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Research Article

Working memory based early intervention program for gifted preschoolers: an effectiveness study[1]

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Abstract

In the literature, it has been shown that working memory, which plays an important role in cognitive development of preschool children and is a concept intertwined with cognitive activities, can be improved. The purpose of this study is to examine the effect of early intervention programs for improving working memory on the working memory performance of gifted children in the pre-school period. In the study, pre-test post-test experimental design of unequal groups of quasi-experimental designs was used. While an early intervention program to improve working memory was applied to the experimental group, the control group did not benefit from this training. The study group of the research consisted of a total of 67 children. The data collection tools used in the study consisted of three groups: scales for identifying and typical development, the scale for determining effectiveness of the early intervention program, and scales to determine the social validity of the study. The quantitative findings showed that the early intervention program developed improved the working memory performance of both gifted and typically developing children. In addition, the students who participated in the study and their parents and teachers found the early intervention program useful. It was observed that the study provided social validity

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Introduction

Some children may be significantly advanced than their peers in many skills (e.g. cognitive skills, academic abilities, interpersonal skills) in early childhood (Olszewski-Kubilius, Limburg-Weber and Pfeiffer, 2003). According to Cukierkorn, Karnes, Manning, Houston, & Besnoy (2008), general characteristics of gifted children in the preschool are: verbal skills developed in a unique and significant way according to age and language use, emotional sensitivity, sensitivity to problems, development, leadership and leadership in cooperative plays, early awareness of differences, using unusual objects in their games, advanced humor ability, metacognitive control, curiosity, advanced cognitive skills, academic achievement and early reading. Currently, an important target of early childhood education is to improve the preconditions that children will need for their success in school and in their future by ensuring their cognitive skills and socialization (Pianta, Barnett, Burchinal, & Thornburg, 2009). Silva (2009) suggested that there is not a single age at which children are developmentally ready to learn more complex thinking styles. Similarly, Kennedy,

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Fisher & Ennis (1991), examining the literature, concluded that although it seems that thinking skills develop with age, the education of these skills can be utilized in the preschool period.

When we examine the skills that thinking skills contain, it is seen that they include important cognitive skills such as analyzing claims or evidence, making inferences by using inductive or deductive reasoning, judgment and evaluation), decision making and problem solving. (Case, 2005; Ennis, 1985; Facione, 1990; Lipman, 1988; Halpern, 1998; Paul, 1992; Tindal & Nolet, 1995; Paul, 1992; Willingham, 2007). Other skills and behaviors defined in this regard include asking and answering questions for explanation, defining terms (Ennis, 1985), determining assumptions (Ennis, 1985; Paul, 1992), interpretation and explanation (Facione, 1990), verbal reasoning, especially in relation to the concepts of probability and uncertainty (Halpern, 1998), guessing (Tindal & Nolet, 1995), and understanding both sides of an issue (Willingham, 2007). Many of these cognitive abilities are called executive functions. In other words, executive functions are the processes that change the operation of other processes and are responsible for coordinating mental activity in order to achieve a specific target (Smith & Kosslyn, 2010: 281). This term comes from Alan Beddeley's effective working memory model, in which there are separate short-term storage systems with verbal and visual information and a central executive working in this warehouse (Smith & Kosslyn, 2010: 281). Working memory, which has been proven to be closely related to a series of executive functions (Smith & Kosslyn, 2010: 318), was described by Baddeley-Hitch (1974) as a structure consisting of two short-term repositories and a control system. According to this structure, working memory is not a station task where basic information waits in the long-term memory path. In contrast, the task of working memory is to allow complex mental information that needs to be integrated, coordinated, and manipulated by multiple pieces of mentally represented information. Secondly, according to this model, there is an inseparable relationship between the control system, which manages the accumulation and elimination of information and is called the "central manager," and storage buffers. This close relationship allows short-term storage to serve as effective working areas for mental operations. Thirdly, this model suggests that there are at least two different short-term memory buffers for verbal information and visual spatial information (Baddeley-Hitch, 1974).

According to the model, three components of working memory (central executive, phonological loop, visual spatial sketchpad) communicate in order to provide a working area for cognitive activities (Smith & Kosslyn, 2010: 249). A better understanding of human working memory has important effects on understanding why people differ in cognitive skills and abilities and why they have different degrees of success in achieving their real-life targets (Smith & Kosslyn, 2010: 241). Research suggests that working memory capacity, defined as the amount of accessible information (Daneman & Carpenter, 1980), varies among individuals and these differences predict the rate at which skills such as general intelligence (measured by standard IQ tests), verbal SAT scores, and even computer programming are acquired (Kane & Engle, 2002; Kyllonen & Christal, 1990; Smith & Kosslyn, 2010: p.241).

Working memory is known to affect a wide range of cognitive skills, which are not as common as following a clue. Considering how much it affects in general in this direction, it is seen that the relationship between working memory and cognitive skills is not surprising. Research on this subject has been further advanced by seeking answers to these questions: "Why do people's working memory capacities differ so much, and in exactly what area are these differences? If we can understand more clearly the components of working memory and which states are critical to real-life cognitive achievement, what methods can be developed to train and work to increase working memory function and enrich one's cognitive repertoire? " (Smith & Kosslyn, 2010: 241).

Studies with different needs groups (gifted children, ADHD) and children with typical development (Klingberg, Fernell, Olesen, Johnson, Gustafsson, Dahlström, Gillberg, Forssberg, & Westerberg, 2005; Kerns, Eso and Thomson, 1999; Klingberg, Forssberg, & Westerberg, 2002; Leana-Taşçılar & Cinan, 2014; Thorell, Lindqvist, Bergman Nutley, Bohlin, & Klingb) show that working memory can be improved with education (Thorell, Lindqvist, Bergman Nutley, Bohlin, & Klingberg, 2009). These and similar findings show the positive effects of cognitive skills training. Early intervention is very important to support cognitive development (Rueda, Rothbart, McCandliss, & Posner 2005). In some studies in the literature (Carlson, 2005; Diamond, Barnett, Thomas & Munro, 2007; Diamond & Lee, 2011; Grunewaldt, Løhaugen, Austeng, Brubakk, & Skranes, 2013; Kroesbergen, van't Noordende & Kolkman, 2014; Bull, Espy, & Wiebe, 2008; Passolunghi & Costa, 2016; Rueda et al., 2005; Tho) an early intervention program was implemented to improve the cognitive skills and working memory of preschool children and positive results were shown. In Thorell et al. (2009), preschool children were given computer-based training for 5 weeks to improve their visual-spatial working memory. As a result of the study, it was observed that children who received training improved significantly in working memory tasks, and it was observed that working memory training could have significant effects on preschool children. In another study by Kroesbergen, van't Noordende, & Kolkman (2014), children's working

memory and early number perception were examined at the end of the general working memory training given to preschool children. At the end of the four weeks of education, it was concluded that children's working memory and early number development significantly changed. In the literature, there are also studies that reveal relationships between individuals' working memory and intelligence development, except for early childhood.

When we examine the early intervention programs for gifted children in the preschool period and the studies in this field, which are an important point of the study, we see that the studies carried out both abroad and in Turkey (Bildiren, 2016; Karnes, Shwedel, & Lewis, 1983; Karnes & Johnson, 1991; Kitano & Kerby, 1986; Meador, 1994; Saranlı, 2017).

As in all special education groups, early identification of gifted children is emphasized. However, there has not been much progress in the preparation of early intervention programs for gifted at early childhood period (Karnes & Johnson, 1991). Walsh, Kemp, Hodge, & Bowes (2012) examined the services for gifted children in their research and revealed that the least amount of services was given in the preschool period. Early intervention programs for working memory that also improve cognitive skills in the preschool period will be very important.

Based on the literature, the necessity and importance of an intervention program that identifies gifted children in the preschool period as a target group and supports the cognitive skills of these children has been revealed. In this direction, the aim of this study is to examine the effect of early intervention programs for improving working memory on the working memory performance of gifted children in pre-school period. This study will reveal the following:

- Whether the working memory performances of gifted children in the preschool period differ from their peers with typical development,
- The effect of the early intervention program to be applied on the working memory performance of children with gifted and typical development,
- The extent to which the working memory performance of children with special abilities and typical development will be affected by the early intervention program to be implemented.

Method

Research Model

Pre-test post-test experimental design of unequal groups of quasi-experimental designs was used in the present study. In this design, a group in addition to the experimental group is determined for comparison or control purposes. Then the measurements of the subjects in the two groups of the dependent variable are taken before the application. In the application process, the experimental process whose effect was tested is not applied to the control group, while it is applied to the experimental group. Finally, after the experimental procedure, the measurements of both groups regarding the dependent variable are taken with the same or a parallel form (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2017; Creswell & Sözbilir, 2017).

Working Group

The working group of the research consists of a total of 67 children who continue preschool education in Izmir in the 2019-2020 academic year. The descriptive characteristics of the working group are presented in Table 1.

Table 1

Demographic Characteristics of the Working Group

Group	Female	Male	Mean Age (month)	RPMTS Mean	ELSS Mean
E (TD)	11	5	65.90	18,2500	63,8125
E (G)	6	11	66.46	27,7059	80,4706
C (TD)	9	8	65.72	17,8824	58,7647
C (G)	7	10	66.40	25,4118	80,9412

E : Experiment Group**,** TD: Typically developed children, G: Gifted Children, RPMTS: Raven Progressive Metris Test Scores, ELSS: Early Literacy Scale Scores

Data Collection Tools

The data collection tools used in the study consisted of three groups: scales for determining gifted and typical developing, the scale for determining the effectiveness of the early intervention program, and scales for determining the social validity of the study.

Measurement Tools to be Used to Identify Special Talented and Typically Developing Children

Candidate Notification Scale for Preschool Gifted Children: The scale developed by Bildiren & Bıkmaz Bilgen (2018) is a scale used to identify gifted children in pre-school period and filled in by teachers. The scale consists of 13 items in 5-point Likert type and three factors (general intelligence, creativity, motivation). The highest score that can be obtained from the whole scale is 65; the lowest score is 13. It was seen that the fit indices of the scale were well fit and between acceptable values, and the structure of the scale with three factors and consisting of 13 items was confirmed as a model. It was found that the scale showed a moderate correlation between the Color Progressive Matrices Test and the CogAT tests. The reliability of the scale, which was calculated using the Cronbach Alpha internal consistency coefficient, was found .95.

Early Literacy Scale: This scale was used in the study to evaluate the upper language skills of the children. The scale developed by Kargın, Ergül, Büyüköztürk, & Güldenoğlu (2015), is a measurement tool that aims to determine the early literacy skills of children in the age group of 5 in a valid and reliable manner. The scale consists of 7 subtests (Receptive Language, Expressive Language, General Naming, Functional Knowledge, Letter Knowledge, Phonetic Awareness and Listening Comprehension), which include reading and writing skills. The factor load values of the items in the subtests of the test consisting of 102 items are between .33 and .93, with KR20 reliability coefficients .65. Test-retest reliability coefficients ranged between .56 and .89, and criterion validity calculations calculated with TEDİL (a valid and reliable literacy test) in receptive and expressive language subtests ranged between .37 and .54.

Raven's Color Progressive Matrices Test: The scale has been developed to evaluate cognitive development and intellectual ability. The scale consists of 36 items in total, 3 sets of 12 items each. The subscales are named A, AB, and B. The scale aims to evaluate the cognitive processes of children under 11 years old. The validity and reliability studies of the scale for 4-6 years old and 3-9 years old children were carried out by Bildiren (2016) and Bildiren (2017). Test-retest and parallel form reliability were used for reliability studies. There is a moderate, positive and significant relationship between the AB Set of the test and the Test-Retest results ($r = 0.436$; $p < .01$). It is seen that there is a moderate, positive and significant relationship between Set B and Test-Retest results ($r = 0.350$; $p < .01$). It is seen that there is a moderate, positive and significant relationship between total test and Test-Retest results ($r = 0.551$; $p < .01$). For validity analysis, the relationship between Bender-Gestalt Visual Motor Perception Test, WISC-R and TONI-3 tests was examined. In line with the findings obtained, it was concluded that the scale is valid and reliable for children in the 4-6 age group.

Measurement Tool to be Used to Determine the Effectiveness of the Early Intervention Program

Working Memory Scale: The scale developed by Ergül, Özgür-Yılmaz & Demir (2016) aims to determine the working memory performance of children in the 5-10 age group. The scale consists of nine subscales in four dimensions, namely verbal and visual working memory and verbal and visual short-term memory (Digit Recall, Word Remember, Meaningless Word Remember, Back Digit Recall, First Word Remember, Pattern Matrix, Block Recall, Choosing the Different, Spatial Discrimination). The validity and reliability study of the scale in Turkey's norms was conducted with 1,494 children between the ages of 5-10. While 634 of this number took part in the trial application carried out in two stages, 860 of them took part in the basis application. While the content validity of the scale was ensured with the expert opinion of the scale, exploratory and confirmatory factor analysis was performed to determine the construct validity. For criterion validity, academic achievement scales developed by the researchers were used. Reliability studies of the scale were conducted based on the test-retest and test halving method. The Cronbach Alpha coefficient was calculated for all subscales of the scale. It was found that these values varied between .69 and .85 for the first trial, between .66 and .84 for the second trial, and between .68 and .99 for the main application. Pearson Product Moment Correlation Coefficient was calculated for test-retest reliability of the scale. Accordingly, the values obtained vary between .41 and .83 and are significant at the .01 level. Their findings show that the scale is a valid and reliable scale to determine the working memory performance of children in the 5-10 age group.

Measurement Tools to be Used to Determine the Social Validity of the Study

Semi-Structured Interview Forms for Children, Teachers and Parents to Evaluate the Early Intervention Program for Improving Working Memory: These form was prepared by the researcher in order to obtain the opinions of the children, teachers and parents of the children participating in the study of the intervention program and the effects of the program on children in order to ensure the social validity of the study.

Data Collection Process

The data collection process of the study was carried out in three stages: determining the gifted children, determining the effectiveness of the experimental study and determining the social validity of the study. The first of the data

collection tools used in the process of determining gifted children, which is the first stage, is a measurement tool completed by teachers. The other two data collection tools provide measurement by making one-to-one application. The data collection process for the first stage proceeded as follows:

- A seminar on "giftedness, identification and characteristics of gifted individuals in the pre-school period" was given to the teachers in the determined institutions.
- Teachers nominated "gifted" and "typically developing" children by using the "Candidate Notification Scale for Preschool Gifted Children."
- "Raven's Color Progressive Matrices Test" and "Early Literacy Scale" were applied individually by the researcher to the children determined as potentially gifted in order to determine their verbal skills.

The second data collection process was carried out at the beginning and at the end of the experimental study (pre-test-post-test) by applying a scale to determine working memory performance. In order to start the experimental process in the study, it is necessary to determine the gifted children in the experimental and control groups. After the determination of these groups, the "Working Memory Scale" was applied to the children who would be in the experimental and control groups before and after the experiment, one-on-one application by the researcher. In order to ensure the social validity of the study, each student, teacher and parent was interviewed using the semi structured interview forms.

Implementation Process

Preparing an Early Intervention Program for Improving Working Memory

The Early Intervention Program for Improving Working Memory has been developed by benefiting from intervention studies conducted to support and improve the working memory performance of preschool children. The aim of the program is to support and improve children's working memory performances through activities prepared in accordance with the cognitive development levels of preschool children. The program to be developed within the scope of this study is planned as 2 sessions per week for 8 weeks.

In the first stage of the curriculum development process, the literature on the development of preschool period and working memory was examined. After the analysis, the main aims and gains of the program were determined. Then, the content of the program was determined in line with these gains and indicators. Twenty different activity plans suitable for the content were prepared. The opinions of a program development specialist, a pre-school education specialist and a working memory research specialist were consulted in order to determine the consistency of the program's goal objectives and its suitability for the preschool period. An opinion form was prepared in order to obtain opinions of the program from experts selected from outside the researcher conducting the study. Activities were organized according to feedback from experts. Then, a pilot study was conducted with the relevant age group for each activity in order to have information about the suitability of the activities in the program for the age group, the use of time and the interest of children. In line with the feedback obtained from the pilot application, the program and activities were finalized. The program has a spiral structure and an activity can be applied more than once during the program implementation.

Experimental Process Steps

Experimental procedures were carried out by the researcher who conducted the study in order to ensure the continuity of group dynamics, to create an atmosphere of trust and ensure consistency in the implementation of training activities and plans.

Experimental transactions were carried out 2 days a week in November, December and January 2019. Four activities per week were held, with an average of 2 activities each day. Each activity was applied for an average of 40-60 minutes, including starting and ending exercises. Twenty activities in the program were repeated alternately in line with the interests and needs of the children. Only the beginning and ending performances were obtained from the children in the control group with special abilities and typical development.

Data Analysis

The quantitative data obtained at the beginning and end of the experimental process were analyzed in the SPSS 23.00 package program. The qualitative data obtained as a result of semi-structured interviews, which are additional data of the study, were analyzed using the inductive data analysis technique. In this analysis, the data were transformed into themes and their frequencies and percentages were calculated according to the categories. In addition, the contents of the expressions of children and teachers about the intervention program were examined.

Validity and Reliability of the Study

In order to ensure internal validity, the subjects to be included in the experimental and control groups will be assigned objectively, the duration of the experiment was limited to a period of 8 weeks considering the maturation effect of the subjects, and the data collection process was carried out by a single researcher. Considering that the percentage of students attending public school is higher in order to ensure external validity, the sample was selected from public schools located in different regions of Izmir. It was stated to the subjects that these studies were a part of their training in order not to create an expectation effect on the subjects.

At the end of the study, opinions were taken from the participants, their parents and teachers. The qualitative analysis made here reveals the reliability of the study. In qualitative studies, researchers look at the accuracy of their observations, rather than looking at consistency in behavior. It is very important to analyze and interpret the information received here correctly.

In this study, the researcher is responsible for creating and conducting the study. The researcher took an active role in analyzing and interpreting the data and ensuring the validity and reliability of the research. In particular, in order to ensure the validity and reliability of the research and to conduct it under ethical conditions, the data collection process to identify the subjects and the application of the experimental process and the application of the pre-test / post-test data were completely carried out by the researcher.

Results

Findings Regarding the Pretest Scores of Children with Typical Development and Gifted in Experimental and Control Groups

Table 2

Pretest Scores of Typically Developing Children and Gifted Children in the Experimental and Control Groups: Mann Whitney U Test Analysis

Experimental Group		N	M	Sd.	Z	p	r
Verbal Working Memory	Gifted Children	17	347.05	41.70	-4.17	.00	-0,726
	Typically Developing Children	16					
Visual Working Memory	Gifted Children	17	510.85	70.24	-4.73	.00	-0.82
	Typically Developing Children	16					
Control Group		N	M	Sd.	Z	p	r
Verbal Working Memory	Gifted Children	17	347.05	41.70	-4.81	.000	-0.82
	Typically Developing Children	17					
Visual Working Memory	Gifted Children	17	510.85	70.24	-4.97	.00	-0.85
	Typically Developing Children	17					

*p<.05

In order to determine whether there is a significant difference between the pre-test scores of gifted children and typical development in the experimental group and the control group, the "Mann Whitney U Test," one of the non-parametric tests, was conducted. The findings obtained are presented in Table 2 in detail. This difference was found to be in favor of gifted children for both verbal working memory and visual working memory pre-test scores.

Findings Regarding the Pre-Test Scores of Gifted Children in the Experimental and Control Groups

In order to determine whether there is a significant difference between the pre-test scores of the gifted children in the experimental and control groups, the "Mann Whitney U Test," one of the non-parametric tests, was conducted. The obtained findings are presented in Table 3 in detail. Accordingly, it was observed that the working memory performances of gifted children in the experimental and control groups were similar before the experimental process.

Table 3

Pretest Scores of Gifted Children in the Experimental and Control Groups: Mann Whitney U Test Analysis

	Working Group	n	M	Sd.	Z	p	r
Verbal Working Memory	Experimental Group Gifted	17	347.05	41.70	-.343	.731	-0.05
	Control Group Gifted	17					
Visual Working Memory	Experimental Group Gifted	17	510.85	70.24	-1.38	.167	-0.23
	Control Group Gifted	17					

*p<.05

Findings Regarding the Difference Between the Post-Test Scores of Gifted Children in the Experimental and Control Groups

In order to determine whether there is a significant difference between the post-test scores of the gifted children in the experimental and control groups, the "Mann Whitney U Test," one of the non-parametric tests, was conducted. The findings obtained are presented in Table 4 in detail. The difference was found in favor of the children in the experimental group for both verbal working memory and visual working memory post-test scores.

Table 4

Working Memory Performance Post-test Scores of Gifted Children in the Experimental and Control Groups: Mann Whitney U Test Analysis

Working Group		n	M	Sd.	Z	p	r
Verbal Working Memory	Experimental Group Gifted	17	393.05	66.54	-5.05	.000	-0.86
	Control Group Gifted	17					
Visual Working Memory	Experimental Group Gifted	17	575.34	103.69	-4.77	.000	-0.81
	Control Group Gifted	17					

*p<.05

Findings Related to the Difference Between Pre-Test Post-Test Scores of Gifted Children in the Experimental Group

In order to determine whether there is a significant difference between the pre-test post-test scores of the gifted children in the experimental group, one of the non-parametric tests, "Wilcoxon Test" was conducted. The findings obtained are presented in Table 5 in detail. Accordingly, it is seen that the working memory performance of specially gifted children in the experimental group increased significantly after the experimental procedure.

Table 5

Working Memory Pre-Test Post-Test Scores of Gifted Children in Preschool Period in the Experimental Group: Wilcoxon Test Analysis

Experimental Group		n	M	St.	Z	p
Verbal Working Memory	Negative Rank	17	.00	.00	-3.63	.000
	Positive Rank	17	9	153		
Visual Working Memory	Negative Rank	17	.00	.00	-3.53	.000
	Positive Rank	17	8.50	.136		

*p<.05

Findings Regarding the Difference Between the Post-test and Follow-up Test Scores of Gifted Children in the Experimental Group

The "Wilcoxon Test," one of the non-parametric tests, was conducted to determine whether there was a significant difference between the post-test and follow-up test scores of special children in the experimental group. The findings obtained are presented in Table 6 in detail.

Table 6.

Working Memory Performance Post-test and Follow-up Test Scores of Gifted Children in the Experimental Group: Wilcoxon Test Analysis

Experimental Group		n	M	St.	Z	p
Verbal Working Memory	Negative Rank	17	3.50	7	-.136	.892
	Positive Rank	17	2.67	8		
Visual Working Memory	Negative Rank	17	1	1	-	.276
	Positive Rank	17	2.50	5	1.08	

Pre-Test Scores Findings of Typical Development Children in Experimental and Control Groups

In order to determine whether there is a significant difference between the pre-test scores of typical developmental children in the experimental and control groups, the "Mann Whitney U Test," one of the non-parametric tests, was conducted. The findings obtained are presented in Table 7 in detail. Accordingly, it was observed that the working memory performances of the children with typical development in the experimental and control groups were similar before the experimental procedure.

Table 7

Pre-Test Scores of Typical Development Children in Experimental and Control Groups: Mann Whitney U Test Analysis

	Working Group	n	M	Sd.	Z	p	r
Verbal Working Memory	Experimental Group Children with Typical Development	16	347.05	41.70	-.966	.334	-0.16
	Control Group Children with Typical Development	17					
Visual Working Memory	Experimental Group Children with Typical Development	16	510.85	70.24	-2.01	.344	-0.35
	Control Group Children with Typical Development	17					

*p< .05

Findings Regarding the Difference Between Post-Test Scores of Children with Typical Development in the Experimental and Control Groups

In order to determine whether there is a significant difference between the post-test scores of the children with typical development in the experimental and control groups, the "Mann Whitney U Test," one of the nonparametric tests, was conducted. The findings obtained are presented in Table 8 in detail. The difference was found in favor of the children in the experimental group for both verbal working memory and visual working memory post-test scores.

Table 8

Post-Test Scores of Children with Typical Development in Experimental and Control Groups: Mann Whitney U Test Analysis

	Working Group	n	M	Sd.	Z	p	r
Verbal Working Memory	Experimental Group Children with Typical Development	16	393.05	66.54	-5.04	.000	-0.87
	Control Group Children with Typical Development	17					
Visual Working Memory	Experimental Group Children with Typical Development	16	575.34	10.69	-5.16	.000	-0.89
	Control Group Children with Typical Development	17					

*p< .05

Findings Regarding the Difference Between Pre-Test and Post-Test Scores of Children with Typical Development in the Experimental Group

The "Wilcoxon Test," one of the nonparametric tests, was conducted to determine whether there was a significant difference between the pre-test post-test scores of the children in the experimental group with typical development. The findings obtained are presented in Table 9 in detail. Accordingly, it is seen that the working memory performance of the children in the experimental group with typical development increased significantly after the experimental procedure.

Table 9

Pretest-Posttest Scores of Typically Developing Children in the Experimental Group: Wilcoxon Test Analysis

Experimental Group		n	M	St.	Z	p
Verbal Working Memory	Negative Rank	16	.00	.00	-3.41	.001
	Positive Rank	16	8.00	120		
Visual Working Memory	Negative Rank	16	.00	.00	-3.50	.000
	Positive Rank	16	8.00	120		

*p< .05

Findings Regarding the Difference Between Posttest and Follow-up Test Scores of Children with Typical Development in the Experimental Group

The "Wilcoxon Test," one of the nonparametric tests, was conducted to determine whether there was a significant difference between the post-test and follow-up test scores of the children in the experimental group with typical development. The findings obtained are presented in Table 10 in detail.

Table 10

Posttest and Follow-up Test Scores of the Children with Typical Development in the Experimental Group: Wilcoxon Test Analysis

Experimental Group		n	M	St.	Z	p
Verbal Working Memory	Negative Rank	16	1	1	-1.47	.141
	Positive Rank	16	3	9		
Visual Working Memory	Negative Rank	16	.00	.00	-1	.317
	Positive Rank	16	1	1		

*p< .05

Findings Regarding the Views of the Children in the Experimental Group About the Program

After analyzing the answers given to the interview questions with specially gifted and typically developing children in the experimental group, they were examined by two researchers and collected under themes and categories. Answers to questions 1, 3, 7 and 8 are categorized as "positive" and "negative," while Question 2 is "same " and "different," Question 4 is a "favorite activity," Question 5 is "difficult," "easy" and "both difficult and easy," and Question 6 is "the most difficult activity." According to the data obtained, 96.96% of the emotions felt while participating in the activities were found to be positive. It was observed that the children expressing positive opinions expressed these views as "Happy," "Excited," "Beautiful," "Curious," "Enthusiastic," "As if to learn something new.," "Beautiful" and "Good." It was seen that 3.04% of the children expressed negative opinions and expressed this opinion as "boring."

When the data obtained are examined, it is seen that 96.96% of the children stated that the activities carried out under this program are different from the activities carried out in the classroom. Children expressing their opinions in this direction *say "These are not boring at all.,"* "There are object games here.," "*For example, our teacher doesn't ask us questions like you.*," "*Those here are for information*.," "*For example, we do different things here*." and "*It's like it's just developing my brain. I remember everything when I got home.*" expressed on the form % 3.04 of the children stated that the activities were similar.

The activities were "easy" for 84.84% of the children. The children who expressed their opinions in this direction said "Because I could do it all. "and "We had a lot of fun doing it. "expressed on the form. Some 15.16% of the children stated that the activities were difficult. Children who expressed their opinions in this direction expressed their views on the form.

When the data obtained were examined, the favorite activities of the children were "None (3.03%)," "Remembering Movements (6.06%)," "Stamps (6.06%)," "Tangram (6.06%)," "I Prepare My Suitcase (12.12%)," "Remembering Pictures (15.15%)", "All (21.21%)" and "Counting Numbers (30.03%) ." When the views of the children were examined, the activities they had the most difficulties were, respectively, "None (48.48%)," "Remembering Pictures (24.24%)" and "Counting Numbers (3.03%)."

Findings Regarding the Views of the Parents of the Children in the Experimental Group about the Program

After analyzing the answers given to the interview questions with the parents of the children with special talents and typical development in the experimental group, they were examined by two researchers and gathered under six themes. These themes are as follows: "Willingness to Participate in Activities," "Children's Expressions," "Observed Differences," "Finding the Activities Useful," "Continuity of the Program" and "Satisfaction with the Provision of Support Education."

When the data obtained were examined, all parents expressed positive opinions on the themes of "Children's Expressions", "The Situation of the Activities Useful", "Continuity of the Program" and "Satisfaction with the Provision of Support Education", it is seen that 93.93% of the parents in the theme "Willingness to Participate in Activities" and 96.96% of the parents in the theme "Observed Differences" gave positive opinions. is seen that 96.96% of the parents stated positive opinions in the contact.

Parents who gave positive opinions on the theme of "Willingness to Participate in Activities" stated their opinions: "*They are aware that he does different activities, which makes us happy*," "*Because having different friends in the workshop made him*

very happy to have puzzles," "*Because it was a lot of fun*," "*He was very happy with the activities that included educational games*," "*There are activities that interest my child,*" and "*Because my child says he's having so much fun and feels his brain is developing.*" "*My child did not want to quit the activity in the classroom, as the activities were held parallel to the lesson hours,*" expressed on the form.

Parents who gave positive opinions on the theme of "Expressions of Children" stated their opinions, "*They said that they made intelligence-enhancing applications in the activities*," "*They told about the activities they did and that they went very well*," "*They told that they played some games with shapes and drawings in a limited time and it was very entertaining*," and "*He said he does memory and retention activities,*" expressed on the form.

Parents who gave positive opinions on the "Observed Differences" theme stated: "*There was a noticeable improvement in focusing attention, reasoning skills, short-term memory processing and such skills. We noticed improvement in expressive and receptive language skills. Self-confidence increased and individual group work skills increased*." "*I noticed that my child made progress in using his memory, remembering verbal and visual stimuli, and managing instructions*." "*My child was good at drawing. But in this process, he brought movement and dimension to his drawings. He was able to convey what was said in detail in the future,"* and "His memory is very good. *Epecially after learning about this situation, I learned that he can keep a lot of things in his memory*," "*I did not notice much change*."

Parents who gave a positive opinion on the theme of "The Situation of Finding the Activities Useful," and their opinions "*I think it is useful. Its development was supported by groups and individual studies that developed self-discipline. I think it contributes to the child's view from a different perspective. Mental exercises were done with enjoyable games, which enabled them to both learn and have fun." "My child is a child who loves mental development activities. I think it is good for him." "Because I observed that my child developed cognitively*." "*I think it contributed to the mental and visual development of my child.*" "*In this way, my child was able to develop his potential,*" and "*I think such an application enables our children to reveal or even increase their potential in a process where stimuli are so important for children*."

Parents who gave positive opinions on the theme of "Continuity of the Program" said, "*We care about the continuation of the program. We believe that activities that will improve the ability to ask questions and increase the power of interpretation that will encourage them to think will be very useful,"* "*If my child has a talent that we do not know, it will be good for his development and development*," "*Continuity in the activities carried out to develop the existing potential of children. I think it is necessary,*" "*Since there is no standard education and it will add a different perspective, it should continue,*" "*For my child to develop different perspectives on situations and events*," and "*I think that such activities in preschool period improve their cognitive skills before academic skills*," expressed on the form.

Parents who gave a positive opinion on the theme of "Satisfaction with the Providing of Support Education" said, "I *think that the necessary support should be provided to realize and develop each child's potential. Such practices are very beneficial for* us," "*Due to the development of our child's awareness, we started thinking about what we can do as parents,*" and "*Because I think it is very effective in discovering and developing children's special abilities*," expressed on the form.

Findings Regarding the Views of the Teachers of the Children in the Experimental Group About the Program

After analyzing the answers given to the interview questions with the teachers of gifted and typically developing children in the experimental group, they were analyzed by two researchers and gathered under five themes. These themes are as follows: "Observed Differences," "Children's Expressions," "Observed Changes," "Continuity of the Program," "Satisfaction with the Provision of Supplementary Education."

When the data obtained were examined, it was seen that the teachers gave positive opinions on all themes. Teachers who gave positive opinions on the "Observed Differences" theme: "*I observed that they were more active in the attention and visual memory studies we carried out in the classroom*," "*I observed that they were willing to participate in practices*," "*I observed that they expressed themselves better and their self-confidence was positively affected*," and "*I observed that the attention span was prolonged, especially in desk activities,*" they expressed on the form.

Teachers who gave positive opinions on the theme of "Children's Expressions" stated their views: "*They stated that the activities were enjoyable and they were happy during the activities*," "*They said that they did mental and visual studies,*" and "*They stated that the activities were appropriate for their interests and that they participated willingly,*" they expressed on the form.

Teachers who gave positive opinions on the "Observed Changes" theme stated their views: "*I observed that their attention spans increased and their awareness increased,*" and "*By working with different teachers, it enabled them to adapt to different environments and to communicate better with their group mates,*" they expressed on the form.

Teachers who gave positive opinions on the theme of "Continuity of the Program" said: "*I think that conditions suitable for the special abilities of such students should be provided*," "*I think it has a great contribution to the development of children*," and "*Because it helped to close the gap in crowded groups because we did not care about children,"* they expressed on the form.

Teachers who gave positive opinions on the theme of "Satisfaction with the Providing of Support Education" said: "*Although we try to apply different studies to these students, it is not very appropriate for us to do this with other friends in the classroom. Therefore, I think it is necessary to support their special abilities by using a different environment and materials suitable for them," "I think that especially gifted children use their potential at the highest level because they receive a different education from their peers*," and "*It eliminated my anxiety of not being able to keep up with our special children,"* they expressed on the form.

Discussion and Conclusion

According to the findings, it can be concluded briefly below;

- It was observed that there was a significant difference between the pre-test scores of the children with typical development and gifted in the experimental group and the control group, and this difference was in favor of children with gifted children for both verbal and visual working memory in both groups.
- It was observed that there was no significant difference between the pre-test scores of the gifted children in the experimental and control groups.
- It was observed that there was a significant difference between the post-test scores of the gifted children in the experimental and control groups and this difference was in favor of the gifted children in the experimental group.
- It has been observed that there was a significant difference in favor of the post-test scores between the pre-test and post-test scores of the gifted children in the experimental group.
- It was observed that there was no significant difference between the post-test and follow-up test scores of the gifted children in the experimental group.
- It was observed that there was no significant difference between the pre-test scores of the children with typical development in the experimental and control groups.
- It has been observed that there is a significant difference between the post-test scores of the children with typical development in the experimental and control groups, and this difference is in favor of the children in the experimental group.
- It has been observed that there is a significant difference in favor of the post-test scores between the pre-test and post-test scores of the children in the experimental group with typical development.
- It was observed that there was no significant difference between the post-test and follow-up test scores of the children in the experimental group with typical development.
- The early intervention program for improving working memory is found useful by the students participating in the study and their parents and teachers, and ensures social validity.

The first result of the study is that there is a significant difference between the pre-test scores of the typically developing and gifted children in the experimental and control groups, and this difference is in favor of specially gifted children for both verbal and visual working memory. In the study conducted by Conway, Kane and Engle (2003), the relationship between working memory capacity and intelligence was examined, and in previous studies, it was stated that working memory capacity could form the basis of Spearman's g factor theory. Similarly, in the study conducted by Jaušovec and Jaušovec (2012) with adults, 30 hours of training was given to examine the effect of training on working memory on the fluent intelligence of the participants. After this training, it was revealed that the performance of the participants in all fluent intelligence tests increased significantly. In another study, Kane, Hambrick, and Conway (2005) aimed to reveal the relationship between working memory and fluent intelligence. In the study, it was stated that Ackerman, Beier and Boyle (2005), who have done research on this subject, agree that working memory capacity is not synonymous with general fluent intelligence (Gf) or reasoning ability. However, considering the results of the hidden variables studies, Ackerman et al. (2005) has been stated to be more strongly related than shown. These researchers re-analyzed 14 data sets obtained from 10 published studies with more than 3,100 young adults and found a strong relationship between working memory capacity and fluent intelligence reasoning factors (median r.72). In a study by Harrison, Shipstead, Hicks, Hambrick, Redick, and Engle (2013), it was stated that working memory is a critical element of complex cognition, especially under conditions of distraction and interference. However, it has been stated that working memory capacity is positively associated with many measures of cognition, including fluent intelligence. In a study conducted by Alp and Özdemir (2007), the relationship between fluent intelligence and information processing speed, short-term memory and working memory capacity in children was examined. In the study, seven information processing speed tests at different complexity levels, the linear and inverse sequence tests and the Nonverbal part of the Cognitive Abilities Test were applied to 68 first-grade students. The data obtained

showed that when evaluated together with the contributions of independent variables, working memory capacity predicted fluent intelligence. In a study by Bildiren, Korkmaz, and Demiral (2017), the aim was to determine the relationships between executive functions and intelligence in children with special abilities. Wisconsin Card Sorting Test (WCST) and WISC-R were used to collect data in the study. As a result of the findings obtained from the research, it was revealed that there is a relationship between WISC-R Verbal IQ in the range of 114-130, there is no common relationship between Performance IQ and WCST, and there is a significant difference between WCST sub-dimensions by age in children with special abilities. When this result of the study is examined, it is seen that it is parallel with the research findings in the literature.

The second and sixth results of the study are parallel to each other. It was observed that there was no significant difference between the gifted children in the experimental and control groups and the pre-test scores showing typical development. In the study in which Melby-Lervåg and Hulme (2013) put forward the methodological requirements of a suitable study aiming to show the effects of training on working memory performance, it was stated that one of the requirements was that the working memory capacity of the groups included in the experiment before the experiment was equivalent. In this direction, these two results obtained from the study show that the methodological requirements of the experiment have been fulfilled.

In the third and seventh results of the study, it is seen that there is a significant difference between the working memory performances of children with gifted and typical development in the experimental and control groups, and this difference is in favor of the children in the experimental group. In addition, the fifth and ninth results of the study show that there is a significant difference in favor of the post-test scores between the working memory pre-test post-test scores of both typically developing and gifted children in the experimental group. Thorell et al. (2009), preschool children were given computer-based visual spatial working memory or inhibition training for 5 weeks. While one group in the experimental group received computer-based visual spatial working memory training, the other group received computer-based inhibition training. While the active control group was playing commercially-sold computer games during the experiment, the data were obtained from the passive control group in the pre-test and post-test. In line with the findings obtained from the study, it was observed that children who received working memory training significantly improved in the tasks worked during the training. In another study by Kroesbergen et al. (2014), the relationship between working memory and early arithmetic skills was examined. The study was conducted with 51 children in the pre-school trial. In the study, there were 3 different groups, including only working memory training, working memory and early arithmetic skills training, and not benefiting from training at all. In the four-week study, 8 sessions of 30 minutes each were applied to the participants. The difference between the content of the education given to children who have only working memory training, working memory and early arithmetic skills training is planned as one application is numerical and the other is not. According to the findings obtained from the pre- and post-test data of the study, the working memory and early arithmetic skills of all children who benefited from the education programs were significantly improved. Similarly, in the study by Passolunghi and Costa (2016), working memory and early arithmetic skills were also studied. The findings obtained after the experiment showed that while early arithmetic skills training only improved arithmetic skills, working memory training improved both working memory and early arithmetic skills. These findings highlighted the importance of implementing programs aimed at improving working memory in addition to activities aimed at developing specific skills in the preschool period. Diamond et al. (2007), conducted another study with 147 children in pre-school period, a program that supports or does not support executive functions but has the same content was applied to two different groups. According to the results obtained from the study, while there was no significant difference between the participants on the Dot Task, which predicted the executive functions relatively little, it was observed that children who received executive function-supported education performed significantly higher in the Flanker task, where executive functions were at the forefront. Despite studies showing that the preschool period is early for the development of executive functions, including working memory, this study revealed that the specified functions can be improved at the age of 4-5. Röthlisberger, Neuenschwander, Cimeli, Michel, and Roebers (2012) examined the effect of the preschool program, which focused on working memory, intervention control and cognitive flexibility, on children's executive functions. The results obtained from the study revealed that this intervention supports the acquisition of all three components of executive functions: working memory, control of intervention and cognitive flexibility. These results in the literature show that working memory training can have important effects on preschool children. In addition to these results, the information obtained from parents, teachers and children shows that the study is effective in the social validity findings of the study. In this direction, the findings obtained from this study are in parallel with the findings in the literature. In the previous literature in this study, studies showing that working memory training is effective and that

working memory performance is measured higher after training (Thorell et al. 2009; Kroesbergen et al. 2014; Passolunghi & Costa, 2016; Diamond et al. 2007; Röthlisberger et al. 2012) parallels this finding of the study.

The fifth and ninth result of the study is that there is no significant difference between the post-test and follow-up test scores of both typically developing and gifted children in the experimental group. According to this result, it is seen that the early intervention program aimed at improving the working memory not only improves the performance of the working memory but also makes this development permanent.

The final result of the study, in line with the opinions obtained after the experiment, it is seen that the early intervention program was found useful by the students participating in the study, their parents and teachers, and the research provided social validity. Evaluating social validity findings in experimental studies aims to determine whether educational programs are sustainable (Schwartz & Baer, 1991). The information obtained from the social validity data shows that children participate in the activities without difficulty, with joy and with fun. However, it is observed that children find these activities different and they want them to be done in their own class. When the information obtained from the parents, which is an important factor of the study, is examined, it is seen that their children are very eager to participate in the activities, they always describe the activities positively, they see positive differences, find the activities useful, they want the program to continue, and they are very satisfied with such supportive education. Similarly, when the expressions of the teachers are examined, it is seen that they observe positive differences in children, that the statements of the children about the program are always positive, that the continuity of the program is very beneficial for them and the children, and they state that such supportive education should continue. The data obtained in this direction show that the education program developed within the scope of the research is a sustainable program with high social validity.

Recommendations

According to the findings and results obtained from the research, the following recommendations have been developed:

- Increasing scientific studies for gifted individuals in pre-school period and their education,
- Establishing and implementing more early intervention programs for gifted individuals in pre-school period,
- Including activities to improve working memory in early intervention programs for gifted individuals in pre-school period,
- Organizing in-service trainings for preschool teachers, including activities for improving working memory,
- Organizing in-service training for preschool teachers on the characteristics and education of gifted children in pre-school period,
- Conducting studies to examine the effects of intervention programs to improve working memory performance on other skills,
- Conducting longitudinal studies examining the effect of early intervention programs for gifted children in preschool period,
- Establishing different early intervention programs for gifted children in pre-school period and investigating the difference between the effects of these programs,
- It is recommended to ensure that all gifted children in pre-school period benefit from early intervention education.

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