencilerle yapılan yarı-yapılandırılmış görüşmeler aracılığıyla toplanmıştır. Veriler istatistiksel olarak değerlendirilmiş ve sonuçlara bu şekilde ulaşılmıştır. Önerilen model başarıyla uygulanmış ve çalışmada yazılımın yabancı dilde etkili bir sözcük öğrenme modeli olduğu; sözcüklerin bu model ile daha etkili ve kalıcı olarak öğrenildiği ve bu modeli daha uzun süreler kullanan öğrencilerin sözcükleri daha verimli ve kalıcı olarak öğrendikleri bulunmuştur.

Anahtar Sözcükler: Sözcük öğrenim modeli, sözcük öğrenme yazılımı, bilgisayar destekli sözcük öğrenimi