Original Article

The Effect of Memorizing the Quran on Cognitive Functions

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Abstract

Background: Memorizing the Quran is an education continuing from the early periods of Islamic education until today. Although this education started in the past to protect the Quran, nowadays, it is continuing as a tradition. **Aims and Objectives:** The main purpose of this study is to investigate the effects of memorizing the Quran on certain cognitive functions of individuals. **Materials and Methods:** The scope of the study is limited to 18 female and 15 male students who have been studying in the 5th, 6th, and 7th grades of Anatolian Imam Preacher Secondary Schools in different districts of İstanbul. After Demographic Information Questionnaire was used, California Verbal Learning Test children's version, Wechsler Memory Scale revised visual reproduction subtest, Trail Making Test, and Verbal Fluency Test were applied twice to collect data about individuals before and after memorization training. **Results:** Findings demonstrated that there is a statistically significant difference in verbal learning, visual learning, attention speed, and phonemic and semantic fluency before and after memorization training. **Conclusion:** In conclusion, memorizing the Quran has positive impacts on verbal and visual memory, attention processes, and lexical and semantic fluency of individuals. It is important with regard to eliminate emptiness in the literature. In future studies, it can be investigated the effects of textual memorization in a foreign language on brain structures and connections.

Keywords: *Childhood education, cognitive processes, memorizing Quran, memory, neuropsychological tests*

Introduction

Hıfz is an education system that is based on memorizing the holy book Quran by using encoding, storage, and retrieval processes of memory.[1] This education system requires to memorize an increasing number of words day by day; therefore, it is also called textual memorization.[2] Since the Ottoman period, traditional hıfz education system is applied in Turkey. Quran is divided into 30 chapters and each chapter is comprised 20 pages. Traditional method starts with memorization of the last page of every chapter and then the second last page of every chapter and so on.[3]

According to the information processing theory, attention and consolidation significantly affect learning. In hıfz education, texts are first stored in sensory memory through visual and auditory senses, then moved to short-term memory with attention and then transferred to long-term memory with consolidation Salehuddin (2018) is found that texts are first stored in sensory memory through visual and auditory senses, then moved to short term memory with attention and then transferred to long term memory with consolidation, in hıfz education. As texts are strengthened by reading continuously and regularly, synaptic connections get more stronger in the brain, and so changes occur in cell and brain circuits.[4] Studies show that textual memorization causes an increased gray matter in certain brain regions and a direct change in brain structures.[2] When the literature and the results are reviewed, there is no such study on the effect of memorizing the Quran on cognitive functions.

With the change of education policy since 2012 in Turkey, hıfz school projects have been activated. It is a good opportunity for those who want to memorize the Quran during the period of secondary school.[5] "The Project of Hıfz with Formal Education" that carries out together by the

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Presidency of Religious Affairs (DİB) and Ministry of National Education provides students the opportunity of memorizing the Quran after 4 years of primary school.[6]

The aim of this study is to seek an answer what is the effect of memorizing the Quran on cognitive functions such as verbal memory, visual memory, attention, and verbal fluency processes. The difference in the current study is that it evaluates hıfz education in the context of mentioned cognitive functions and it is a quantitative study about hıfz education.

Materials and Methods

The ethics committee approval has been obtained from Uskudar University Non Interventional Research Ethics Committee report number of B.08.6.YÖK.2. ÜS.0.05.0.06/2018/1033 (24 December 2018).

The study is started after the ethics committee approval was obtained from Üsküdar University on December 24, 2018, with the number 1033. This research was conducted with 18 female and 15 male students who have been studying in the 5th, 6th, and 7th grades of Anatolian Imam Preacher Secondary Schools in different districts of İstanbul. Participants get involved in the hıfz education program which is applied in Mehmet Akif Ersoy and Mustafa Can Quran Courses within the Presidency of Religious Affairs. While this study was conducted with female students from January to June in 2019, it was handled with male students from December 2019 to August 2020.

This study is a quantitative research with pre- and posttest experimental design. This experimental design was used to determine the changes over time in cognitive functions as a dependent variable. Four neuropsychological tests were applied to evaluate certain cognitive performances before starting the study. These tests were applied once again 5½ months later for females and 8 months later for males. The cognitive functions that measured by the neuropsychological tests are verbal memory, visual memory, attention, and verbal fluency processes. To examine the effect of memorizing the Quran (as an independent variable) on cognitive functions (as a dependent variable), the data obtained from pre- and posttest values were compared with each other and converted into statistics.

Instruments

Demographic Information Questionnaire

This form involves information about student's age, number of siblings, medication use, studying environment, hand preference, education, and socioeconomic levels of parents.

California Verbal Learning Test-children's version

The California Verbal Learning Test-children's version is used to examine in many aspects of auditory and verbal learning for children.[7] It consists of 11 subtests: immediate recall (IR) measures learning slope and continuity of learning in time; distraction variable measures proactive interference which means that old memories disrupt new memories; short-delay free recall measures short-term verbal memory; long-delay free recall measures long-term verbal memory and retroactive interference which means that new memories disrupt old memories; short-delay cued recall measures short-term memory with category clued; long-delay cued recall measures long-term memory with category clued; perseveration (P) measures words repeated in a trial; intrusions (I) represent to say extra-list intrusions other than target words; semantic clustering (SC) shows the efficiency of learning styles and strategies; discriminability (D) gives information about the ability to distinguish target words from other category words; and response bias (RB) is the tendency to identify words as belonging on the target list.[8,9]

Wechsler Memory Scale-revised visual reproduction subtest

The Wechsler Memory Scale-revised is one of the most common and useful neuropsychological testing.[10] Visual Reproduction Subtest which measures the visual capacity of individuals is used in this study. The score of immediate visual reproduction (IVR) gives information about short-term visual memory. The score of delayed visual reproduction (DVR) provides information about long-term visual memory.[11]

Trail Making Test

Trail Making Test (TMT) is a neuropsychological test which is used to assess visual attention, task switching as well as executive functions. It consists of A and B forms.[12] Trail making A form (TMT-A) provides information about visual search speed and scanning, it measures psychomotor and attention speed. Trail making B form (TMT-B) provides information about shift attention between one task and another, it measures response inhibition, mental flexibility, and visual search speed.[13] When A duration is subtracted from B duration TMT (A-B), the effect of the speed variable disappears and it gives a clearer information about attention, flexibility, and task switching. When A duration is added B duration TMT (A + B), it gives general information about visual scanning and attention.[14-16]

Verbal Fluency Test

The Verbal Fluency Test provides information on the ability of producing as many as words possible from a category in a certain time period. The test is used to evaluate executive functions and it consists of three different parts and their perseverations.[17] Counting animal (CA) measures semantic fluency; CA perseveration measures stereotypes repetitions; Controlled Oral Word Association (COWA) measures phonemic fluency; COWA perseveration (COWAP) measures repetition in phonemic fluency; sequential category naming (SCN) measures the ability to switch between two categories; and SCN perseveration measures repetition in semantic fluency.[18,19]

Data analysis

The data obtained from this study were analyzed using the software package SPSS® version 20.0, IBM Inc., Chicago, IL, USA. Paired sample *t*-test was used for normally distributed data, Wilcoxon signed-rank test was used for not normally distributed data to examine differences between before and after cognitive performances, and also independent sample *t*-test was used to evaluate gender differences in their performances. The data were analyzed at a 95% confidence interval and $P < 0.05$ significance level.

Results

A total of 33 participants took part in the study. About 54.5% of them were girls, 87.9% of them do not use a medication at full strength, 57.6% of them have separate rooms, and 87.9% of them use their right hands. It has been defined that 45.5% of monthly income was at the middle level. Majority (36.4%) of students' mother were at the primary education level and 24.2% of their fathers were at the high school education level. The average age of the students was 11.52 ± 1.25, and the average number of siblings was 3.18 ± 1.01.

The results from Table 1 show that memorizing the Quran significantly influences the IR, predisposition of distractive variables, short- and long-delay free and cued recalls, SC, and discriminability processes of individuals ($P < 0.01$). Moreover, there is no statistically significant difference in perseveration, RB, and intrusions ($P > 0.05$).

As shown in Table 2, memorizing the Quran significantly influences the immediate and delayed visual reproduction of individuals ($P < 0.001$).

As shown in Table 3, there is a statistically significant difference in terms of duration to complete TMT A and B Form between pre- and postmemorization training of individuals ($P < 0.001$). Besides that, there is a statistically significant difference in durations of TMT A ± B Form between before and after memorization training ($P < 0.01$).

As shown in Table 4, individuals' pre and post performances in CA, controlled oral word association, and sequential category naming are significantly influenced from memorizing Quran education ($P < 0.05$). However, there is no statistically significant difference before and after education in terms of perseveration of CA, controlled oral word association, and sequential category naming performances ($P > 0.05$).

As shown in Table 5, there is no statistically significant difference in terms of changes in IR, short- and long-delay free recall, immediate and delayed visual reproduction, trail making B form duration, CA, controlled oral word association, and sequential category naming before and after memorization training according to gender ($P > 0.05$). There is only found a statistically significant difference in duration to complete TMT B form pre and post training in favor of females ($P < 0.05$).

Table 1: California Verbal Learning Test-children's Version changes

CVLT-C subtests	Pretest (*n*=33)	Posttest (*n*=33)	*t*	*P**
IR	46.61±7.35	59.70±7.09	−11.192	0.000
DV	5.18±1.91	6.82±2.22	−3.708	0.001
SDFR	9.33±2.61	12.09±2.11	−6.183	0.000
SDCR	9.45±2.29	12.52±2.21	−8.470	0.000
LDFR	9.61±2.20	12.82±1.92	−8.065	0.000
LDCR	9.70±2.20	12.79±1.76	−8.292	0.000
P	6.85±5.56	8.03±4.74	−1.126	0.268
SC	20.79±6.00	35.48±13.91	−6.081	0.000
RB	0.041±0.35	0.032±0.15	0.141	0.889
CVLT-C subtests	**Pretest (*n*=33)**	**Posttest (*n*=33)**	***Z***	***P****
D	94.54±4.55	97.97±2.17	−4.013	0.000
I	2.61±3.24	2.79±3.87	−0.135	0.892

*Paired sample *t*-test, **Wilcoxon signed-rank test. IR: Immediate recall, DV: Distraction variables, SDFR: Short-delay free recall, SDCR: Short-delay cued recall, LDFR: Long-delay free recall, LDCR: Long-delay cued recall, P: Perseveration, SC: Semantic clustering, RB: Response bias, D: Discriminability, I: Intrusions

Table 2: Wechsler Memory Scale-revised visual reproduction subtest changes

WMS-R subtests	Pretest (*n*=33)	Posttest (*n*=33)	*t*	*P**
IVR	8.91±2.40	12.36±2.23	−9.415	0.000
DVR	7.58±2.82	11.91±2.67	−9.423	0.000

*Paired sample *t*-test. IVR: Immediate visual reproduction, DVR: Delayed visual reproduction

Table 3: Trail Making Test changes

TMT subtests	Pretest (*n*=33)	Posttest (*n*=33)	*t*	*P**
TMT (A)	42.58±12.99	32.82±10.20	7.191	0.000
TMT (B)	102.97±35.25	75.33±20.56	5.133	0.000
TMT (A-B)	60.39±32.53	42.52±21.38	3.044	0.005
TMT (A+B)	145.55±42.01	108.15±24.42	7.176	0.000

*Paired sample *t*-test. TMT (A): Trail making A duration, TMT (B): Trail making B duration, TMT (A−B): Trail making A minus B duration, TMT (A+B): Trail making A plus B duration

Discussion

This study was conducted to determine the effect of memorization training on cognitive functions. Individuals who took the education of Quran memorization were examined in terms of verbal memory, visual memory, attention speed, and verbal fluency performances. There are many studies related to the qualification of hıfz education in the literature, but there is no quantitative study related to the effect of hıfz education on cognitive functions. Therefore, this research will set light to future studies.

In literature, it has been reported that memorizing the Quran includes many benefits for improving memory.[1,20] Methods such as visualization of words, consecutive succession, individually mnemonic coding, and grouping are used

Table 4: Verbal Fluency Test changes

VFT subtests	Pretest (*n*=33)	Posttest (*n*=33)	*t*	*P**
CA	17.42±4.56	19.30±5.16	−2.125	0.041
COWA	21.24±9.61	27.58±8.72	−5.837	0.000
COWAP	0.39±0.65	0.61±0.82	−1.269	0.214
SCN	7.15±2.06	8.30±1.94	−2.510	0.017
SCNP	0.15±0.36	0.33±0.47	−1.644	0.110
VFT subtests	**Pretest (*n*=33)**	**Posttest (*n*=33)**	***Z***	***P****
CAP	0.58±1.20	0.24±0.50	−1.268	0.205

*Paired sample *t*-test, **Wilcoxon signed-rank test. CA: Counting animal, COWA: Controlled oral word association, COWAP: Controlled Oral Word Association perseveration, SCN: Sequential category naming, SCNP: Sequential category naming perseveration, CAP: Counting animal perseveration

Table 5: *T*-test results comparing males and females pre- and posttest changes

Pre-post test changes	Male (*n*=15)	Female (*n*=18)	*P**
IR	12.33±5.93	13.72±7.41	0.563
SDFR	2.26±3.03	3.16±2.09	0.323
LDFR	3.40±2.58	3.05±2.07	0.674
IVR	3.80±1.82	3.16±2.33	0.399
DVR	5.13±2.74	3.66±2.42	0.114
TMT (A)	12.66±7.36	7.33±7.48	0.049
TMT (B)	34.60±39.41	21.83±21.03	0.244
CA	3.46±5.57	0.55±4.34	0.102
COWA	0.26±1.03	0.16±0.92	0.771
SCN	1.00±2.29	1.27±2.94	0.768

*Independent sample *t*-test. IR: Immediate recall, SDFR: Short-delay free recall, LDFR: Long-delay free recall, IVR: Immediate visual reproduction, DVR: Delayed visual reproduction, TMT (A):Trail making A duration, TMT (B): Trail making B duration, CA: Counting animal, COWA: Controlled oral word association, SCN: Sequential category naming

during hıfz education.[1] As a result of researches, it has been revealed that if more and more words are memorized every day, it will prepare and develop the memory by increasing its capacity (Salehuddin, 2018). Researchers found that individuals who took the education of Quran memorization show high academic success because several cognitive functions are activated at the same time in textual memorization.[1] Furthermore, they found that individual's posttraining cognitive performances were positively affected.[20]

According to a study conducted on individuals who took hıfz education for 1 year, it has been found increased gray matter volumes in the anterior cingulate gyrus, orbitofrontal cortex, left inferior temporal gyrus, right occipitotemporal gyrus, left inferior parietal gyrus, right perirhinal cortex, superior parietal cortex, and posterior and anterior cingulate cortex.[2] These brain regions are generally associated with sensory, decision-making, adaptation to unexpected results, memory, recognition, reading, and pronunciation. It is an indication that the cell and brain circuits change with experiences.[4] Individuals who memorize the Quran constantly can do that activity with the ability of neuroplasticity.

If words or texts are memorized in a foreign language by repeating word by word without learning of meaning deeply, it is called rote memorization. This situation has an important place in word retrieval.[21] Rote memorization takes a large place in hıfz education. A statistically significant difference in short- and long-term verbal memory skills of participants after hıfz education is compatible with literature. Besides, the results of literature show that memorization training causes increased discrimination skill, continuity of learning in time, and efficiency in learning strategies. These are indicators of a good memory process. Ebbinghaus who worked on memorization of nonsense syllables suggested that association is the basis of remembering and he showed the effect of environmental variables and associations on remembered information.[22,23] In this study, the increase of short- and long-delay cued recall supports previous researches, and the increase of predisposition of disruptive stimuli after memorization training shows that the old learning does not make later learning difficulties. In addition to all these, this study showed that there is no statistically significant difference in the individuals' intrusions by saying new words other than the target words and recognizing words which is learned previously.

Individuals who recite verses from any page visualize and recall written words in detail. In the light of literature, photographic memory term is used to represent this situation.[24] This study revealed increased immediate- and long-term visual memory capacity of individuals after memorization training.

According to the lexical approach, language consists of word information. Reading in a foreign language using encoding and recalling processes positively affects on working memory.[25,26] In Quran memorization training, words and texts are learned based on vocabulary rather than grammar. This study shows the increased psychomotor and attention speed, response inhibition, cognitive flexibility, visual scanning speed, general visual monitoring, and working memory performances of participants after hıfz education. The findings from the current study are consistent with previous studies.

Studies on memory show that semantic and syntactic factors have facilitating effect on learning. Semantic fluency represents semantic factors and it is based on producing words related to the category; phonemic fluency represents syntactic factors and it is based on generating sound-related words.[27,28] In this study, a statistically significant difference in phonemic and semantic fluency of participants is found after memorization training, it supports the relevant literature studies. The frontal lobe has an important function in phonemic fluency according

to the researches.[29,30] The phonemic fluency result of this study suggests that frontal lobe functioning of the individuals became syntactically better after memorization training. According to the current study, there is a fact that a statistically significant difference in phonemic fluency is stronger than the statistically significant difference in semantic fluency, so this suggests that words are realized with a sound-oriented rather than a category-oriented in hıfz education. In addition, the sample in this study did not know the Arabic language, this phenomenon supports the idea related to phonemic fluency. Furthermore, it emerges as a new research topic in semantic fluency. Along with these, it is determined that there is a significant increase in students' ability to switching between categories.

Studies have shown that if the retrieval process is extremely emphasized, texts will be permanent in long-term memory.[31] Therefore, it is thought that there might be a statistically significant difference in perseverations of individuals who took hıfz education. However, the term of perseveration mentioned in the literature does not represent transferring information from short-term to long-term memory. For this reason, the lack of a statistically significant difference in verbal learning, phonemic and semantic fluency perseverations in this study could not be explained in the light of the information in the literature.

The changes pre and postmemorization education were evaluated according to gender. It was examined whether there is a brain-based relationship between gender and learning new word processes in literature studies. Researchers have been found that female students perform better than boys in planning and attention processes.[32] In this study, it is revealed that continuity of learning over time, long- and short-term verbal memory, long- and short-term visual memory, cognitive flexibility, and phonemic and semantic fluency changes between pre and post training do not differ by gender, however, it is found a difference in psychomotor and attention speed in favor of female students.

This research is limited to the results of the scales applied to students who took memorizing Quran education and 2018–2019 and 2019–2020 academic years. It is assumed that the sample represents the general population in this study. To eliminate these limitations, it is important to carry out studies with a larger sample that represents the general population.

Sapuan *et al*.[2] are found that textual memorization creates extensive connections in the brain using brain imaging methods. In future studies, it can be provided to determine the effect of memorizing the Quran on possible brain regions. In addition, it can be studied whether the significant increase in cognitive functions is permanent or short term. However, it can be considered the effect of memorizing a text without understanding its meaning on cognitive functions in terms of semantic processing. If it is considered mentioned factors in further studies, it will be made important contributions to the literature.

Patient informed consent

There is no need for patient informed consent.

Ethics committee approval

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There are no conflicts of interest to declare.

Author contribution area and rate

Sümeyye Şirin (%50): Data acquisition, interpretation of data for the study, collection of review of literature, wrote the manuscript.

Barış Metin (%40): conception/design of the work, help in data analysis, critical revision for important intellectual content.

Nevzat Tarhan (%10): guided in developing the extent of the study and contributed to the manuscript with his critiques.

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