The Impact of Age of Acquisition on the speed of Lexical retrieval in Bilinguals

[1]Dr. Reem M. Al Qenai, [2]Dr. Abbas H. Al-Shammari

[1]*Assistant Professor, Kuwait Technical College, State of Kuwait, English & General Studies Department, E-mail:* reemalqenai@gmail.com
[2]*Associate Professor, Kuwait University, State of Kuwait, Faculty of Graduate studies, E-mail:* dr_abbas_7_@hotmail.com

Abstract

The current study assessed the performance of 100 (Arabic-English) early and late bilinguals who lived in Kuwait and were exposed to English as a second language. These students are all students at a technical college in Kuwait who are in their second year of study. They are majoring in scientific fields as many of them are employees enrolled to pursue their education. We used free naming and translation tasks to investigate bilinguals' lexical activation and the effect of age of acquisition on lexical semantic processing. The current study's main goal was to distinguish the lexical semantic organization of early and late bilinguals and to see if there was a difference in the performance of both types of bilinguals in both tasks. It investigated whether the age of acquisition effect emerged during the subjects' lexical activation process. According to the findings, early bilinguals had a faster reaction time and a higher rate of accuracy than late bilinguals.

Keywords: Semantic organization, language memory, AOA, Early and Late bilinguals.

INTRODUCTION

Language appears to be the most robust mechanism of human interaction, as it is easily used to grasp and express a wide range of ideas and emotions. It is used to communicate ideas to one another and to accurately represent what we see around us. Another important role of language is that it allows us to think about ourselves, our thoughts, and other people. Language for communication includes various sophisticated mental processes in the bilingual's mind as well as massive information about the various meanings of words that facilitate the transmission of thoughts and ideas.

Characteristic features in the mental lexicon shed light on essential dimensions of the essence of semantic representation. Numerous proposed semantic hypotheses and meaning representation models rely on these statistical patterns as operational concepts. As these hypotheses and models show, semantic properties are frequently used to perform reliable and quantitative verification of mental lexicon structure statements. Many semantic representation hypotheses, including prototype theory (Rosch & Mervis, 1975) and moral theories, focus on semantic features (Smith & Medin, 1981). The hierarchical network model of semantic memory and language representation (Collins & Loftus, 1975), the Semantic Feature Comparison Model (Smith, Shoben, & Rips, 1974), the Featured and Unitary Semantic Space (FUSS) Model (Vigliocco, Vinson, Lewis, & Garrett, 2004), and the Vector Model of Memory (Hintzman, 1986) are among the approaches (Hinton & Shallice, 1991; Plaut & Shallice, 1993).

A significant number of experimental results relating to comprehension suggest that the bilingual's language is being activated concurrently (Beauvillain and Grainger, 1987; Grainger and Dijkstra, 1999). The facilitation or

inhibition of output from one language to another, particularly the orthographic and phonological details in one language words, is an example of bilingual languages' simultaneous activation (Bijeljac-Babic, Biardeau and Grainger, 1999).

Some studies, such as those conducted by Genesee, Paradis, and Crago (2004), Meisel (2009), Unsworth, and et al., believe that early bilinguals may pattern similarly to simultaneous bilinguals when they pass through different trajectories from L2 learners due to the latter group's later age of onset. According to bilingualism research, simultaneous bilingualism improves and maintains competition in both languages. Their early acquisition is a good indicator of their narrow postlexical status, whereas their late acquisition may include pragmatics and word level awareness. Furthermore, Harley and Wang (1997) discovered that early bilinguals outperformed older bilinguals in many areas, including pronunciation, morphology, and syntax. Furthermore, Krashen, Long, and Scarcella (1979) discovered that early foreign language learners outperform late learners in the long run. These and other studies confirm that early language learners or bilinguals have an advantage in oral communication over late bilinguals (Genesee, 1987; Swain & Lapkin, 1986; Wesche, Morrison, Ready, & Pawley, 1990). Other research works by scholars such as (Cummins 1981; Cummins & Swain, 1986; Lapkin, Swain, & Shapson, 1990; Swain & Lapkin 1986) confirmed that children who have early language learning have more advantageous cognitively and academically than the late ones, and they also have more proficient oral skills than the late ones.

The mental lexicon, which is mentioned here for its relevance to the paper's topic, is defined as "a mental representation of words stored in memory, including information about a word's meaning, pronunciation, syntactic characteristics, and so on (Carroll, 1999)." The theory of the mental lexicon investigates the characteristics and form of meanings, as well as the psychological representation of words. The main components of the mental lexicon are vocabulary knowledge (phonetics, syntax, morphology, and semantics), mental lexicon organization (the process of storing these vocabularies in memory), and vocabulary

extraction (the activation of lexical knowledge). The role of the mental lexicon is to store and organize words in the brains of bilinguals.

Older and later studies classified the bilingual mental lexicon into numerous models (Weinreich (1953) and Dong & Gui (2002)), the most contentious of which are the word association model and concept mediation. Levelt (1989) assumes that the two parts of the lemma and lexeme are included in the internal structure of the lexical entry. Lemma is concerned with semantic and syntactic aspects such as word meaning and knowledge of word classes, whereas lexeme is concerned with morphological and phonological aspects such as word spelling and word variations.

Methodology

Data collection and Participants

A total of 100 students have been chosen as participants for this paper in order to collect data. They are early and late bilinguals who lived in Kuwait and were exposed to English as a second language. These students are all students at a technical college in Kuwait who are in their second year of study. They range in age from 19 to 25 years. The researcher met the participants at their colleges and study locations. The date included 100 stimuli that were displayed on a laptop and shown to the participants. These stimuli included images of vegetables, fruits, animals, clothing, and birds that were randomly presented to the participants in order for them to name them in order to perform the free naming task.

The participants were split into two groups: early bilinguals and late bilinguals. The researchers then use DMDX and check vocal software to measure the reaction time and accuracy of responses in 4000 milliseconds for early and late bilinguals. Actually, the participants were instructed on how to complete this picture naming task and to respond freely in either English or Arabic. The stimuli were presented in a linguistics lab in the presence of a DMDX and check vocal software specialist.

Stimuli

In this study, 100 stimuli were displayed on a laptop and presented to the participants. These stimuli included images of vegetables, fruits,

animals, clothing, and birds that were randomly presented to the participants in order for them to name them in order to perform the free naming task. Name agreement, imageability, familiarity, frequency, age of acquisition, and length values were available for each image. Further information about the framing task is provided in the following section on the nature of data and methodology.

The DMDX software listed all of the responses and reaction times of the early and late bilinguals after the stimuli presentations were completed. Furthermore, the researchers imported such lists into the check vocal software to obtain more accurate results, as the check vocal software tracks the participants' response times and reactions from the start to the finish. Finally, the researchers compared the mean or average reactions of both early and late bilinguals. The comparison revealed results that demonstrate the similarities and differences between the two bilingual groups. The results section of this paper discusses and details the findings.

Discussion

Carroll and White (1973) hypothesized that bilinguals who learned their second language earlier in life were faster at naming pictures and translating terms than bilinguals who learned their second language later in life. The age at which skills or concepts are acquired or gained is referred to as the age of acquisition (AoA). The significance of the age of acquisition in linguistics and bilingualism in particular has been extensively researched in the past and present, and will continue to be investigated in the future. The current study looks at the rate of lexical activation in high and low proficient bilinguals based on the age at which they learned their second language.

Because high proficient bilinguals unlock words and pictures in L2 faster and more accurately than low proficient bilinguals, proficiency level has a significant impact on the lexical activation of both high and low proficient bilinguals. Those bilinguals who acquired L2 earlier are highly fluent due to their early age of acquisition. In contrast, bilinguals who learned the language later are less proficient, and this study can demonstrate whether or not this assertion is correct. Bilinguals in this sample were classified as early or late bilinguals based on the age at which they learned the language. Then, using DMDX to validate vocal tools, we tested the response time and precision of early and late bilinguals in a 2000-millisecond time frame. According to their LEAP-Q responses, 18 participants were early bilinguals and 32 were late bilinguals. The hypothesis of this study was that there is no difference in performance between early and late bilinguals on picture naming and translation tasks. As a result, in this study, we compared reaction time and accuracy in early and late bilinguals.

A t-test analysis was used to compare lexical activation speed on the picture naming task between the early and late bilingual groups. The reaction time for the early bilinguals was 1087.21, MSE = 39.40401, and the reaction time for the late bilinguals was 1509.65, MSE = 48.14059. The statistical analysis revealed a significant difference in reaction time between early and late bilinguals t (2,48) = -5.964, MSE = 70.829438, p=.001.05.

Table 1. *MRTs & ACC of early and late bilinguals on picture naming task.*

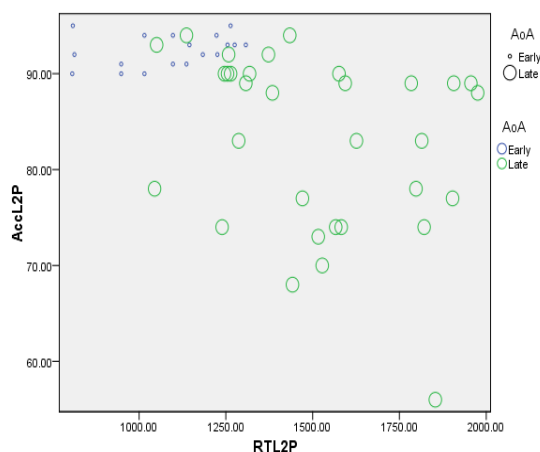|	AoA	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
RTL2P	Early	18	1087.2019	167.17704	39.40401			
	Late	32	1509.6457	272.32429	48.14059	-5.964	48	.000
AccL2P	Early	18	92.3889	1.64992	.38889			
						4.225	48	.000
	Late	32	83.0625	9.24204	1.63378			

Figure 1. *Distribution of early and late bilinguals' performance on picture naming task.*

According to the table above, early bilinguals performed faster than late bilinguals, and their accuracy rate was also higher. The early bilinguals' accuracy rate was 92.39 percent, MSE =.38889, while the late bilinguals' accuracy rate was 83.1 percent, MSE = 1.63378. This suggests that there is a significant difference in reaction time and accuracy between early and late bilinguals t (2, 48) = 4.225, MSE = 9.326389, P=.001.05.

Because the current study's primary concern is the second language, it sought to evaluate the performance of early and late bilinguals in their L2. This section investigated the naming latency variations in bilingual lexical access of two groups of participants based on their age of acquisition. It was investigated whether participants in the first group named L2 pictures better than participants in the second group and whether the age of acquisition had any effect on the results of the picture naming task in the high and low groups. The age of acquisition is also being investigated to see if it can predict latency trends. Statistical comparisons of bilingual participants' response time and accuracy rate revealed a significant statistical gap in naming L2 images, with early bilinguals being faster and more precise than late bilinguals.

The purpose of this study was to demonstrate how situational factors such as language acquisition age influence external factors such as proficiency. According to the findings of this study, situational variables such as age of acquisition played a significant role in predicting a bilingual's level of proficiency, influencing the lexical-semantic organization. The results of the study in participants who were historically classified as early or late learners show that those who learned their second language earlier are more fluent and organize language faster than those who learned it later. This statement does not imply that all high proficient bilinguals were early bilinguals or that all low proficient bilinguals were late bilinguals. However, the majority of early bilinguals are extremely fluent, and some participants are late bilinguals but extremely proficient.

The current study found that the age of acquisition had a significant impact on bilingual accuracy scores and naming latencies. Participants who had previously studied L2 in an English-speaking setting had higher accuracy ratings and shorter naming latencies than those who had recently learned L2. As a result, acquisition age is an external (situational) factor that can influence the lexical-semantic organization mechanism in reaction time and picture naming accuracy. As a result, the current study supported the findings of Van Loon-Vervoorn (1989) and Brysbaert et al. (2000), who claimed that the age of acquisition can influence bilingual lexical organization. In two PWI experiments, evidence from their studies reveals minor effects of L2 age of acquisition on speed and accuracy.

The performance of late and early bilingual participants in translation task was also investigated. The performance of two groups of bilinguals on L2 word translation was examined in this task based on their age of acquisition. A t-test was performed on the mean reaction time of the two groups in L1 to L2, and the results showed that the early bilinguals performed similarly to the late bilinguals in terms of reaction time and accuracy. The results of the t-test comparison between the two groups are shown in Table 2.

Table 2. *T-test result of MRTs and ACC of early and late groups on translation task from L1 to L2*

AoA		N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
RTL 2T	Early	18	1442.5 170	363.7060 8	85.72634	-1.178	48	.245
	Late	32	1553.1 141	291.2034 0	51.47798			
ACC L2T	Early	18	91.722 2	2.82438	.66571	6.947	48	.000
	Late	32	81.593 8	5.79131	1.02377			

The reaction time of the early bilinguals in the translation task from L1 to L2 was 1442.52, MSE = 85.72634, and the late bilingual group was 1553.12, MSE = 51.47798. The results show that early bilinguals and late bilinguals had a similar time translating words from L1 to L2. As a result, no statistically significant difference in reaction time could be found between the two groups t (2, 48) = -1.178, p=.245>.05. The accuracy rate was also examined and compared using the same t-test, which revealed that the percentage of correct responses for early bilinguals was 91.72 percent and 81.6 percent for late bilinguals. The accuracy rate analysis revealed a significant difference in performance between the two bilingual groups t (2, 48) = 6.947, p =.001.05. Figure 4.24 depicts the distribution of reaction time and accuracy on the L2 translation task among early and late bilinguals.
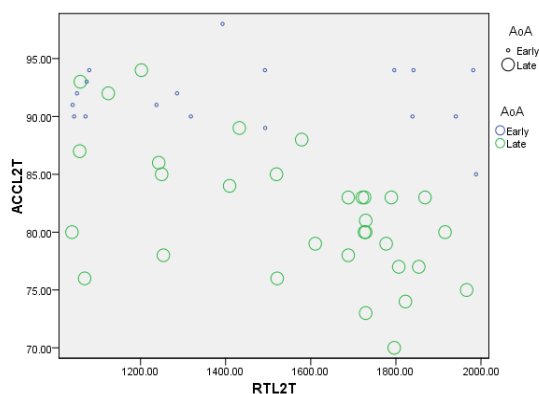

Figure 2. *Distribution of reaction time and accuracy of both early and late bilinguals in L2 translation.*

Conclusion

In bilinguals, the age of acquisition reveals details about semantic organization, memory, and language production (see Johnston and Barry, 2006 and Juhasz, 2005 for comprehensive reviews). The effect of age of acquisition on the concept of bilinguals who learned the language earlier outperforming bilinguals who learned the language later, with early pictures being named or recognized more quickly and reliably than late pictures, is investigated in this study. The majority of previous research on the topic has assumed that the effect of acquisition age on proficiency level is increased lexical activation and access. The developmental architecture of semantic networks and memory is similar to the age of acquisition in several ways, which contributed to the formation of the age of acquisition semantic hypothesis (Brysbaert, 2000). The age at which words are acquired, according to Brysbaert and colleagues (2000), may be a critical component of the semantic system, i.e. memory.

The findings of this study supported the semantic theory's prediction that L2 acquisition age would have the greatest impact on activities requiring access to the semantic stage of language production. The central argument is that early acquired images or items would benefit from faster and more effective lexical activation because they were the first to join the representational structure, whereas later acquired words or items would be built on top of them. As a result, the representation of late acquired words is influenced by early acquired words.

Furthermore, responses to images in early childhood were linked to shorter naming latencies than responses to images introducing new concepts in later childhood (Carroll & White, 1973). This discovery had a huge impact on word and image perception theories, which heavily relied on frequency as a psycholinguistic predictor to describe behavioral evidence like reaction times. Frequency and acquisition age are linked, with early-acquired items having a higher frequency (being more prevalent) and late-acquired items having a lower frequency (being less prevalent) (less common). This finding emphasizes the importance of acquisition age and its impact on the lexical-semantic organization process.

When it comes to naming pictures, the age at which a person learns a skill has an impact, but not when it comes to translating words (word naming). The statistical analysis of the study backed up this claim. The arbitrary mapping hypothesis' prediction that age of acquisition has little effect on the word naming task was confirmed as a result of this finding. With the hypothesis that acquisition age has an effect on picture naming tasks, Raman (2006) investigated the effect of acquisition age on the rate of lexical activation. As a result, while age has no bearing on word naming tasks, it does on picture naming tasks.

Another study, Morrison, Hirsh, Chappell, and Ellis, corroborates the current analysis' findings (2002). Word and object naming tasks were used to test the cumulative frequency hypothesis' claims. There was, however, no discernible link between acquisition age and participant age. Furthermore, numerous studies have failed to support the theory with evidence (e.g., Gilhooly, 1984; Morrison et al., 2002). Early and late bilinguals' naming latencies were more affected by their age of acquisition. Acquisition age has been shown to have a significant effect on reaction times that cannot be explained solely by the combined frequency account. As a result, the cumulative frequency theory's claim that the eras of bilingualism and language learning are unrelated is debunked by this research. The age of a bilingual has an effect on lexical sematic organization, according to the current study, with bilinguals who started learning L2 at a young age processing and unlocking meanings from the bilingual memory faster than those who learned language later in life.

The majority of world languages are affected by age of acquisition, according to studies. As a result, the findings of this study are thought to be a one-of-a-kind contribution to the study of the impact of acquisition age on the lexical-semantic organization of Arabic-English bilinguals. The effects of acquisition age have been discovered, with acquisition age having a significant impact on how visually presented images are processed.

The findings of Izura and Ellis (2002), who asked bilinguals to rate the age at which they first learned English words, were confirmed in this study (L2). The findings show that bilinguals' picture naming and lexical decision times in Spanish (L1) are influenced by their acquisition age, as are their picture naming and lexical decision times in English (L2). The L2 age of acquisition effect was independent of the L1 age of acquisition effect, and native language had little effect on L2 age of acquisition ratings, according to a multiple regression analysis. In both studies' image naming tasks, age of acquisition had a significant effect on the speed of lexical activation and meaning retrieval, indicating that this variable improves bilinguals' lexical semantic encoding and organization.

In general, these findings support the experimental hypotheses that the age of acquisition effect cannot be comparable or equal under these conditions because early bilinguals incorporate L2 images and words into their lexicon before late bilinguals. Because picture production is thought to be independent of language, the picture data suggests a strong influence of age of acquisition. These findings support the semantic hypothesis (Brysbaert et al., 2000), which states that the age at which bilingual memory is formed is influenced by the age at which it is acquired. Even if there are no L1-specific effects on free recall in L2, L2 speakers' semantic organization of the language processing mechanism differs from monolinguals'.

Reference

[1]   Bahrani, T., & Sim, T. S. (2012). Informal Language Learning Setting: Technology or Social Interaction?. Turkish Online Journal of Educational Technology-TOJET, 11(2), 142-149.

[2] Bijeljac-Babic, R., Biardeau, A., & Grainger, J. (1997). Masked orthographic priming in bilingual word recognition. Memory & Cognition, 25(4), 447-457.

[3] Blanco-Elorrieta, E., & Pylkkänen, L. (2015). Brain bases of language selection: MEG evidence from Arabic-English bilingual language production. Frontiers in human neuroscience, 9, 27.

[4] Brysbaert, M., Van Wijnendaele, I., & De Deyne, S. (2000). Age-of-acquisition effects in semantic processing tasks. Acta Psychologica, 104(2), 215-226.

[5] Carroll, J. B., & White, M. N. (1973). Word frequency and age of acquisition as determiners of picture-naming latency. The Quarterly Journal of Experimental Psychology, 25(1), 85-95.

[6] Chee, M. W. (2006). Dissociating language and word meaning in the bilingual brain. Trends in Cognitive Sciences, 10(12), 527-529.

[7] Cohen, J. (1988). Statistical power analysis for the behavioural sciences, 2nd edn.(Hillsdale, NJ: L. Erlbaum Associates).

[8] Collins, A. M., & Quillian, M. R. (1969). Retrieval time from semantic memory. Journal of verbal learning and verbal behavior, 8(2), 240-247.

[9] Costa, A., Miozzo, M., & Caramazza, A. (1999). Lexical selection in bilinguals: Do words in the bilingual's two lexicons compete for selection?. Journal of Memory and language, 41(3), 365-397.

[10] Costa, A. (2005). Lexical access in bilingual production In Kroll JF & De Groot AMB (Eds.), Handbook of bilingualism: Psycholinguistic approaches (pp. 308–325).

[11] Costa, A., Albareda, B., & Santesteban, M. (2008). Assessing the presence of lexical competition across languages: Evidence from the Stroop task. Bilingualism, 11(1), 121.

[12] Crinion, J., Turner, R., Grogan, A., Hanakawa, T., Noppeney, U., Devlin, J. T., ... & Price, C. J. (2006). Language control in the bilingual brain. Science, 312(5779), 1537-1540.

[13] Dalrymple-Alford, E. C. (1968). Interlingual interference in a color-naming task. Psychonomic Science, 10(6), 215-216.

[14] De Groot, A. M., & Kroll, J. F. (Eds.). (2014). Tutorials in bilingualism: Psycholinguistic perspectives. Psychology Press.

[15] Dijkstra, T. (2001). What we know about bilingual word recognition: A review of studies and models. In Proceedings of the Plenary Address at the International Symposium on Bilingualism.

[16] Dijkstra, T., Timmermans, M., & Schriefers, H. (2000). On being blinded by your other language: Effects of task demands on interlingual homograph recognition. Journal of Memory and Language, 42(4), 445-464.

[17] Dijkstra, A. F. J., & Van Heuven, W. J. (2002). The architecture of the bilingual word recognition system: From identification to decision.

[18] Durgunoğlu, A. Y., Nagy, W. E., & Hancin, B. J. (1991). Cross-language transfer of phonemic awareness. Center for the Study of Reading Technical Report; no. 541.

[19] Duyck, W., & Brysbaert, M. (2002). Forward and backward number translation requires conceptual mediation in both balanced and unbalanced bilinguals. Journal of Experimental Psychology: Human Perception and Performance, 30(5), 889.

[20] Fishman, J. A. (1965). Who speaks what language to whom and when?. La linguistique, 1(Fasc. 2), 67-88.

[21] Gerard, L. D., & Scarborough, D. L. (1989). Language-specific lexical access of homographs by bilinguals. Journal of Experimental Psychology: Learning, memory, and cognition, 15(2), 305.

[22] Giles, H., & Williams, A. (1994). Patronizing the young: Forms and evaluations. The International Journal of Aging and Human Development, 39(1), 33-53.

[23] Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. Bilingualism: Language and cognition, 1(2), 67-81.

[24] Grosjean, F. (2010). Bilingual. Harvard university press.

[25] Grosjean, F. (1982). Life with two languages: An introduction to bilingualism. Harvard University Press.

[26] Grosjean, F. (1997). Processing mixed language: Issues, findings, and models. Tutorials in bilingualism: Psycholinguistic perspectives, 225-254.

[27] Issa, S. H., Awadh, F. H., & Ahmed, H. R. (2022). The role of proficiency level in the speed of lexical activation. Cogent Arts & Humanities, 9(1), 1999613.

[28] Issa, S. H., Ahmed, H. R., Alwan, E. E., Mutahar, A. A., Bajiri, M. E., & Abhishek, B. P. (2021). An objective tool for classification of language deficits in adults. Review of International Geographical Education Online, 11(5), 4237-4246.

[29] Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. Journal of memory and language, 33(2), 149-174.

[30] Kroll, J. F., Van Hell, J. G., Tokowicz, N., & Green, D. W. (2010). The Revised Hierarchical Model: A critical review and assessment. Bilingualism (Cambridge, England), 13(3), 373.

[31] La Heij, W. (2005). Selection processes in monolingual and bilingual lexical access. Handbook of bilingualism: Psycholinguistic approaches, 289-307.

[32] Lightbown, P. M., & Spada, N. (2001). Factors affecting second language learning. English language teaching in its social context, 28-43.

[33] Marian, V., Blumenfeld, H. K., & Boukrina, O. V. (2008). Sensitivity to phonological similarity within and across languages. Journal of Psycholinguistic Research, 37(3), 141-170.

[34] Marian, V., Blumenfeld, H. K., & Kaushanskaya, M. (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. Journal of speech, language, and hearing research.

[35] Marian, V., & Spivey, M. (2003). Competing activation in bilingual language processing: Within-and between-language competition. Bilingualism, 6(2), 97.

[36] McCormack, P. D. (1977). Bilingual linguistic memory: The independence-interdependence issue revisited. Bilingualism: Psychological, social, and educational implications, 57-66.

[37] van Loon-Vervoorn, W. A., & Willemsen, I. (1989). Selective disturbance in lexical knowledge in the elderly with or without dementia. Tijdschrift voor gerontologie en geriatrie, 20(2), 59-65.

[38] Van Heuven, W. J., Dijkstra, T., & Grainger, J. (1998). Orthographic neighborhood effects in bilingual word recognition. Journal of memory and language, 39(3), 458-483.

[39] Watkins, K. E., Marsick, V. J., Wofford, M. G., & Ellinger, A. D. (2018). The evolving Marsick and Watkins (1990) theory of informal and incidental learning. New directions for adult and continuing education, 2018(159), 21-36.

[40] Waxman, S., & Gelman, R. (1986). Preschoolers' use of superordinate relations in classification and language. Cognitive Development, 1(2), 139-156.