IJQE

International Journal of Quality in Education
Online, https://dergipark.org.tr/tr/pub/ijqe
Volume: 6, Issue 1, 2022

e-ISSN:2636-8412

THE EFFECT OF THE MEMORY EDUCATION PROGRAM PREPARED WITH COMPUTER ANIMATIONS ON THE MEMORY DEVELOPMENT OF PRE-SCHOOL CHILDREN

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Abstract

The main purpose of this research is to examine the effect of the Memory Education Program supported by animations on the phonological, visual-spatial and semantic memory skills of preschool children. The study group consisted of 40 children aged 61-72 months, attending the kindergartens of two primary schools in the same region of the Ministry of National Education in the Etimesgut district of Ankara province in the 2016-2017 academic year. The research was carried out in a pre-test post-test experimental design with a control group, and one of the schools was randomly selected as the experimental group and the other as the control group. The Memory Training Program supported by animations prepared by the researcher was applied to the experimental group two days a week for ten weeks. The data of this research were collected through the General Information Form and the Memory Battery for Preschool Children. The Memory Battery for Preschool Children was administered to the experimental and control groups as a post-test at the end of the ten-week education program. Four weeks after the post-test *application, the battery was re-administered to 20 children in the experimental group to determine whether the training provided was permanent. The distributions of children and families regarding the demographic characteristics are given as frequency and percentage values. Whether there is a difference in the Memory Battery for Preschool Children scores of the children participating in the Memory Education Program at the end of the experiment compared to the children who did not participate in this training; distributions are normal and since the equality of regression slopes for all subtests is provided, ANCOVA has been tested. The t-test for Repeated Measurements was used in the comparison of the post-test and the retention test in the experimental group. The significance level was determined as 0.05. As a result of the findings, it was determined that the Memory Education Program supported by animations had a positive effect on the development of children's phonological, visual- spatial and semantic memory skills, and this effect was permanent.*

Keywords: *Preschool, Memory development, Memory education, Computer animation*

Introduction

Memory can be defined as a mental system that holds and stores personal information and controls these mechanisms (Ashcraft, 2002). For this, information is perceived by the sense organs, then processed, recorded and stored in anatomical regions (Mesulam, 2004). Today, it is accepted that memory is not a single piece of mind-specific skill, but one of the basic functions of the mind, consisting of independent processes and systems represented in different places in the brain (Schacter, 2010).

It dates back to Ebbinghaus, who made the first experimental studies on memory. In his studies, he found the forgetting curve by concentrating on the relationship of time with memory, and it was stated that according to this curve, the learning material was forgotten faster in the first few hours following the learning activity and then much slower (Schultz & Schultz, 2002). In 1890, a distinction was made between primary and secondary memory. It was stated that the content in the primary memory is transferred to the secondary memory, which contains all the acquired information permanently, and that the secondary memory, unlike the primary memory, can find and retrieve information when necessary (Kilitçi, 2012). In 1949, short-term memory based on the temporary electrical activity of the brain and long-term memory based on neurochemical processes were defined (Baddaley, 2007); In 1968, the multi-store memory model was introduced by Atkinson and Shiffrin by explaining the sensory recording, short-term memory and long-term memory systems (Cangöz, 2005). In 1974, the concept of working memory was proposed, stating that short-term memory does not hold information passively, but processes it (Baddeley, 2003). Then created a hierarchical memory model based on the content of the stored information (Cangöz, 2005). Long-term memory is divided into three systems: episodic memory, semantic memory, and procedural memory. Accordingly, episodic memory includes personal experiences and allows the individual to consciously recall past experiences with time and space information (Tulving, 2002). Semantic memory consists of general information that is not related to a specific time and context and mental concepts that the individual has (Solso, Maclin, & Maclin, 2009). Procedural memory, on the other hand, includes skills and actions that are not consciously aware and cannot be expressed in words (Kilitçi, 2012). In 1985, term memory is classified as explicit and implicit memory. Implicit memory is defined as previous experiences affecting behavior without a conscious and voluntary recollection of them; Explicit memory involves the conscious retrieval of past experiences (Graf & Schacter, 1985).

In this study, phonological and visual spatial memory, which are parts of working memory, will be emphasized. In addition, semantic memory will be emphasized.

Working Memory

The multi-component working memory model was first developed by Baddeley in 1974 (Baddaley, 2002). The working memory center consists of four parts as an executive, phonological loop, visuospatial area and episodic buffer (Baddeley, 2003). Central Administrator; It provides the control, regulation and monitoring of the activities taking place in the phonological loop and visual-spatial area. At the same time, it is seen as a system that regulates and controls the information entering and leaving the long-term memory, responsible for cognitive functions (Baddeley, 2003). The phonological Loop is based on speech and sound-based knowledge (Baddeley, 2003). Responsible for phonological-based knowledge, speech, short-term recording of verbal material, foreign language learning. Relatedly, it is also responsible for the processing of speech-based inputs and learning new words that are new to the person (Baddaley, Gathercole, & Papagno, 1998). It is also stated to help acquire grammar and learn to read (Baddeley, 2000). Visual Spatial Space; responsible for maintaining and using visual and spatial information (Baddeley, 2003); visuospatial material, visual imagery, short-term recording of visual and spatial material, shapes, movement and image (Baddaley, Gathercole, & Papagno, 1998). In studies on the functioning of visual spatial memory, it has been determined that storage may be primarily spatial, depending on the task type; when the stimulus is presented as motor or kinesthetic or through color and shape, it can be mostly visual (Baddeley, 2003). The working memory model has been reorganized and the episodic buffer concept has been introduced as the fourth component of working memory. The visuospatial field acts as a temporary interface between the phonological loop and long-term memory systems and is responsible for holding information from various sources in coherent chunks (Baddeley, 2000).

Semantic Memory

Semantic memory, which is a part of the hierarchical memory model, is seen as the memory where symbolic information about the world is stored (Tulving, 2002). Semantic memory includes information about facts and long-term memory information about the world, including words, concepts, and grammar. It contains general information about the world that connects concepts and ideas and how to express these concepts and ideas with language (Ashcraft, 2002). Semantic memory requires pre-existing knowledge of words and concepts; forms the basis of performance in tasks such as word identification, lexical decision making, and word completion (Schacter, 2010).

As can be seen, semantic memory contains general information about the world that connects concepts and ideas and how to express these concepts and ideas with language (Ashcraft, 2002). It is important to understand its development in children, as working memory is considered the primary step in higher-level cognitive processes such as intelligence, language learning and academic learning (Montgomery, Magimairaj, & Finney, 2010).

Working memory has an important role in supporting children's learning during the school years, as well as their learning in adulthood. The point that the experts who make researches about working memory emphasize is that working memory is necessary to store information while learning activities that require complex skills and knowledge in the classroom are mentally controlled. In such activities, the student who has problems in working memory fails and learning becomes slow and distorted (Alloway, 2006). Children's storage and control of information in short-term memory begin in school years. In studies, it has been determined that children who perform poorly in central executive tasks that require simultaneous storage and processing of information have problems in reading, mathematics and reading comprehension (Leana, 2009). It is also seen that working memory measurements made at the age of four-five before starting school are a good predictor of students' academic achievement (Gathercole, Brown, & Pickering, 2003). The phonological loop, which is an important component of working memory, is important for learning the sound patterns of new words that are necessary to improve vocabulary. Children who have problems with the phonological loop have difficulties in learning new words both in their mother tongue and in foreign language education (Gathercole & Baddeley, 1990). Working memory is also related to complex cognitive behaviors such as understanding, reaching conclusions, and problem-solving (Eangle, 2002). In order to develop working memory, which is responsible for complex cognitive activities such as language processing, visuospatial thinking, reasoning, problem-solving and decision making (Miyake, 2001), it is necessary to organize activities to cover these areas.

In semantic memory, verbal and visual information are tightly linked and stored. Many psychologists also agree that coding information, both visually and verbally, facilitates recall (Yıldız, 2013). Accordingly, coding information by associating information semantically and using phonological and visual inputs together in memory education programs can improve children's memory skills. Research reveals that there is a difference between remembering a word as a picture, in writing, or by reading it orally. Words presented in pictures or verbally are better remembered than words presented in writing because attention can be focused less on words presented in written form (Foos & Goolkasian, 2005). Accordingly, it is seen that including materials and activities designed to attract children's attention can increase children's memory skills.

From early years, the experiences provided to children with visual and verbal stimuli using various materials can be effective in children's learning by creating memory strategies. Gaining the skills of using strategy in the preschool years, when learning is the fastest, will support the development of the child's thinking skills. The child, who develops a memory strategy by using various visual and verbal materials, will be more successful in becoming an individual who adapts easily to the environment in his future life, makes a better sense of the world he lives in, and fits the definition of a qualified person that society needs (Özyürek, 2009). Memory training programs are important, in which children can consciously receive stimuli from the environment, direct their attention and concentration, store this information in their memory, and recall and use them when necessary (Temel, Kurtulmuş, & Kaynak, 2016). Animations can be used in memory training in terms of being remarkable, suitable for repetition, supporting active learning, and being interactive. It is thought that animations, which have both auditory and visual features by appealing to children's different senses, are useful in structuring the learning process by embodying abstract concepts that preschool children have difficulty in understanding, supporting memory skills such as comprehension, coding and recall. This study, it was aimed to evaluate the effects of the memory education program prepared with computer animations applied to preschool children aged six, on children's phonological, visual-spatial and semantic memory skills.

Method

Working Group

In order to determine the study group, the aiming sampling method and the analogous technique were used. Two different schools located in the same region in the Etimesgut district of Ankara were randomly selected as one control group and one as the experimental group. The research was completed with 40 children, 20 in the experimental group and 20 in the control group.

Data Collection Tools

In the study, General Information Form was used to obtain information about the demographic characteristics of the children in the study group and their parents, and the Memory Battery for Preschool Children was used to evaluate their memory skills. Memory Battery for Preschool Children was developed by the researcher; It consists of three subscales. While the first two scales evaluate phonological and visual-spatial memory, which are parts of children's working memory, the third scale evaluates semantic memory. (Obalı, 2018), (Obalı & Ömeroğlu, 2018).

Memory Training Program

During the development of the Memory Training Program, the literature on memory and memory training was examined. The acquisitions and indicators related to memory in 2002, 2006, 2013 Pre-School Education Programs prepared by the Ministry of National Education were scanned and the appropriate ones were taken. Since it was seen that these achievements and indicators were not sufficient for the training program, new achievements and indicators were written by the researcher. The achievements and indicators prepared were presented to the expert opinion. A total of 12 achievements and 47 indicators were created for the Memory Training Program by making adjustments according to the feedback of the experts. After the achievements and indicators were determined, activities were prepared considering the developmental characteristics and individual differences of 60-72 months old children. In the preparation of the activities, the principles from the close to the far environment, from the known to the unknown, from the simple to the complex, from the concrete to the abstract were taken into consideration. In addition, attention was taken to the integration of the activities and to ensure the active-passive balance in the activities. The activities prepared in the form of games, movement, music, Turkish, drama, art, preparation for literacy, mathematics and science are planned to ensure the active participation of all children. Transitions between activities have been prepared in conjunction to facilitate the transition of children from one activity to another. Methods such as interactive-computerized teaching, question-answer, demonstration and learning by doing were used, and individual, small group and large group studies were carried out. The activities were planned daily as 20 sessions in ten weeks, two days a week. Within the scope of the Memory Training Program, 40 activities were prepared, two per day and four per week. While the activities were being prepared, they were planned as activities to develop phonological, visual, visual-spatial and semantic memory skills. Within the scope of the Memory Training Program; one animation video and one interactive animation application for each week; A total of ten animation videos and ten interactive animation applications were prepared by a computer expert and a researcher. After the activities, animation videos and interactive animation applications were completed, they were presented to the expert opinion, and the Memory Training Program was found suitable for age group and memory education by the experts.

Necessary permissions were obtained before the Memory Training Program was implemented. Memory Battery for Preschool Children was applied to the experimental and control groups as a pre- test. The prepared education program was applied to the experimental group twice a week for ten weeks, and daily education programs were given to the children in the control group by their preschool teachers. In order to improve phonological memory skills, activities were applied to remember from the sound, to find the visual of the object heard, to remember the spoken word, to remember and find the word pair in a whole, to make the sequence of what they heard, to complete the story by remembering what they listened to. Animations and interactive animation applications were made for children to remember what they heard, to find the object that the sound belongs to, to remember the sound, word, word pair and story they heard or heard before. In order to develop visual spatial memory skills, it is necessary to remember the missing or added object, to remember one or a series of objects, to make a sequence of occurrence, to remember the object that was shown and hidden and to find it among other objects, to remember the whole from the piece, to find the object to which the pattern or piece belongs, by remembering according to the example. Activities, animations and interactive animation applications were carried out to recreate, remember the details in the picture, find the location of the object shown and hide, and take a position according to the said place. In order to develop semantic memory skills, activities aimed at naming, describing the shown object or picture, counting its features, remembering and finding the missing aspects were applied. To remember the categories of general information; Animations and interactive animation applications were made for naming objects or pictures, counting their features. Memory Battery for Preschool Children was administered to the experimental and control groups as a post-test at the end of the ten-week education program; Four weeks later, the Memory Battery was reapplied to 20 children in the experimental group to determine whether the training provided was permanent.

Data Collection

While collecting the data, the General Information Form was filled by the parents of the children in the study group. The Memory Battery for Preschool Children was administered to the children by the researcher. The data obtained were recorded in the Evaluation Forms.

Analysis of Data

The distribution of the demographic characteristics of children and families is given as frequency and percentage values. In order to determine the appropriate tests to be used in the analysis of the research data, the data were tested for normality. Depending on the effect of the applied memory training, at the end of the experiment, the effectiveness of the program was tested between the experimental and control groups by performing ANCOVA, since the distributions were normal and the equality of regression slopes was provided for all subtests in order to test whether there was a difference compared to the children who did not participate in this training at the end of the experiment. In the experimental group, the t-test was used for repeated measurements in the comparison of the post-test and the permanence test. The significance level was 0.05.

Results

Results Regarding Demographic Information of Children in Experimental and Control Groups and Their Parents

It was determined that 55% of the children in the experimental group were girls and 45% were boys; It was determined that 40% of the children in the control group were girls and 60% were boys.

It was determined that 45% of the children in the experimental group had no siblings, 30% had one, 15% had two, 5% had three and 5% had four; It was determined that 30% of the children in the control group did not have siblings, 60% had one and 10% had two siblings.

65% of the children in the experimental group were the first, 15% were the second and 20% were the third children; It was determined that 65% of the children in the control group were the first and 35% were the second children.

While 65% of the children in the experimental group were in their first year of pre-school education, 35% of them were in their second year in pre-school education; It was determined that 70% of the children in the control group were in the first year of pre-school education, while 30% were in the second year of pre-school education.

It was determined that 5% of the mothers of the children in the experimental group were primary school graduates, 5% secondary school graduates, 50% high school graduates, and 40% undergraduate degrees; It was determined that 20% of the mothers of the children in the control group were primary school graduates, 20% were secondary school graduates, 25% were high school graduates and 35% were undergraduate graduates.

It was determined that 5% of the fathers of the children in the experimental group were primary school graduates, 5% secondary school graduates, 30% high school graduates, and 60% undergraduate degrees; It was determined that 10% of the fathers of the children in the control group were primary school graduates, 15% secondary school, 15% high school graduates, and 60% undergraduate degrees.

Results Related to Pretest-Posttest Scores of Experimental and Control Groups

First, the suitability of the data to the normal distribution was tested. Shapiro-Wilks test is used if the size of the study group is less than 50 and Kolmogorov-Smirnov (K-S) test is used if the scores are large (Büyüköztürk, 2008). Since the group size was less than 50 in this study, the Shapiro-Wilks test was used.

As a result of the analysis, it is seen that the distribution of both the pre- and post-tests of the experimental and control groups did not differ significantly from the normal distribution ($p>.01$). In addition, regression slopes were tested for each subtest. Because before making a comparison between the groups, it should be checked whether the ANCOVA's assumptions "the scores of the groups regarding the dependent variable are normally distributed and the slopes of the regression lines to be used in the estimation of the groups' post-test statistical scores are equal" (Büyüköztürk Ş., 2001). Since the distribution was normal and the regression slopes were equal for each subtest, the analyzes were continued with ANCOVA, one of the parametric analyzes.

Analysis of covariance ANCOVA is a powerful technique that allows comparison between groups by controlling another variable that is related to the independent variable other than the independent variable whose effect is tested in a study (Büyüköztürk Ş., 2001).

ANCOVA Results of Posttest Scores Adjusted for Phonological Memory Scale Pretest Scores According to Experimental-Control Groups

The equality of the regression slopes in the Phonological Memory Scale was tested and then ANCOVA analysis was carried out.

Table 1 - ANCOVA Results of Phonological Memory Scale Nonsense Words Subtest Experiment-Control Groups of Posttest Scores Adjusted According to Pretest Scores

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	54.97	1	54.97	20.35	0.000	0.35
Group	145.90	1	145.90	54.00	0.000	0.59
Error	99.98	37	2.70			
Adjusted total	300.85	39				

When Table 1 is examined, it was found that there was a significant difference between the post-test scores of the children in the experimental and control groups in terms of the meaningless Words Subtest scores, according to the ANCOVA results in which the pretest scores were taken as the covariate ($F(1.37)=54.00$, $p< 0.05$; $\eta2=0.59$). Accordingly, it is seen that the training provided is effective.

ANCOVA Results of Posttest Scores Adjusted for Visual Spatial Memory Scale Pretest Scores According to Experiment-Control Groups

The equality of the regression slopes for the Black and White Matrices, Colored Matrices and Shaped Matrices Subtests in the Visual Spatial Memory Scale were tested separately, and then ANCOVA analyzes were started.

Table 2 - ANCOVA Results of Posttest Scores Adjusted for Pretest Scores for Visual Spatial Memory Scale Black and White Matrices Subtest by Experiment-Control Groups

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	2857.38	1	2857.38	47.16	0.00	0.56
Group	1306.69	1	1306.69	21.57	0.00	0.36

Error	2241.62	37	60.58			
Adjusted total	6405.69	39				

When Table 2 is examined, it was found that there was a significant difference between the posttest scores of the children in the experimental and control groups in terms of Visual Spatial Memory Black and White Matrices Subtest scores, according to the ANCOVA results in which the pretest scores were taken as the common variable ($F(1, 37)=21, 57$, $p<0.05$; $\eta2=0.37$). In this case, it is seen that the training provided is effective.

Table 3 - ANCOVA Results of Posttest Scores Adjusted for Pretest Scores of Visual Spatial Memory Scale Colored Matrices Subtest by Experiment-Control Groups

Source of Variance	Squares Total	sd	Squares Average	F	p	η2
Pre-test	2723.86	1	2723.86	28.68	0.00	0.43
Group	1670.91	1	1670.91	17.59	0.00	0.32
Error	3514.09	37	94.98			
Adjusted total	7908.86	39				

When Table 3 is examined, it was found that there was a significant difference between the posttest scores of the children in the experimental and control groups in terms of Visual Spatial Memory Colored Matrices Subtest scores, according to the ANCOVA results in which the pretest scores were taken as the common variable ($F(1, 37)=17.59$, $p<0.05$; $\eta2=0.32$). In this case, it is seen that the training provided is effective.

Table 4 - ANCOVA Results of Visual Spatial Memory Scale Shaped Matrices Subtest of Posttest Scores Adjusted According to Pretest Scores According to Experimental-Control Groups

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	3262.67	1	3262.67	44.89	0.00	0.54

Group	2303.06	1	2303.06	31.69	0.00	0.46
Error	2689.23	37	72.68			
Adjusted total	8254.96	39				

When Table 4 is examined, it was found that there was a significant difference between the post-test scores of the children in the experimental and control groups in terms of Visual Spatial Memory Shaped Matrices Subtest scores, according to the ANCOVA results in which the pre-test scores were taken as the common variable ($F(1, 37)=31.69$, $p<0.05$; $\eta 2=0.46$). In this case, it is seen that the training provided is effective.

ANCOVA Results of Posttest Scores Adjusted for Semantic Memory Scale Pretest Scores According to Experimental-Control Groups

Equality of regression slopes for Word List Creation, Picture Naming, Word Description and Word Picture Matching Subtests in Semantic Memory Scale was tested separately and then ANCOVA analysis was carried out.

Table 5 - ANCOVA Results of Semantic Memory Scale Word List Creation Subtest According to Experiment-Control Groups of Posttest Scores Adjusted According to Pretest Scores

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	342.37	1	342.37	16.13	0.00	0.30
Group	1288.82	1	1288.82	60.71	0.00	0.62
Error	785.43	37	21.23			
Adjusted total	2416.62	39				

When Table 5 is examined, it was found that there was a significant difference between the post-test scores of the children in the experimental and control groups in terms of the Semantic Memory Scale Word List Creation Subtest scores, according to the ANCOVA results in which the pretest scores were taken as the common variable ($F(1, 37)=60, 71$, $p<0.05$; $\eta 2=0.62$). In this case, it is seen that the training provided is effective.

Table 6 - ANCOVA Results of Semantic Memory Scale Picture Naming Subtest Posttest Scores Adjusted According to Pretest Scores According to Experiment-Control Group

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	152.23	1	152.23	27.14	0.00	0.42
Group	125.50	1	125.50	22.38	0.00	0.37
Error	207.52	37	5.61			
Adjusted total	485.25	39				

When Table 6 is examined, it was found that there was a significant difference between the post-test scores of the children in the experimental and control groups in terms of the Semantic Memory Section Picture Naming Subtest scores, according to the ANCOVA results in which the pre-test scores were taken as the common variable ($F(1, 37)=22.38$, $p<0.05$; $\eta2=0.37$). In this case, it is seen that the training provided is effective.

Table 7 - ANCOVA Results of Posttest Scores Adjusted for Semantic Memory Section Word Description Subtest Pretest Scores According to Experiment-Control Groups

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	641.51	1	641.51	28.75	0.00	0.43
Group	2757.91	1	2757.91	123.61	0.00	0.77
Error	825.49	37	22.31			
Adjusted total	4224.91	39				

When Table 7 is examined, it was found that there was a significant difference between the post-test scores of the children in the experimental and control groups in terms of the Semantic Memory Scale Word Description Subtest scores, according to the ANCOVA results in which the pre-test scores were taken as the common variable ($F(1, 37)=123.61$, $p<0.05$; $\eta2=0.77$). In this case, it is seen that the training provided is effective.

Table 8 - Semantic Memory Section Word Picture Matching Subtest ANCOVA Results of Posttest Scores Adjusted According to Pretest Scores According to Experimental-Control Groups

Source of Variance	Squares Total	sd	Squares Average	F	p	η^2
Pre-test	6.60	1	6.60	9.33	0.00	0.20
Group	3.35	1	3.35	4.75	0.03	0.77
Error	26.15	37	0.71			
Adjusted total	36.10	39				

When Table 8 is examined, it was found that there was a significant difference between the posttest scores of the children in the experimental and control groups in terms of the Semantic Memory Scale Word Picture Matching Subtest scores, according to the ANCOVA results in which the pretest scores were taken as the common variable ($F(1, 37)=4, 75$, $p<0.05$; $\eta2=0.11$). In this case, it is seen that the training provided is effective.

Results Concerning the Permanence Test Scores of the Children in the Experimental Group

In the experimental group, the t-test was used for repeated measurements in the comparison of the post- test and the permanence test. The t-test is used to test whether there is a significant difference between the mean scores of the two groups (Büyüköztürk Ş. , 2001). 0.05 was used as the level of significance, and it was stated that there was a significant difference in the case of $p<0.05$, and there was no significant difference in the case of $p>0.05$.

T-Test Results of the Children in the Phonological Memory Scale Experimental Group Regarding the Difference Between Posttest and Permanence Test

Table 9 - Phonological Memory Scale Nonsense Words Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Non-sense Words	Post	20	18.00	1.86	.41			
	Permanence	20	18.00	2.10	.47			

0.00	19	1.0

Table 9 shows that the post-test mean score of the children in the experimental group for the Phonological Memory Scale Nonsense Words Subtest was X̄=18 and the mean of permanence practice was equal to X̄=18, and the scores were (t=0.00), (p>0.05). there appears to be no difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Visual Spatial Memory Scale Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Table 10 - Visual Spatial Memory Scale Black and White Matrices Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Avg.	t	sd	p
Non-sense Words	Post	20	59.90	9.68	2.16	0.00	19	0.76
	Permanence	20	60.45	11.25	2.516			

In Table 10, the post-test mean scores of the children in the experimental group for the Visual Spatial Memory Scale Black and White Matrices Subtest are between X̄ =59.9 and the permanence application averages between X̄=60.4 (t=-0.30), (p>0). ,05) it is seen that there is no significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Table 11- Visual Spatial Memory Scale Colored Matrices Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Colored Matrices	Post	20	55.30	9.03	2.01	-1.55	19	0.13
	Permanence	20	57.40	10.89	2.43			

In Table 11, the post-test mean scores of the children in the experimental group for the Visual Spatial Memory Scale Colored Matrices Subtest are between X̄=55.3 and the permanence application averages of X̄=57.4 (t=-1.5), (p>0,). 05) it is seen that there is no significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Table 12 - Visual Spatial Memory Scale Shaped Matrices Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Shaped Matri-ces	Post	20	53.55	9.25	2.07			
	Permanence	20	55.95	11.33	2.53	-1.44	19	0.16

In Table 12, the post-test mean scores of the children in the experimental group for the Visual Spatial Memory Scale Shaped Matrices Subtest are between X̄=53.5 and the permanence practice averages X̄=55.9 (t=-1.44), (p>0,). 05) it is seen that there is no significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

The t-Test Results of the Semantic Memory Scale Experimental Group Children on the Difference Between Posttest and Permanence Test

Table 13 - Semantic Memory Scale Word List Creation Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Word List	Post	20	29.50	5.20	1.16			
	Permanence	20	32.20	8.05	1.80	-1.94	19	0.06

In Table 13, the post-test mean scores of the children in the experimental group for the Semantic Memory Scale Word List Creation Subtest are between X̄=29.5 and the permanence practice averages of X̄=32.2 (t=-1.94), (p>0,). 05) it is seen that there is no significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Table 14 - Semantic Memory Scale Picture Naming Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Picture Naming	Post	20	18.15	3.32	.74			
	Permanence	20	17.55	4.14	.92	0.80	19	0.43

In Table 14, the post-test mean scores of the children in the experimental group for the Semantic Memory Scale Picture Naming Subtest are between X̄=18.15 and the permanence practice average of X̄=17.5 (t=0.80), (p>0.05). there appears to be no significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Table 15 - Semantic Memory Scale Word Explanation Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p
Describing Word	Post	20	38.70	7.34	1.64			
	Permanence	20	39.30	10.17	2.27	-0.40	19	0.68

In Table 15, the post-test mean scores of the children in the experimental group for the Semantic Memory Scale Word Description Subtest ranged from X̄=38.7 to X permanence=39.3 (t=-0.40), (p>0.05).) does not appear to be a significant difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Table 16 - Semantic Memory Scale Word Picture Matching Subtest Experimental Group Children's t-Test Results Regarding the Difference Between Posttest and Permanence Test

Tests	Application	N	Average	SS	St. Error of Average	t	sd	p

Word Picture Matching	Post	20	4.85	.933	.20			
	Permanence	20	4.75	1.26	.28	-0.43	19	0.66

In Table 16, the post-test mean scores of the children in the experimental group for the Semantic Memory Scale Word Picture Matching Subtest were between X̄=4.85 and the permanence practice average between X̄=4.75 (t=0.438), (p>0.05). there appears to be no difference. When the posttest and permanence test findings of the experimental group are compared, it can be said that the permanence of the Memory Training Program continues.

Discussion and Conclusion

In this study, which was conducted to examine the effect of the Memory Education Program supported by animations on the phonological, visual-spatial and semantic memory skills of preschool children, an experimental design with experimental and control groups was used. The Memory Battery for Preschool Children developed by the researcher was used as a measurement tool, and the scores of both groups were found to be close to each other according to the results of the pre-tests applied to the experimental and control groups. The Memory Training Program was applied to the experimental group two days a week for ten weeks. The education program is aimed to develop phonological and visual-spatial memory skills and semantic memory skills, which are parts of children's working memory. At the end of the training, the Memory Battery for Preschool Children was applied as a post-test in the experimental and control groups. Four weeks after the post-test application, the battery was re-administered to 20 children in the experimental group to determine whether the training provided was permanent.

Although the groups were close to each other according to the pre-test results at the beginning of the study, a significant increase was observed in the scores of the experimental group after the application of the memory training program supported by the animations.

When the findings for the Phonological Memory Scale were examined, it was found that the memory training given with animations in the Memory Education Program was effective in the development of children's phonological memory. Accordingly, it can be said that doing preschool activities with applications such as animation, using technology and computer software to help children remember words and word pairs, supporting verbal communication, contribute to the development of children's phonological memory. Looking at the results of the studies in the literature, phonological working memory was found to be significantly related to vocabulary (Hoff, Core, & Bridges, 2008). In addition, it has been seen that communicating with oral language, using hearing aid technology effectively, and receiving early family or preschool education support phonological working memory performance (Doğan, 2011). Studies have shown that working memory pieces of training cause changes in brain activities, that is, the increase in prefrontal and parietal activity after working memory training affects the nervous systems underlying working memory; children's performance in working memory task improved significantly with training (Olesen, Westerberg, & Klingerg, 2004), (Loosli, Buschkuehl, Perrig, & Jaeggi, 2012); It also shows that the training given using computer software is effective (Segers & Verhoeven, 2002). It can be said that these results support the result in the study that children's phonological memory skills can be improved with training.

When the results for the Visual Spatial Memory Scale were examined, it was found that the memory training given with animations in the Memory Training Program was effective in the visual spatial memory development of children. The Memory Training Program supported by animations, activities, animation videos and interactive animation applications were made with children to improve their visual-spatial memory skills. In these activities and animations, by enabling children to remember the object, entity or picture they see, their color, place and shape; At the same time, visual spatial memory skills were developed by using memory strategies such as coding and grouping. At the end of the training, it was observed that the post-test scores of the children in the experimental group increased significantly compared to the post-test scores of the children in the control group in all of the Visual Spatial Memory Scale, Black and White Matrices, Colored Matrices and Shaped Matrices Subtests. When the research results in the literature are examined; shows that training covering mental abilities is related to working memory capacity, the increase in memory capacity is not only defined by biological or hereditary factors, but also depends on experiences and training (Lee, Lu, & Ko, 2007). In addition, it was found that the successful use of semantic grouping strategy (Scheleepen & Jonkman, 2012), descriptions and explanations positively affect visual spatial memory (Vales & Smith, 2015). Working memory training has significantly improved children's working memory skills, which are an important predictor of school success (Kroesbergen, Noordende, & Kolkman, 2014); the visual retention memory of educated children develops; It is possible to see that the visual-spatial areas of the educated students are more effective than the uneducated students (Altıparmak, 2016). In addition, animation films and interactive applications have a positive effect on the visual perception development of 60-72-month-old children, and materials prepared to teach concepts with the help of animation are suitable for preschool children (Yücelyiğit, 2014); It has been emphasized that preschool children who are educated with animation are more successful than the other group in gaining concepts (Gürbulak, 2013). It can be said that these results support the finding that children's visual-spatial memory skills can be improved with education.

When the results for the Semantic Memory Scale were examined, it was found that the memory training given with animations in the Memory Training Program was effective in the semantic memory development of children. The Memory Training Program supported by animations, activities, animation videos and interactive animation applications were made with children to improve their semantic memory skills. In these activities and animations, semantic categories were scripted for children and activities were carried out, and semantic memory was supported with phonological and visual codes. When the research results in the literature are examined, it is seen that the cognitive development training program has a positive and significant effect on the attention, perception and memory development of children (Temel, Kurtulmuş, & Kaynak, 2016); depending on the memory training given, free recall is based on semantic codes (Melby-lervag & Hulma, 2010); It is seen that it is important to support the education of preschool children with software and applications suitable for their developmental characteristics (Çakıroğlu & Taşkın, 2016). It can be said that these results support the finding that children's semantic memory skills can be improved with education.

When the post-test scores of the experimental group and the follow-up test scores for permanence are examined, it is seen that there is no significant difference (p>0.05) between the post- test mean scores of the children in the experimental group and the permanence application mean scores in all subscales. According to these findings, the phonological, visual-spatial and semantic memory skills of the experimental group children developed at the end of the education; It can be said that the Permanence of the Memory Training Program continues in Phonological Memory Scale, Visual Spatial Memory Scale Black and White Matrices, Colored Matrices and Shaped Matrices, Semantic Memory Scale Word List Creation, Picture Naming, Word Description and Word Picture Matching Subtests. When the research results in the literature are examined, regardless of gender and educational status of parents, the applied memory training program has a positive effect on the memory development of children (Özyürek, 2009); compared learning, delayed recognition, visual and verbal short-term and long-term memory, general memory index scores of the same children at the age of six and eight. As a result; It was determined that the experimental group's deferred recognition, visual and verbal short- term and long-term memory, general memory indexes follow-up test scores were higher than the same score of the control group (Özyürek, 2013). In addition, the experimental group supported by computer games was more successful in the posttests, and it was observed that permanence was achieved according to the results of the permanence test applied five weeks after the implementation of the posttests of the experimental study (Çankaya, 2012). When the results of the research were examined, it was seen that the use of animation in education in the preschool education period increased the permanence and the positive effects of the applied memory training program on the memory development of children continued. As a result, when the results of the studies in the literature are examined, it can be said that this study coincides with the findings.

Suggestions

- Different memory training programs can be developed to help children increase their memory skills.
- By applying memory training with gifted or special needs children, the effect of these children on their memory skills can be examined.

- In family education studies, parents can be provided with information about memory development, and by providing activities, games, practices and suggestions to improve memory skills, families can support memory development.
- The knowledge and experience of educators on how to better support memory skills in children can be increased through in-service training activities.
- Activities and programs that increase the memory skills and capacity of children can be included more in the daily flow.

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