

Analysis of the Relation between Phonological Memory and Long Term Memory on Foreign Language Vocabulary Acquisition

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Abstract: Learning is not only an innate skill that comes naturally. It is also an acquired ability which is influenced culturally by environment. Language learning is one of the most impressive compositions for personal human development and socialization. The influential aspect of language learning theories is cognitive learning theory that underlines humans' language learning.

Vocabulary acquisition is the sub-field of cognitive linguistics that has been the major concept for researchers. Vocabulary acquisition has been studied with phonological memory which plays an important role in L1 and L2 learning. The present study analyzed supplemented vocabulary acquisition with 149 students, who have been learning two languages, apart from their first language. The researchers attempt to find out effect of the phonological memory and long term memory on the learning of second language vocabulary acquisition. This study with one hundred forty nine (99-Bosnian, 24-English and 26-Turkish) adolescent investigated the effects of phonological memory and long term memory on L2 vocabulary acquisition at the International School of Sarajevo.

This paper analyzed the effects of the phonological memory and long term memory underlying foreign vocabulary acquisition in adolescents by testing the influence of supplemented vocabulary knowledge.

Keyword: memory, cognitive, adolescent.

Yabancı Dil Kelime Ediniminde Fonolojik Bellek ve Uzun Süreli Bellek İlişkisinin Analizi

Öz: Öğrenme sadece doğal olarak edinilen bir beceri değil aynı zamanda çevreden kültürel olarak etkilenen edinilmiş bir yetenektir. Dil öğrenimi, insanın kişisel gelişimi ve sosyalleşmesi için en etkileyici kompozisyonlardan biridir. İnsanlarda dil öğreniminin altını çizen kuramların önemlilerinden biri bilişsel öğrenme kuramıdır.

Kelime edinme, araştırmacılar için önemli bir kavram olan bilişsel dilbilim alanının alt dalıdır. Kelime edinimi, birinci ile ikinci dil öğreniminde büyük rol oynayan fonolojik bellek ile beraber araştırılmıştır. Bu çalışmada, iki yabancı dil öğrenen 149 öğrenci üzerinde kendi ana dillerinin yanında desteklenen ikinci dilin, kelime edinimi üzerindeki

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etkisi incelenmeye çalışıldı. Ana dil ve yabancı dildeki kelime bilgisiyle uzun süreli bellek arasında karşılıklı sağlam bir ilişki olduğu ölçülmüştür. Araştırmacılar, fonolojik bellek ve uzun süreli belleğin ikinci dilde kelime edinimi üzerindeki etkilerini bulmayı amaçlamışlardır. Bu çalışmada Sarajevo uluslararası okulunda yabancı dil olarak iki dil öğrenen 149 (24 İngilizce, 99-Boşnakça ve 26-Türkçe) ergenin uzun süreli hafıza becerileri ve yeteneklerinin yabancı kelime edinimi üzerindeki etkileri araştırıldı. Ergenlerde fonolojik bellek ve uzun süreli belleğin, tercüme ve resimle desteklenen yabancı kelime edinimine etkileri test edilerek analiz edildi.

Bu makale desteklenen kelime bilgisini test ederek fonolojik bellek ve uzun süreli belleğin ergenlerde yabancı dilde kelime edinimine etkilerini inceledi.

Anahtar Kelimeler: bellek, bilişsel, ergen

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I. INTRODUCTION

It is suggested that phonological memory and long term memory are the responsible subcomponent of working memory. Baddeley stated that the phonological memory is the primarily a language learning device for vocabulary acquisition (Baddeley, 2003). A number of researchers tried to find out the relationship between phonological short term memory, (the importance of the phonological loop) and long-term mental representations for language learning. These representations are essential for knowledge of phonological process, such as individual words and chunks. In recent studies of the phonological short-term memory (PSTM) showed that phonological memory is the ability of retain and verbal information, which depends on the function of the phonological loop (Kaushanskaya & Yoo, 2012). In addition, phonological loop which has phonological short-term memory capacity, is an essential indicator of vocabulary acquisition in children, adolescents and adults (e.g., Gathercole & Adams, 1993, 1994; Gathercole, Service, Hitch, Adams, & Martin, 1999), (e.g., Gathercole, Hitch, Service, & Martin, 1997). In the light of above statements, phonological memory with short term memory is a gateway to long-term memory that helps to the working memory to acquire new vocabulary (Pickering, 2006).

The present study analyzes the relationship between phonological memory and long term memory for adolescents who have been learning L2 vocabulary over the school year. Both receptive and responsive supplemented vocabularies were used to measure the possible mutual relations of phonological and long-term memory with different aspects of L2 vocabulary acquisition.

II. THE PHONOLOGICAL LOOP

The idea that verbal working memory involves both a “mind’s ear” (that hears information as internally) and a “mind’s voice” (that repeats information in rehearsal) is central to current thinking about the phonological loop. Research results from experimental and neuropsychological studies show that memory of language has a strong relation with the phonological loop. That is, the phonological loop is a buffer for language processing. The phonological loop is essential as one of the parts of working memory that the mind relies on for spoken and written material. The two parts, the “mind’s ear” and “mind’s voice” function differently in STM and LTM. The phonological store, works as an inner ear and holds information in speech-based form for about 1-2 seconds. Spoken words get in the store directly while written words must transformed into an auditory form before they can be stored in phonological memory. The phonological loop in the STM is subject to rapid decay lacking actual verbal rehearsal (Baddeley, 1986). The function of the phonological loop is to store verbal, speech-based material. Most studies on working memory use verbal information that depends on the performance of the phonological loop. The development of the phonological loop is thought to be based to the evolution and processes of speech perception (the phonological store) and production (actual articulatory rehearsal) (Baddeley&Hitch, 1974; Baddeley, 1986, 2000).

The articulatory rehearsal process is thought to retrieve the contents that are being held in the phonological store and thusly refresh the memory trace. While the phonological store directly records input from one’s own speech, information from other sources enter the phonological store only through recoding; that is, by articulatory rehearsal. Phonological loop gets information like a tape loop.

III. LONG TERM MEMORY

The ability to remember the people, places, and things encountered in the course of daily life is a fundamental form of cognition that guides behaviour. The kind of memory involved in these situations is long-term memory, information that is acquired in the course of an experience and that persists so that it can be retrieved long after the experience is past. William James (1890) defined this kind of memory as “the knowledge of a former state of mind after it has once dropped from consciousness.” The term ‘long-term memory’ is reserved for memory of experiences that occurred at a point in time prior to the immediate past or near present, and also for knowledge that had been acquired over long periods of time (Gathercole & Alloway, 2008)

Many psychologists use the three-stage model proposed by Richard Atkinson and Richard Shiffrin (1968).According to this model, information is stored in three memory systems: sensory memory, short-term memory, and long-term memory.

Long-term memory refers to the storage of information over an extended period. Long term memory is (LTM) the third step of information storage. New information

is constantly being transferred into long term memory that has far more information that includes pictures, words, sounds, smells, tastes, and touches. If you can remember something that happened more than just a few moment ago whether it occurred just hours ago or decades earlier, then it.

IV. THE STANCE OF PHONOLOGICAL LOOP IN LONG-TERM LEARNING

In recent years, there are many studies on the role of phonological loop and memory in human's cognitive activities. It is not clear why the phonological loop should be a piece of human cognition at all (Baddeley, Gathercole, and Papagno, 1998). According to Baddeley et al. (1998), one function of the phonological loop is not to remember familiar words but to help learning and acquiring new vocabulary.

Some influential studies results suggests that the phonological storage capacity which is critical to memory span plays only a limited role in language processing, but an important role in the maintenance and learning of phonological forms. (Martin, 1993). The previous study of Martin had evidence from a variety of participants populations, suggested that the phonological loop and working memory have evolved as a system for supporting language learning, or long-term learning of phonological forms.

According to the Baddeley's study (1986) with adults, suggested that memory span is diminished by increasing word length, phonological similarity, and articulatory suppression. The study of Gathercole and Baddeley's (1989) tested the vocabulary skills, phonological memory, nonverbal intelligence, and reading skills of children with two times after one year later. They got similar result that phonological memory score was highly correlated with vocabulary acquisition. The results of study suggested that phonological memory have a direct fundamental influence on vocabulary acquisition. Gathercole, Willis, Emslie and Baddeley (1991) continued with the longitudinal study of phonological memory on vocabulary acquisition. They also found the strong impact of phonological memory on vocabulary acquisition. Later on, other studies tried to find the extended relation between phonological loop and native vocabulary development to either the acquisition of foreign language vocabulary.

V. PLACING PHONOLOGICAL MEMORY AND L1, L2 VOCABULARY ACQUISITION

Research conducted in the area of L1 learning showed that the main role of the phonological loop is in supporting long-term retention of the sound patterns in new vocabulary. In addition the cumulative evidence of multiple studies suggests that phonological memory is highly related to various aspects of second language learning. In other words, there is a proliferation of evidence in linguistic studies suggesting that phonological memory is a crucial cognitive process behind success in L1 and L2 acquisition. One of the influential studies of Gathercole et al. observed that children with strong phonological memory skills show better learning of the phonological forms of new

words introduced experimentally than do low-memory children, which is consistent with the aforementioned assumption (Gathercole et al., 1991, 1992).

As in L1 vocabulary acquisition, evidence has also shown that phonological memory predicts L2 vocabulary acquisition. L2 studies have indicated that phonological memory is correlated with children's L2 vocabulary (Cheung, 1996; Service, 1992; Service & Kohonen, 1995). Moreover, phonological memory accurately predicts the ability of both children (Cheung, 1996) and adults (Atkins & Baddeley, 1998; Gupta, 2003; Service, Maury & Luotoniemi, 2007; Spéciale, Ellis, & Bywater, 2004) to acquire new L2 vocabulary. This explanation has been supported by findings from studies which revealed significant relationships between non-word repetition and L2 lexical development (e.g. Masoura & Gathercole, 1999, 2005).

Evidences of mentioned previous studies suggest that phonological memory processes and aspects of human verbal short and long -term memory may be related with learning language and vocabulary acquisition.(e.g., Bates, Bretherton, & Snyder, 1988; Carlisle & Nomanbhoy, 1993), and reasoning skills. (e.g., Golinkoff, Mervis, & Nippold, Erskine, & Freed, 1988; Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002).

In other words, research on L1 acquisition has provided useful information on the involvement of the phonological memory in L2 vocabulary acquisition. The tasks, nonword repetition, have also been used to assess phonological memory in acquisition of L2 words.

The present study investigates;

1. Is there any statistically significant correlation between long term memory at Time 1 (with Supplementary Images and Translation) and, L2 vocabulary acquisition at Time 2?
2. Is there any statistically significant correlation between long term memory and phonological memory at Time 1 and Time 2?

VI. METHOD

A. Participants, Design and Procedure

This study was applied quantitative research approach and serial non word recognition tasks (English, Turkish, Bosnian and Arabic) were used. A task involving two sentences with brief retention interval is generally referred to long term memory (LTM) task.

The main objective of the present study is to examine the nature of the relationship between phonological memory, long term memory, and L2 vocabulary acquisition in adolescent (aged between 13 and 17). During the 2014-2015 educational year measures were taken twice at the end of second semester (Time 1) and after 15 days (Time 2) so as to investigate the extent to which L2 learners rely on their phonological memory skill during their L2 vocabulary acquisition.

There are 515 students in the International School of Sarajevo. The research sample contains of 149 adolescents (ages 13-17 years) who were randomly selected from different classes and nations. The adolescents' age was ranged between 13 and 17 years, (17year 27students, 16 year 35students, 15 year 31students, 14 year 24students, 13 year 32students). They have been studying Turkish, English, and Bosnian on a regular basis for 3 years on average. In terms of gender distribution, there were 76 female and 73 male participants.

The present study began with the family language questionnaire that was given to the participants and their parents to collect demographic information about the adolescents as well as other factors that influence the adolescents' first and second language development, such as country of origin, the age when LI and L2 were learned, language use at home, and socioeconomic status. All adolescents were being taught English, Turkish, and also Bosnian as a foreign language by the teacher at their school.

As the most of students do not know Arabic language, is assumed to be main language that can show us exact differences of vocabulary acquisition. Not only simple and partial correlations as well as repeated measures of phonological memory test are used to find out the relationship among variables. These variables are languages of 149 students who have been learning two languages, apart from their first language which, effects of native language on learning of second language vocabulary acquisition.

For serial non word recognition, four sub-tasks were used. The English serial recognition task was administered first, followed by Bosnian, Turkish, and Arabic serial recognition tasks. The instructions were tape-recorded in Bosnian, English and Turkish (the learners' LI) and were given to the participants at the beginning of the testing session.

Stimuli were tape-recorded from the natural speech of a native speaker of English (for the English serial recognition task), Bosnian (for the Bosnian serial recognition task), Turkish (for the Turkish serial recognition task), and Arabic (for the Arabic serial recognition task). Following the second presentation, participants had to state whether the two presentations had been the same or different.

Examples of auditory stimuli correct responses,

Balb el zbak seerqu

Balb el seerqu zbak. "Different"

Galın güçir, kanin goçır.

Galın güçir, kanin goçır.. "Same"

In addition, the Turkish as well as Arabic serial non word recognition task was used since it has been assumed to be a purer measure of phonological memory in that performance on such a task would not be significantly mediated by an increase of long term lexical-phonological representations. Results from the serial recognition tasks were tape-recorded for later analysis.

In Time 1, the participants were instructed to novel word of English, Bosnian, and Turkish translations. While the written form of the foreign word was shown on the left side of the computer screen, (English, Bosnian, Turkish translations and pictures of Arabic and Turkish serial non word recognition test) were shown on the right side of the computer screen. The participants each pair was presented twice during the learning phase.

In Time 2, the delayed serial non word recognition vocabulary testing applied after two weeks. The delayed test session, participants returned to the laboratory, and were tested on long-term retention of the learned vocabulary. Participants completed the recognition tasks for words learned by picture and translation supports. After delayed testing, participants were administered standardized assessment measures of vocabulary knowledge and phonological memory. In this study the four languages serial non word recognition test results were compared using statistical techniques. Initially, we intended to evaluate vocabulary knowledge across four languages. Then, the relationship is explained simply in terms of the mediating influence of phonological short-term memory and long term memory skills.

The data were collected and coded into Excel then to SPSS statistical program for presentation, and analysis. The discussion revolves around the computed means and standardized scores in relation to the aspects and fields where L2 vocabulary acquisition is produced.

Table 1. Simple Correlation of four Languages

ASNWRT1	Pearson Correlation	1							
	Sig. (2-tailed)								
TSNWRT1	Pearson Correlation	.183*	1						
	Sig. (2-tailed)	.025							
BSNWRT1	Pearson Correlation	.187*	.269**	1					
	Sig. (2-tailed)	.022	.001						
ESNWRT1	Pearson Correlation	.299**	.304**	.417**	1				
	Sig. (2-tailed)	.000	.000	.000					
ASNWRT2	Pearson Correlation	.756**	.083	.221**	.294**	1			
	Sig. (2-tailed)	.000	.313	.007	.000				
TSNWRT2	Pearson Correlation	.109	.817**	.313**	.339**	.278**	1		
	Sig. (2-tailed)	.187	.000	.000	.000	.001			
BSNWRT2	Pearson Correlation	.204*	.275**	.780**	.376**	.347**	.428**	1	
	Sig. (2-tailed)	.013	.001	.000	.000	.000	.000		.000
ESNWRT2	Pearson Correlation	.254**	.244**	.332**	.789**	.413**	.395**	.389**	1
	Sig. (2-tailed)	.002	.003	.000	.000	.000	.000	.000	

Correlations of Four Languages 1-Bosnian (BSNWTR) 2-English (ESNWTR) 3-Turkish (TSNWTR) 4-Arabic (ASNWTR) Serial recognition test results (Serial non word recognition) Significance of comparisons (p) is marked by asterisks next to the t values. Significance at $p < 0.01$ is marked by two asterisks **; significance at $p < 0.05$ is marked by one asterisk *

Table 2. Simple Correlation of Supported serial non word recognition test

ASNRTR1	Correlation						
	Significance (2-tailed)						
TSNRTR1	Correlation						
	Significance (2-tailed)	.022					
BSNRTR1	Correlation	.189	.269				
	Significance (2-tailed)	.021	.001				
ESNRTR1	Correlation	.293	.316	.425			
	Significance (2-tailed)	.000	.000	.000			
ASNRTR2	Correlation	.809	.119	.257	.257		
	Significance (2-tailed)	.000	.149	.002	.002		
TSNRTR2	Correlation	.094	.871	.334	.313	.178	
	Significance (2-tailed)	.256	.000	.000	.000	.030	
BSNRTR2	Correlation	.194	.301	.816	.353	.265	.381
	Significance (2-tailed)	.018	.000	.000	.000	.001	.000
ESNRTR2	Correlation	.249	.291	.373	.805	.288	.319
	Significance (2-tailed)	.002	.000	.000	.000	.000	.000

1-Bosnian (BSNRTR) 2-English (ESNRTR) 3-Turkish (TSNRTR) 4-Arabic (ASNRTR)

Four different languages recognitions and responses were completed in two sessions (Time 1 and Time 2). It was observed that there is significant correlation. Arabic serial non word recognition test result (ASNRTR1) and Bosnian serial non word recognition test result (BSNRTR1) have a significant correlation ($r(149) .187, P < 0.022$). And also, between (ASNRTR1) and (ESNRTR1) highly significant correlation was observed ($r(149).299, P < .000$). Opposed to other languages recognitions and responses, middle significant correlation were observed between Turkish serial non word recognition (TSNRTR1) and Arabic non word recognition test result (ASNRTR1) ($r(149) .183, P, < .025$). However, Arabic serial non word recognition, as a (foreign) language was significantly correlated with all three languages second serial non word recognition measures except (TSNRTR) ($r(149).109, P < .187$). In addition these in the second session, between the results of tests, the highly significant correlations were observed. Simple correlations showed that for adolescents, the four serial non word recognition tasks (i.e., (English, Bosnian, Turkish, and Arabic) were significantly correlated to one

another at both testing periods (correlations between Arabic2 and Bosnian2; $r = .347$, $p < .000$ for Time 1 and Time 2 respectively, English2 and Bosnian2, $r = .389$ and $p < .000$ for Time 1 and Time 2 respectively; Bosnian2 and Turkish2, $r = .428$, $p < .000$ for Time 1 and Time 2 respectively). The coefficients obtained are displayed in Tables 1.

In addition Partial correlation is a suitable to get the data for recognition, responses and to clarify the differences between supported two languages (i.e. Turkish, Arabic) and unsupported two languages (i.e. English, Bosnian), to show the impacts to the results of L2 vocabulary acquisition. Partial correlations also showed that for adolescents, the four serial non word recognition tasks (i.e., (English, Bosnian, Turkish, and Arabic) were significantly correlated to one another at both testing periods (correlations between Arabic1 and Arabic 2; $r = .809$, $p < .000$ for Time 1 and Time 2 significantly, English1 and English 2, $r = .805$ and $p < .000$ for Time 1 and Time 2 respectively; Bosnian1 and Bosnian2, $r = .816$, $p < .000$ for Time 1 and Time 2 respectively, Turkish 1 and Turkish2, $r = .871$, $p < .000$ for Time 1 and Time 2 significantly). The coefficients obtained are displayed in Tables 2.

Table 3. Comparisons of Languages Serial non word recognition Test Results

	Correlation	Sig.
ASNWRT2& ASNWRT2	.278	.001
BSNWRT2& ESNWRT2	.389	.000
TSNWRT2 & ESNWRT2	.395	.000
ASNWRT2 & BSNWRT2	.347	.000
ASNWRT2 & ESNWRT2	.413	.000
ASNWRT1 & ASNWRT2	.756	.000
TSNWRT1&TSNWRT2	.817	.000
BSNWRT1& BSNWRT2	.780	.000
ESNWRT1& ESNWRT2	.789	.000

Comparisons of four Languages 1-Bosnian (BSNWTR) 2-English (ESNWTR) 3-Turkish (TSNWTR) 4-Arabic (ASNWTR) Serial recognition test Result

Serial non word recognition score was significantly correlated with foreign serial non word recognition result. ASNWRT2 result respectively correlated between TSNWRT2 ($r=0.278$, $p > 0.01$). Significant correlation was observed between BSNWRT 2 result and ESNWRT2 result ($r=0.389$, $p > 0.00$). L1 acquired, supported background knowledge, and English, Bosnian, Turkish, Arabic vocabulary test results were highly associated with one another. (ASNWRT2 and BSNWRT 2 ($r, 387$, $p > 0.00$), for Time 1 and Time 2 respectively, TSNWTR2 and ESNWTR2 ($r, 347$, $p > 0.00$), for Time 1 and Time 2 middle correlation, ASNWRT2 and ESNWRT 2 ($r, 413$, $p > 0.00$), for Time 1 and Time 2

significant correlation, supported ASNWRT1 and ASNWRT 2 ($r, 756, p > 0.00$), for Time 1 and Time 2 highly significant, BSNWRT1 and BSNWRT 2 ($r, 780, p > 0.00$), for Time 1 and Time 2 highly significant, supported TSNWRT1 and TSNWRT 2 ($r, 817, p > 0.00$), for Time 1 and Time 2 highly significant correlation ESNWRT1 and ESNWRT 2 ($r, 789, p > 0.00$), for Time 1 and Time 2 highly significant correlation) During the gathering of data, it was found out that there is an impact of L1 vocabulary knowledge and also supported foreign vocabulary effect vocabulary acquisition. The partial correlations at both time periods are summarized in Table 3.

A paired samples t-test was conducted to compare the correlations (in table. 2) of Bosnian, English, Turkish and Arabic languages. Serial non word recognition tests are calculated by computing the differences between the paired values. The comparison of English, Bosnian serial non word recognition test and Turkish, Arabic serial non word recognition test results showed the confounding influences of learning and supporting foreign vocabulary acquisition. A number of studies have examined the role of phonological memory in L1 (e.g., Gathercole et al., 1991; 1992) and L2 vocabulary acquisition in pre-adolescents Baddeley et al., 1988) and adults (e.g., O'Brien et al, 2006).

VII. DISCUSSION

This study reviewed and clarified literature using a consistent data sets and methodologies which established the relationship between long term memory and phonological memory of adolescents L2 vocabulary acquisition.

All participants' (Turkish and Arabic) performance on the serial non word recognition task (SNWRT) at Time 1 (Turkish and Arabic) which indirectly measures vocabulary knowledge, was significantly correlated with their performance at Time 2. In both Bosnian and English, the results show that, as predicted for learners, phonological memory at Time 1 was significantly correlated with vocabulary acquisition at Time 2.

Additionally, the finding that supplemented vocabulary knowledge alone (via pictures and definitions) also predicted L2 vocabulary acquisition is consistent with the possibility that the specific relationship between phonological memory at Time 1 and L2 vocabulary performance at Time 2. The result may highlighting relationship between phonological memory and vocabulary knowledge, which adds further evidence to the view of the primary role of phonological memory in both L1 and L2 (e.g., Gathercole et al., 1999; Service, 1992).

Results showed that the correlations increased their significance between Time 1 and Time 2. In both English and Bosnian findings revealed that for all participants, middle significant positive correlations were observed between phonological memory at Time 1 and serial non word recognition test at Time 2. As seen above, the partial correlations carried on so far have allowed for the assessment of the nature of the relationship between phonological memory and supported L2 vocabulary at both testing points (i.e., Time 1

and Time 2). However, these analyses do not necessarily provide a means for exploring the causal directionality of that relationship. At both testing times, there was a significant positive correlation in all participants between, phonological memory and L2 vocabulary acquisition; such a relationship appears to suggest that increases in phonological memory capacity reflect increases in L2 vocabulary acquisition.

In addition, results reported in Tables 2. and 3 shows that the strength of the correlation between phonological memory and L2 vocabulary acquisition was significantly greater for the supplemented words in a foreign language than the native language learners at both time points. It can be obviously indicated that phonological memory plays a causal role in L2 vocabulary acquisition or that L2 ability plays an important role in phonological memory. And also, L2 vocabulary acquisition is fundamentally related to phonological memory and supported by prior knowledge.

This result shows similar evidence like Gathercole studies which is related with the essential role of novel phonological phenomena and the long term store. (e.g., Avons, Wragg, Cupples, & Lovegrove, 1998; Gathercole et al., 1999; Gathercole & Baddeley, 1990; Gathercole et al., 1991; 1992).

Furthermore it was found that knowledge of native and foreign vocabulary has highly significant relationship in contributions of phonological memory to long-term memory. The present study particularly based on the serial non word recognition test which had tested the recognition of auditory.

Implication for the future research, it is possible that written rehearsal task would be a more efficient approach than an auditory rehearsal tasks. The written rehearsal task of serial non word recognition can be studied.

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