

THE IMPACT OF VERBAL WORKING MEMORY ON VOCABULARY ACQUISITION OF ENGLISH AS A SECOND LANGUAGE

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ABSTRACT

The purpose of the present study is the examination of the role of verbal working memory in vocabulary acquisition in second language learners of English. Previous studies have shown that verbal working memory positively affects the acquisition and learning of new words. In the present study we tested the receptive vocabulary knowledge of the students, followed by feedback, when needed; then it was a fifteen-minute interval, where a verbal working memory task was administered. Afterwards, we asked them to name the words presented in the *Receptive Vocabulary Task* in order to detect how many of the unknown words do they remember and a week after we run the same expressive vocabulary task so as to check how many of the unknown words were acquired. Our findings have shown that (a) our students have scored higher during the re-administration of the *Expressive Vocabulary Task* and (b) a correlation was detected between the *Receptive Vocabulary Task* and the re-administration of the *Expressive Vocabulary Task* a week after. We may deduce that the finding manifests the impact of the feedback and repetition, in line with the working memory skills of the participants, as significant factors in vocabulary acquisition. The finding also suggests the inclusion of the aforementioned factors in our teaching methods.

Keywords: Expressive and receptive vocabulary knowledge, verbal working memory, English as a second language.

INTRODUCTION

Throughout the years, many studies and experiments have been done on human memory in order to gain general knowledge about cognition and how the brain processes. More specific questioning of whether and how necessary it (working memory) is in children when learning a second language, likewise has been investigated. The later has become even more relevant in understanding cognitive development and its correlation, if any, to acquiring a second language, thus possibly leading to important evolutionary strategies and newer, better, and improved methods of teaching and learning which can be justifiably developed and applied.

In the past many studies have proven the significance of working memory interacting to learn vocabulary of a second language. More specifically, previous studies prove a strong link between vocabulary acquisition and verbal working memory (see Baddeley et al., 1998, for review). These findings suggest that verbal working memory supports the storage of unknown words in long term memory (Masoura & Gathercole, 1999, for review). Many studies found that the most reliable predictor of success in learning English vocabulary is repetition, since the links between working memory and long-term storage become stronger (Service, 1992; Service & Kohonen, 1995).

Based on the previous findings, in the present study we aim to test vocabulary acquisition of English using immediate feedback and checking for students' verbal working memory skills and how do they affect their vocabulary knowledge.

LITERATURE REVIEW

Saville-Troike (2010) defines 'receptive', for the purpose of English language learners, as: an adjective that describes 'willingness to listen to or accept ideas, suggestions, etc.' This definition can be directly related to 'receptive vocabulary' being explained as new lexical items that will be read and listened to by a learner of a second language and is not yet familiar with. On the other hand, 'expressive' is defined for English language learners as: an adjective that describes 'showing or expressing something; of or relating to expression' (Saville-Troike, 2010). For the purpose of this study, thus, it can be inferred that 'expressive vocabulary' is that which will be written or spoken articulately and correlates a certain word to a specific picture, item, or notion in the learner's brain enhancing the embedding of new knowledge.

According to Benati & Angelovska (2016), memory is the applicable skill with which learners encode, store, and retrieve information. The pattern that has predominantly been assumed to take precedence is that all types of input are obtained by our sensory and automatically are stored in either short term or long-term memory (Mastin, 2010). Various factors such as aptitude and memory capacity play a role in what types of input get stored in which memory. However, Baddeley & Hitch (1994) rename short-term memory to presently known working memory. This reestablishment was necessary in order to justify Baddeley's (2003) proposed model consisting: 'of a limited capacity storage that is supported by two systems: the phonological loop which is responsible for processing auditory (receptive) information; and the visual- spatial sketchpad, which is responsible for processing visual (expressive) information' (Baddeley, 2003). In other words, working memory can be referred to as being 'processing space in the brain where someone can hold and compute information' which may or may not even necessarily progress through to long- term memory for the reason that some aspect of the input may require further processing or is merely not that challenging enough to fill up the memory storage space (Cowan, 2008; VanPatten & Benati, 2010). Or, rather, as Conway and colleagues describe working memory, as being 'the ability to mentally maintain information in an active and accessible state while concurrently and selectively processing new information.' (Conway et al., 2007). On the contrary, Miyake and Shah (1999) and Ruchkin and colleagues (2003), debate and question whether working memory storage can be considered anatomically and functionally separate from long term memory, or rather if they are merely activated parts of long-term memory (Miyake & Shah, 1999; Ruchkin et al., 2003). O'Reilly and colleagues (1999) theoretically claimed that active maintenance of self-regulated and dynamically updated information is the main role of the prefrontal cortex; much like what Baddeley's central executive, proposing arousal as an emergent property (O'Reilly et al., 1999). Although, there have been multiple theories and explanations of short term and working memory models throughout the evolution of time, the common factor in all is the notion that both maintain a limited capacity. Thus, the two lexical terms short term memory and working memory may still, even presently, be used interchangeably (Mastin, 2010).

In the last decades, studies have shown the significant impact of working memory on vocabulary acquisition of a second language. Based on the type of input, whether it is controlled explicit declarative, or automatic implicit procedural knowledge, and the specific capacity, of each memory storage at that particular time, that is the decisive factor in where the brain will store the newly acquired information (Coolidge & Wynn, 2005). It is without a doubt that in

the diverse universe that humanity inhabits, it is each learner's personal working memory that is just one of the individual differences that affects second language acquisition. Earlier researchers such as Schmidt (1990) and Gass (2011) argued that attention is the only single factor that establishes what and how is selected and processed for language learning; however, Benati and Angelovska (2016) contradicts this by claiming that working memory plays a direct role in second language acquisition by means of under certain conditions of exposure, for example: processing capacity, input, and the demands of exercises. There have been some studies that have shown a positive outcome of good short term or working memory skills having affirmative affect leading to learning more abundant amounts of vocabulary knowledge which is stored using the declarative memory store (Bablekou et al., 2014). On the other hand, learners that may have passed Krashen's the Critical (age) Period as explained in Saville-Troike, (2010) or have attenuated memory skills cannot be expected to possess strong procedural memory. These older or weaker memory learners will utilize their declarative memory even for more required instances than usual, for example with recalling lexical chunks that include tense as fact memorizing rather than retrieving the form in which to create it (Ullman, 2001). Although older learners will not be the main focus in this paper or study, it should be notable that younger learners can exist which possess weaker memory skills and can benefit from Ullman's claims.

METHODOLOGY

Participants

In the study took part six students. All of the students have Greek as their first language (L1) and have studied English as a second language (L2) both compulsory in their conventional school systems and additionally at this particular private English school. The students were divided into two groups, B1 and B2 level in correlation to the CEFR framework, taught in intermediate pre-lower and lower classes. Of these two levels, the B1 students consisted of one female and two male teenagers and the B2 students also consisted of one female and two male teenagers. The ages of the students ranged from 13-15 years old. The students are currently taught English by a non-native speaking teacher, in a mixed ability learning classroom environment, with modern pedagogical methodology techniques, and up to date technological advances, three days a week in classes that are 80 minutes in length. No extra criterion was taken into consideration when accepting the learners to take part in the experiment.

The Zervas Private English School of Kalamaria (Thessaloniki, Greece) was the location where both sessions of the experimental parts took place. Due to the study taking place during class time the students were individually and in random order taken from their classroom environment to take the tests in a quieter area of the schools so attention would not be hindered. There was no consistency in which area or room the tests were given because of the varying time schedule and availability of the empty classrooms allowed for the execution of the experiment.

Material

The material that was used in this experiment consisted of 3 separate tasks. The tasks were the following and were given in this particular order:

- a) Receptive vocabulary task
- b) Verbal working memory skills (Digits Backwards Recall) and
- c) Expressive vocabulary task

The experiment consisted of two separate sessions. All three tests were administered in the first session and it took each participant about 15 – 20 minutes to complete the entire session.

However only the third test was re-administered in the second session and it took each student about 10 – 15 minutes to complete the second session. The two sessions were assessed with the time period of a one week lapse in between for the purpose of testing memory of vocabulary retrieval after the one-week period. The tests were conducted on a personal laptop in order to have the flexibility of classroom location change, if needed, plus it was safer for any saved data to be held strictly confidential without any doubt. For further details, excerpts of the three tests can be found in the Appendices. These tests and other variations of them have been conducted many times in the past by numerous researchers. The specific ones used for the purpose of this study have been slightly adapted: from the Renfrew (1998) “Word Finding Vocabulary Test” also from Alloway and colleagues (Alloway et al., 2004) and re- designed by Bablekou et al. (2014).

In all tests the students were assessed individually. The *Receptive Vocabulary Task* was a multiple-choice task in which the participant was orally given a vocabulary word and they in return responded by answering with either pointing to or stating the correct corresponding number of their selected answer. If the participant failed to supply the correct answer, immediate feedback as to which was the correct answer was provided. The test contained a total of 50 words. The scoring procedure used to assess the results of the test for each participant is as follows. Each participant was assigned with a number coding instead of their name to conform to privacy of identification purposes. Throughout the duration of the test, the examiner marked next to each vocabulary word either a ‘0’ for an incorrect answer or ‘1’ for a correct answer. If the answer was incorrect immediate feedback was supplied otherwise the continuation of the test was administered. After the completion of the test the score depicted the correct responses out of the total number of test items.

The second test was the *Verbal Working Memory Task* (also known as Digit Backwards Recall Test) examined verbal working memory. The verbal recall of the digits in reverse order that are given in auditory fashion can be appraised as a challenging task. It required the participating students to transform the series in which the numbers were heard and retrieve them in opposite form. These series though were categorized into 7 levels of difficulty, meaning each level raised the quantity of digits in the series by one. The levels began with 2 digits and the final level contained 7 digits. Each level included six different digit series of which only a minimum of 4 had to be correctly recollected for the advancement to the next level. A practice session with 4 examples were provided to the students. The means by which the recording and scoring of the test took place were on the same form itself. After the examiner provided the digits, the answer presented by the participant was simultaneously documented as it was being produced and in consecutive order was assessed with the grading system of ‘0’ equaling an incorrect answer and ‘1’ representing a correct response. These marks were calculated to depict a score entailing the sum of correct answers and in relevance which mnemonic level was achieved by each participant.

The third task was *Expressive Vocabulary Task*, which was performed on a personal laptop with the use of a Power Point projection. The task consisted of each student being shown one picture at a time on the screen and their verbal response and retrieval of the correct vocabulary word was anticipated for each. Moreover the same pictures and vocabulary used in Receptive Vocabulary Task were also used in this task. The same test was re-administered after a week and after giving feedback to the participants in order to detect interference of working memory. As in the Receptive vocabulary test, the scoring was exactly the same. The work sheet was consistent with the aforementioned one as in the receptive test. Additionally, the marking of the answers adhered to the similar grading system of ‘0’ equaling incorrect and ‘1’

corresponding to a correct answer. Finally, the summing of the score was computed to display the number of correct answers out of the total number of test items. The coding was the same for both sessions one and two.

This current study, as many before it, will attempt to answer the main question of whether working memory abilities assist the learning of vocabulary in second language young students or if they are rather independent of one another. Particularly inquiring if good working memory and short-term memory skills influence and contribute to a better and larger quantity of vocabulary knowledge in the second language. Through the reexamination in this experiment questioning if any correlation exists in the actual role of working memory and acquiring second language vocabulary. It can be hypothesized that the second language learners that possess stronger working memory skills will obtain better results in the Expressive Vocabulary Test in the defiant possibility of not being familiar with a specific word due to the fact that they will profit from their good memory skills and benefit from the previously provided immediate feedback. Conversely, it can be predicted that learners that have weaker verbal working memory skills will not have the advantage of benefiting from the previously supplied instant feedback.

The improving development of good working memory skills in teenagers may prove to be beneficial in the recollection and learning of vocabulary in second language acquisition. Immediate feedback may prove to be beneficial in using working memory skills to improve vocabulary learning in teenagers.

RESULTS

The results have shown that in the Receptive Vocabulary Task, each student scored rather high which was expected due to its nature of having multiple choice answers. It can be estimated that both B1 (Stud01-03) and B2 (Stud04-06) level participants scored on average about the same performance. The scores ranged from the lowest being 42 and the highest being 47 out of 50 as the top score. The average or mean of all the participants' result is rounded to 45 (see Table 1 below).

For the analysis of the Expressive Vocabulary Task, which took place in the first session, it should be noted that even though immediate feedback was provided to the participants the overall performance was not as good as the scores of the previous task. Likewise, the students' scores ranged from a low 38 to a high 46 (76-92%). On average the test accomplishment earned a 40.7 (81,4%). In the re-administration of the task (one week later), it can be understood that a wider range of grades existed. The scores fluctuated between a 36 as the low and a 48 for the high (72-96%). The mean of all the students was calculate to produce a 42.7 (85.4%); (see Table 1 below). It can be claimed that better performance was exhibited with one week apart from the trial including feedback and that memory retrieval proved more efficient for the most part.

In the Verbal Working Memory Task, participants also have shown rather high performance, taking into account their age. The two levels of students B1 and B2 both had one stronger achiever and two weaker participants. However it is unusual to consider the fact that the two B2 (higher level) weaker students scored lower marks than the two B1 (lower level) weaker students on the test. The findings verify that working memory abilities are individual abilities, which are not always related to age factor (see Table 1 below).

Table 1. Participants' performance on the given tasks

		Receptive Vocabulary Task (/50)	Verbal Working Memory Task	Expressive Vocabulary Task (/50)	Expressive Vocabulary Task (re-administration; /50)
B1 level English class	Stud01	42	21 (level 4)	39	40
	Stud02	47	19 (level 4)	46	48
	Stud03	47	14 (level 3)	39	44
B2 level English class	Stud04	47	12 (level 3)	43	48
	Stud05	46	35 (level 7)	38	40
	Stud06	42	16 (level 4)	39	36
Total		45.2	19.5	40.7	42.7

After running the analysis of the raw scores on the SPSS 21 statistical program to compile whether correlation was proved from this experiment, it was found that there is no strong correlation existent. Statistically significant differences between participants performance was not found. Only a rather weak correlation was discovered between the receptive vocabulary scores and those of the expressive vocabulary scored after the provided feedback ($r=.817$, $p=.047$).

DISCUSSION

In the present study we aimed to test the impact of verbal working memory abilities on the acquisition of vocabulary knowledge in second language learners of English. For this reason we tested our students in terms of their receptive and expressive vocabulary skills and in their verbal working memory skills. During the administration of the receptive and expressive vocabulary tasks feedback was provided and a week after the expressive vocabulary task was re-administered in order to see how many unknown words have they stored.

The results exhibited that the receptive skills of the students were higher than their expressive (similar to previous studies Gibson et al., 2012); in addition the given feedback and the repetition aided the students to remember more unknown words (Service, 1992; Service & Kohonen, 1995). As for the underlying question of the present experiment whether working memory capabilities and skills help second language vocabulary learning; this study found that students, overall, tended to produce more successful responses after the feedback that was provided. Thus, with this taken into account it can be interpreted that according to each student's amount of good working memory ability is what assisted with response both after immediate feedback and after the one week's interval (similar to previous studies Service, 1992; Service & Kohonen, 1995). It is still not quite evident that this is a sole factor if either the more amount of working memory skills present equates with the more amount of vocabulary attained and whether this factor separately influences second language learning aside from all the individual differences that make each student unique.

The absence of this finding may be related to other factors that we have not taken into account. Thus, the limitations of the present study were that we did not take into account the attention span, motivation, stress level, aptitude, learning style and strategies of each child because of the lack of the additionally need time, material, and equipment necessary for extra investigation in order to conclude with these determinants. We suggest that the aforementioned factors should be taken into account for similar future studies.

CONCLUSIONS

From the outcomes of the present study, we may conclude that feedback and repetition aid vocabulary acquisition. Although we did not find a straightforward correlation between working memory skills and vocabulary knowledge, as expected, our findings still support the importance of immediate feedback and multiple exposure (repetition) to new words as counterbalanced factors to students' working memory skills.

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