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60-72 Aylık Çocuklara Uygulanan Sorgulama Tabanlı Problem Çözme Etkinliklerinin Çocukların Problem Çözme Becerisine Etkisinin İncelenmesi[1]

Examining the Effect of Inquiry-Based Problem-Solving Activities on the Problem-Solving Skills of 60-72 Months Old Children

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ÖZ: Bu araştırmanın amacı, 60-72 aylık çocuklara uygulanan sorgulama tabanlı problem çözme etkinliklerinin çocukların problem çözme becerilerine olan etkisini incelemektir. Araştırma nicel araştırma desenlerinden birisi olan öntest-sontest kontrol gruplu deneysel desen kullanılmıştır. Araştırmanın çalışma grubunu, 13 çocuk deney ve 13 çocuk kontrol grubunda olmak üzere toplam 26 okul öncesi dönem çocuğu oluşturmaktadır. Araştırmacılar tarafından hazırlanan sorgulama tabanlı problem çözme etkinlikleri 10 hafta ve haftada 3 gün olacak şekilde toplam 30 oturum deney grubuna uygulanmıştır. Veri toplama aracı olarak demografik bilgi formu ve Çocuklar için Problem Çözme Becerisi Ölçeği kullanılmıştır. Araştırma sonucunda deney grubu çocuklarının problem çözme beceri puanları, kontrol grubuna dahil edilen çocukların problem çözme beceri puanlarından istatistiksel açıdan daha yüksek bulunmuştur. Bir diğer ifade ile çocuklara uygulanan sorgulama tabanlı problem çözme etkinlikleri çocukların problem çözme becerisini olumlu olarak etkilemiştir.

Anahtar sözcükler: Okul öncesi, problem çözme becerisi, sorgulama tabanlı öğretim.

ABSTRACT: The present study aims to examine the effect of inquiry-based problem-solving activities on 60-72 months old children's problem-solving skills. In the study, the pretest-posttest control group experimental design which is among the quantitative research designs was used. The study group consists of a total of 26 pre-school children as 13 in the experimental and 13 in the control group. The inquiry-based problem-solving activities prepared by the researchers were applied to the experimental group as a total of 30 sessions for 10 weeks and three times a week. Demographic information form and Problem-Solving Skills Scale were used as data collection tools. As a result of the study, it was determined that the problem-solving skill scores of the children in the experimental group were statistically higher than the students in the control group. In other words, inquiry-based problem-solving activities positively affected the problem-solving skills of children.

Keywords: Preschool, problem-solving skill, Inquiry-based teaching.

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1. INTRODUCTION

One of the most important objectives of many countries in educational institutions' curricula is to develop the problem-solving skills of children (Dyah & Setiawati, 2019; Lile Diamond, 2017; Wehmeyer & Palmer, 2000). Through the problem-solving skill acquired at an early age, children experience the behaviors they will encounter in their future life and learn the behaviours necessary for adapting to the real world (D'Zurilla, Nezu, Maydeu-Olivares, 2004; Walker et al., 2013). Furthermore, they form a basis for several skills that they would learn or acquire in the next educational steps. Problem-solving is one of the essential skills, especially for early childhood children. Because these skills follow children throughout their lives. Children solve the problems they encounter in real life by using these skills they learn (Beckley, 2013). Dewey (1933) also mentioned this situation in projective thought theory. According to the theory, children actively use the problem-solving skills acquired in educational environments in real life. Dewey defines problem-solving skills as a creative thinking process. Thorndike stated that problem-solving is not only about reaching the result. Individuals' experiences are important for problem-solving. Especially individuals learn from their mistakes and find solutions to the problem piece by piece. According to Meador (1997), problem-solving is closely related to creativity. To solve a problem, an extraordinary and extraordinary thinking system must be created.

Problem-solving skill is one of the mathematical process standards determined by the National Council of Mathematics Teachers- (NTCM) (2000). No primary statistics compare the problem-solving skills of children living in different countries. However, PISA and TIMSS exam results can also give us information about children's problem-solving skills. In the Program for International Student Assessment (PISA) 2018 research in which 79 countries participated as 37 of them were Organization for Economic Cooperation and Development (OECD) members, the problem-solving strategies were examined within the field of mathematics. When the results of the study were examined, it was observed that China, Singapore, Macau, Hong Kong, and Taiwan were the leading countries. Turkey, on the other hand, ranked 42nd among 79 countries. When the average scores were examined, it was concluded that the average scores of children in Turkey were lower than both the participant countries and OECD countries (OECD, 2019; Schleicher, 2018). Another exam measuring problem-solving skills is Trends in International Mathematics and Science Study (TIMSS). According to the TIMSS 2015 research report, Singapore, South Korea, Taiwan, and Japan were the most successful countries in the world. Although the TIMSS scores of Turkey increased in 2015, it was observed that the scores were below the overall average score and Turkey's place in the ranking did not change (Koyuncu & Ilgaz, 2019; Yücel & Karadağ, 2016). When the results of both exams were examined, it can be stated that the problem-solving skill scores of children in Turkey are below the average score of the world.

One of the most important reasons for the low problem-solving skills of children is the defects in the implementation of the programs (Branscombe et. al., 2014; Seefeldt, 2005). When the pre-school curriculum in Turkey was examined, it was mentioned that children should develop problem-solving skills for the problems they would encounter in conflicts and it was emphasized that problem-solving skills should be supported to demonstrate positive behaviours. In the activity plans prepared with the guidance of the program, indicators such as problem analysis, finding alternative solutions to the problem, establishing cause and effect relationships, etc. are included. While it is stated that problem-solving skills should be given with child-centered activities in the program, how this acquisition will be provided to children or which teaching philosophy should be used is not elaborated (MoNE, 2016; Sıddık, 2019; Yıldırım, 2014). When the pre-school curriculums of countries with high problem-solving skill levels are examined, it can be observed that activities are presented to students with a teaching

philosophy based on inquiry or research. Moreover, it is known that inquiry-based teaching programs are applied as supportive curricula in certain countries in addition to the national curricula (Brna et. al., 2002; Scherer & Beckmann, 2014; Simon, 2020).

When the reason why countries use inquiry-based curricula is examined, it was observed that inquiry-based curricula provide students to wonder and constitute behaviours towards exploring (Fielding, 2012; Kuklthau, Maniotes, & Caspari, 2007; Scardamalia, 2002). The inquiry-based teaching philosophy is explained as a process containing the creation of a product that provides students to ask questions, research the subjects they are curious about, discuss, and reflect on what they understood. The main goal of inquiry-based teaching is to enable children to actively experience their learning processes by exploring. Children experience the stages of certain steps in the activity process that progresses based on inquiry-based teaching philosophy (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011; Feyzioğlu, 2019; Wolfe, 2019). According to Rushton (2008), inquiry-based teaching stages advance in six steps as stimulate; activate and communicate; plan and predict; investigate; record and report; connect and evaluate, respectively. According to NRC (2000), inquiry-based teaching has five common features regardless of the grade it is applied. These features can be explained as; (a) engaging the activity with a question; (b) enabling children to answer the questions and using clues in the process; (c) presenting the answers by the children; (d) comparing their explanations and other explanations by the children; (e) sharing the obtained results. In the "engaging the activity with a question" step, it is required to start the activity with an interesting question. It is important that this question should come from the children, however, sometimes this question does not come from the students. In this stage, a situation that children encounter in their social environment can be asked to them as a problem. Thus, the participation of the students in the activity can be provided. In the second stage which is "providing children to answer the questions and using clues in the process", teachers should provide clues about the subject of which students are desired to interact with and behave in a way that would facilitate children to answer to the questions and prevent them from digressing. In the "presenting the answers by the children" stage, students should first research to answer the questions. Children prepare their answers in accordance with the question. They base their behaviours on an idea in the answering process. In this process, it is required to provide clues and proof that would facilitate children's scientific explanations. The significant point here is to provide experiences that students have experienced before. In "comparing their explanations and other explanations by the children" stage, it should be provided for children to listen to each other. Children perform evaluations between their answers and the answers presented by their friends and make additions or changes to these answers. In this process, children evaluate the sufficiency and reasonableness of the answer. In the last stage which is "sharing the obtained results", children present the solutions to their peers, teachers, or parents. In this stage, the expression of the opinions by the children provides them to perform self-evaluation.

When the literature is examined, there are studies showing the effectiveness of inquiry-based programs. As a result of the study Hong and Diamond (2012) to examine the effect of children's learning status of scientific concepts and scientific words with the inquiry-based science program on the improvement of pre-school children's problem-solving skills, it was concluded that the inquiry-based education applied to the experimental group positively affected the children's learning levels of scientific concepts and words and increased their problem-solving skills. In the study conducted by Alabay and Özdoğan (2018) with pre-school children, inquiry-based science activities were applied to the experimental group in an external environment and whether it affects the scientific process skills of children was examined. As a result of the research, it was observed that inquiry-based science activities

applied in an external environment enabled a significant increase in the observation, classification, estimation, measurement, data recording, deduction, and total scientific process skill scores of the children in the experimental group. As a result of the study conducted by Arı and Yılmaz (2016) to examine the effect of disaster prevention subject taught with inquiry-based education within the scope of science and technology course on the success of children on this subject and the attitudes of children in a disaster condition, it was concluded that the attitudes and success levels of the group which received inquiry-based education were significantly higher than the other group. Activities about density prepared with the inquiry-based approach with the pre-school children were prepared and presented by Kabataş, Memiş, and Çakan Akkan (2016). As a result of the study, it was determined that the children who learned the subject of density with inquiry-based education structured the concept easier. In the study conducted by Samarapungavan, Mantzicopoulos, and Patrick (2008) to examine the effect of inquiry-based science education on learning the concepts of science and scientific process skills, it was concluded that children in the experimental group learned the concepts within the concepts of biology functionally and their scientific process skills increased compared to the control group. Peterson and French (2008) prepared an inquiry-based science program for pre-school children that would last five weeks and determined the mixture of colours as the subject. As a result of the research, it was concluded that children who participated in the inquiry-based activities answered more questions and used more scientific terms about the mixture of colours. In the study conducted by Casey, Dicarlo, and Sheldon (2019) to examine the effect of social sciences education prepared with the inquiry-based approach and applied to 36-48 months old children in the schoolyard, the observational notes and course plans of the teachers were analysed. As a result of the analysis, it was determined that the inquiry-based social studies education applied in the schoolyard positively affected the development of children's democratic competence. Carraway-Stage and Goodell (2011) examined the efficiency of inquiry-based dietetics education applied to pre-school children. Children in the age group of 3-5 years old were included in the research and training of 15-sessions in which nutrition is integrated with mathematics, science, art, music, and reading activities were planned. As a result of the research, it was concluded that inquiry-based dietetics education motivated children to explore and taste fruits and vegetables. Dejonckheere, Wit, Keere, and Vervaet (2016) conducted a study with children in the age group of 4-6 years old to examine the efficiency of inquiry-based science education in pre-school classrooms. In the study, the interests of children towards the causal incidents and scientific reasoning skill levels were measured after the education. After the completion of the education, it was determined that the skill levels of the children in the experimental group significantly increased than the control group according to the posttest results. Like these studies, there are lots of studies revealing the positive effects of inquiry-based education processes on several skills of pre-school children.

According to national studies, it is seen that preschool teachers in Turkey perform activity-oriented practices instead of child-oriented practices. In addition, it was concluded that preschool teachers have a high tendency to use ready-made plans and practice teacher-centered practices (Sak, Erden, & Morrison, 2016; Güzeldere Aydın, Ocak Karabay, & Arıcı, 2018; Can & Kılıç, 2019). In addition, one of the most important parts of inquiry-based teaching is "starting with a question". When the studies were examined, it was seen that preschool teachers in Turkey asked closed-ended questions to children. When the contents of the questions were examined, it was determined that most of the questions were at the level of thinking skills at the lower cognitive level (Bay & Alisinanoğlu, 2012; Öztürk Samur & Soydan, 2013). The importance of this study is that the problem-solving skill levels of children are low compared to the children of many countries (PISA and TIMSS results) and that preschool teachers cannot apply the steps required for inquiry-based teaching. In the study, it was planned to determine on what level

problem-solving skill activities prepared in accordance with the inquiry-based teaching philosophy affect the problem-solving skills of children. Accordingly, examining the effect of inquiry-based problem-solving applied to 60-72 months old children on the problem-solving skills constitutes the main objective of the study. In accordance with this purpose, answers were sought for the following questions:

(a) Is there a significant difference between the pretest and the posttest scores of the Problem-Solving Skills Scale of the experimental group children?

(b) Is there a significant difference between the Problem-Solving Skills scale pretest and posttest scores of the control group children?

(c) Is there a significant difference between the Problem-Solving Skills Scale posttest scores of the experimental and control group children?

(d) Is there a significant difference between the posttest and follow-up test scores of the Problem-Solving Skills Scale of the experimental group children?

(e) Is there a significant difference between the posttest and follow-up test scores of the Problem-Solving Skills Scale of the experimental and control group children?

2. METHOD

2.1. Research Design

In the present study, among the quantitative research design, the pretest-posttest control group experimental model was used. Pretest-posttest control group experimental design is a widely accepted semi-experimental model. It is a research model including a single experimental and single control group in which the experimental and control group is selected systematically, and the posttest scores are examined at the end of the pretest and experimental process (Campbell & Stanley, 1996). This model which is mostly preferred in the fields of education and psychology, the experimental and control groups are created randomly, and measurements are performed with the dependent variable (Karasar, 2005).

2.2. Study Group

The study was conducted with a total of 26 children between 60-72 months old in a pre-school educational institution. 13 of these children were in the experimental and 13 of them were in the control group. The demographic information of the children was given in Table 1.

Table 1: *Demographic Information of Children*

Demographic Information		Control Group		Experimental Group	
		n	%	n	%
Sex	Girl	5	38,5	3	23,1
	Boy	8	61,5	10	76,9
Duration of Continuing Preschool Education	12 months and under	-	-	-	-
	13 months-24 months	7	53,8	7	53,8
	25 months- 36 months	6	46,2	6	46,2
Order of Birth	First	10	76,9	10	76,9
	Second	3	23,1	3	23,1

Table 1 (Continued): *Demographic Information of Children*

Demographic Information		Control Group		Experimental Group	
		n	%	n	%
Mother's Educational Status	High school	6	46,2	5	38,5
	Associate	1	7,6	-	-
	University	6	46,2	7	53,8
	Graduate	-	-	1	7,7
Father's Educational Status	High school	7	53,8	3	23,1
	Associate	1	7,7	-	-
	University	5	38,5	10	76,9
	Graduate	-	-	-	-
Mother's Age	35 and under	3	23,1	6	46,2
	36-40 years old	8	61,5	5	38,5
	41 years old and above	2	15,4	2	15,4
Father's Age	35 years and under	1	7,7	2	15,4
	36-40 years old	4	30,8	5	38,5
	41 years old and above	8	61,5	6	46,2

When the gender distribution is examined; 38.5% of the control group were girls and 61.5% were boys; and 23.1% of the experimental group were girls and 76.9% were boys. It was concluded that the continuance of the pre-school education processes of both groups was equal. It was determined that while the children in the experimental and control group continued pre-school education for 13-24 months, 46.2% of them were continuing pre-school education for 25-36 months. When the birth order variable was examined, it was observed that this variable was equal in both groups as well. It was concluded that 76.9% of the children in the experimental and control group were first-born and 23.1% of them were second born. When the education status of the parents was examined, it was observed that the mothers in both groups were university graduates, the fathers in the experimental group were mostly university graduates, and the fathers in the control group were mostly high-school graduates. It was determined that the 61.5% of the mothers in the control group were in the age group of 36-40, 23.1% of them were 35 years old and below, 15.4% of them were 41 years old and above; 46.2% of the mothers in the experimental group were 35 years old and below, 38.5% of them were in the age group of 36-40, and 15.4% of them were 41 years old and above. Finally, it was observed that 61.5% of the fathers in the control group were 41 years old and above, 30.8% of them were in the age group of 36-40, and 7.7% of them were 35 years old and below; 46.2% of the fathers in the experimental group were 41 years old and above, 38.5% of them were in the age group of 36-40, and 15.4% of them were 35 years old and below.

Cluster sampling was used in the selection of the experimental and control groups. First, an easily accessible pre-school was chosen. There were 4 classes in this school with children aged 60-72 months. From these classes, an experiment and a control group were determined according to the random sampling method. There were 13 children in both the experimental and control groups. Both teachers have graduated from the pre-school teaching undergraduate program. They have an experience of 5-10 years. In the first stage, Problem-Solving Skills Scale was applied to both groups and the pretest scores of the experimental and control group were compared with Mann Whitney U Test. The results of the analysis were given in Table 2.

Table 2: *Mann Whitney U Test Results for Comparison of Pretest Scores of Experimental and Control Group Children*

PSSS	Groups	N	$\bar{x}$	sd	MR	SR	U	Z	p
Total Score	Experimental Group	13	36,46	4,351	176,50	13,58	83,50	-,052	,959
	Control Group	13	36,61	4,253	174,50	13,42			

When Table 2 is examined, it can be stated that there was not a significant difference between the total scores of the children in the experimental and control group from the Problem-Solving Skills Scale (PSSS). In other words, it can be stated that the problem-solving skills of children in the control and experimental groups were similar before the experimental process.

2.3. Data Collection Tools

As the data collection tools, “General Information Form” was used to determine the demographic information of children and parents and the "Problem-Solving Skills Scale” was used to reveal the problem-solving skills of children.

2.3.1. *General Information Form*

In the study, the General Information Form developed by the researchers was used. The questions in this form include demographic information about the children and parents. General information form consists of a total of 7 questions regarding child's sex, child's date of birth (date-month-year), child's birth order, parents' education status and parents' age. General information form was sent to all parents before the research and controlled whether the groups provide the equivalence before starting the experimental process.

2.3.2. *Problem-Solving Skill Scale*

Problem-Solving Skill Scale (PSSS) was developed by Oğuz and Köksal Akyol in 2012. The scale was prepared to determine the problem-solving skill levels of 60-72 months old children. In the validity and reliability study of the scale, the reliability coefficient was found to be .86, and the correlation coefficient after the test-retest was found as .60. The scale consists of “PSSS Guidance”, “PSSS Implementer Directive”, “PSSS Problem Situation Images (18 images)”, and “PSSS Evaluation Form”. PSSS is a five-point Likert type scale and participants score between “0-4” for the solutions prepared for each problem situation. In PSSS, the scoring is carried out as; “0” if there are not any solutions, “1” for a single solution, “2” for two solutions, “3” for three solutions and “4” for more than three solutions. In order for children to get a point from the solutions, each solution should be different from the other. In the application, children may repeat one of the solutions that were already given, thus, children do not get any points for repeated solutions. The score interval of PSSS is 0-72. The increasing score in PSSS indicates a high problem-solving skill level. The total score obtained from the scale questions gives the problem-solving score of a child. The reliability value was recalculated in the present study and the Cronbach alpha value was found as .83.

2.4. Data Collection

Necessary approvals were taken from the Ministry of National Education (MoNE) after the school was determined. The activities that would be applied and the research were explained to the teachers and the school management, and their approval was taken. Moreover, the text that explains the research was sent to the parents of the children in the experimental and control group. The written consent of the parents was taken as well. The thirty-activity plan was prepared by the researchers with the guidance of the MoNE 2013 Pre-school Curriculum by examining the items on the scale. The opinions of three specialists were taken for the prepared activity plans and the necessary editing was carried out. Visual cards were prepared for the eighteen problem sentences in the scale and the visuals were prepared in accordance with the order of the scale items. The statements were read to children in the age group of five-six years old (60-72 months) individually with the question-answer method in a silent environment and the scale was filled by taking short notes according to the answers of the children. It was avoided to give any clue about the problem-solving stages. The study was finalized by completing the eighteen problem situations in approximately 20-25 minutes for each participant. After the experimental and control groups were determined, inquiry-based problem-solving activities of 30 sessions in total for 10 weeks were applied to the experimental group by the researcher. The activities lasted 30-50 minutes on average.

2.5. Sample Activity Content

A puppet was used in all the activities. The name, Tofi, was given to this puppet with the children. In each activity, problematic situations arise for Tofi and its surroundings and solutions were sought for these problems with the children. Furthermore, inquiry-based education philosophy was based on each activity. The learning process of a sample activity is given below.

Learning Process. An envelope arrives at the classroom, and it is written on the envelope that the sender is Tofi. The envelope is opened with the children and the letter inside is read to the children.

Tofi: Dear Venus classroom, hello, I am Tofi. I came to your classroom on Monday, and I was very sad. Do you remember why I was sad? (Answers are taken) Because I accidentally damaged an item of a person whom I like a lot. I broke Pelin's moneybox, and I was very sad. However, you helped me and gave me lots of ideas for the broken moneybox, and I tried one of them at my house instead of crying. I made a new moneybox to Pelin since I could not repair the broken one and now, I am acting more cautiously while playing. I appreciate what you did. You gave great ideas to me! I am sending my pawprint to thank you, however, both of my paws were painted, and I do not know what to do or how to clean. Warm regards, meow, meow! (Stimulate/Starting the process with a question) The teacher shows the pawprint at the end of the letter to the children. An area is chosen to demonstrate the gift of Tofi and the teacher says that people can do the pawprint with their hands. The pawprint is drawn on the blank papers on the activity tables by first using the fist and then the fingers. The drawings are left to dry, the end of the letter is emphasized, and what Tofi said is reminded to the children. The teacher says that "Look, Tofi's paws were painted and now, your hands are painted as well". The fact that their hands are painted is discussed whether it is a problem situation. Answers are sought for the following questions: Can we prevent from painting everywhere with painted paws/hands? How? Can we move freely with painted paws/hands? How? The water is cut but your hands and Tofi's paws are painted, what can we do? The answers are noted by the teacher (Taking the answers of children –Activate and

communication/Finding Solutions by Using Proofs/Defining the Problem-Collecting Data about the Problem-Presenting Solution to Problem).

Time is given (duration of two songs) to all students to try their own solution. At the end of the trials, which method the children chose and whether they concluded, how they felt while trying are discussed by sitting in U-shape with the children. Answers are sought for 'What else could be done?' Wiping with a wet towel, waiting for the paint to dry, etc. are evaluated as alternative solutions. The children are asked to draw the solution they want to propose to Tofi on the paw printing papers drawn by the children to solve the painted paw problem. The drawings are prepared for cargo to be sent to Tofi by putting in a large envelope. (Hypothesizing for the solution of the problem, trying the hypothesis, discussing the result, reporting/Evaluating the Explanations of Children with the Alternative Explanations, Presenting and Supporting the Findings)

2.6. Data Analysis

In the analysis of the data that was collected with the data collection tools, the collected data were entered into the SPSS 21.0 program. The necessary statistical analyses were conducted with this program by considering the main objective and the sub-objectives of the study. The skewness and kurtosis values of pretest, posttest, and permanence scores of the children in the experimental and control groups were calculated within the scope of the research. Non-parametric tests were chosen since the kurtosis and skewness values did not vary between +/-2. While the comparison between the children's PSSS pretest/posttest and posttest/permanence test score means was conducted with the "Wilcoxon Signed Rank Test", "Mann Whitney U Test" was used in the comparison of pretest, posttest, and permanence test scores of the groups.

3. FINDINGS

3.1. Findings Regarding Children's Problem-Solving Skills Pretest-Posttest Scores

Wilcoxon Signed Rank Test was performed to compare the pretest and posttest scores of children in the experimental group from the Problem-Solving Skill Scale in accordance with the first sub-problem of the research. The analysis results were given in Table 3.

Table 3: *Wilcoxon Signed Rank Test Results between the Pretest-Posttest Scores of Children in the Experimental Group from Problem-Solving Skill Scale*

PSSS	Groups	n	$\bar{x}$	Sd	Z	p
Total Score	Pretest	13	36,46	4,35	-3,185	,001**
	Posttest	13	44,61	4,36		

*p<,05 ** p<,01

When Table 3 is examined, a significant difference is observed in favour of the posttest between the pretest and posttest scores of the children. In other words, it can be stated that inquiry-based problem-solving activities applied to the children in the experimental group increased the problem-solving skills of children.

Wilcoxon Signed Rank Test was performed to compare the pretest and posttest scores of children in the control group from the Problem-Solving Skill Scale in accordance with the second sub-problem of the research. The analysis results were given in Table 4.

Table 4: *Wilcoxon Signed Rank Test Results between the Pretest-Posttest Scores of Children in the Control Group from Problem-Solving Skill Scale*

PSSS	Groups	n	$\bar{x}$	Sd	Z	p
Total Score	Pretest	13	36,61	4,25	-3,075	,002**
	Posttest	13	40,84	3,02		

**p<,05 ** p<,01*

When Table 4 is examined, a significant difference was observed in favour of the posttest between the pretest and posttest scores of the children. In other words, it can be stated that when the MoNE pre-school program is applied to children in the control group without any supplementary program, their problem-solving skills increase.

3.2. Findings Regarding the Problem-Solving Skills Posttest Scores of the Children in the Experimental and Control Groups

Mann Whitney U test was performed to determine whether there is a significant difference between the Posttest scores of children in the experimental and control groups from the Problem-Solving Skill scale. The Mann Whitney U test results were given in Table 5.

Table 5: *Mann Whitney U Test Results for Post-test Scores of Experimental and Control Group Children*

PSSS	Groups	n	$\bar{x}$	Sd	MR	SR	U	Z	p
Total Score	Experimental	13	44,61	4,36	220,00	16,92	40,00	-2,291	,022*
	Control	13	40,84	3,02	131,00	10,08			

**p<,05*

When Table 5 was examined, a significant difference was determined in favor of the experimental group between the total posttest scores of children in the experimental and control group from the Problem-Solving Skill Scale (PSSS). In other words, it can be stated that the problem-solving skill levels of children in the experimental group increased statistically significantly compared to the children in the control group.

3.3. Findings Related to the Experimental Group Children's Problem-Solving Skill Posttest-Follow-up Test Scores

Wilcoxon Signed Rank Test was performed to compare the posttest and follow-up test scores of children in the experimental group. The analysis results were given in Table 6.

Table 6: *Wilcoxon Signed Rank Test Results between the Posttest and Follow-up test Scores of Children in the Experimental Group*

PSSS	Groups	n	$\bar{x}$	Sd	Z	p
Total Score	Posttest	13	44,61	4,36	-1,604	,109
	Follow Up	13	44,15	4,21		

When Table 6 was examined, there was not a significant difference between the total pretest and follow up scores of the Problem-Solving Skill Scale according to the Wilcoxon Signed Rank Test used in the comparison of posttest and follow-up test scores of the experimental group. In other words, four weeks after the end of the application process of inquiry-based problem-solving activities applied to the experimental group, there was not a significant increase or decrease in the total problem-solving skill scores, and the education was permanent.

3.4. Findings Regarding the Problem-Solving Skills Follow Up Scores of the Children in the Experimental and Control Groups

The Mann Whitney U test was performed to determine whether there was a significant difference between the Follow-Up Test scores of the experimental and control groups in the Problem-Solving Skill Scale four weeks after the experimental process. The Mann Whitney U test results were given in Table 7.

Table 7: *Mann Whitney U Test Results for Follow Up Scores of Experimental and Control Group Children*

PSSS	Groups	n	$\overline{x}$	Sd	MR	SR	U	Z	p
Total Score	Experimental	13	44,13	4,21	216,50	16,65	43,50	-2,116	,034*
	Control	13	40,53	3,09	134,50	10,35			

*p<,05

When Table 7 was examined, a significant difference was determined in favour of the experimental group between the total follow up test scores of the children in the experimental and control group from the Problem-solving Skill Scale (PSSS). In other words, a significant increase was determined in the experimental group compared to the control group four weeks after the completion of inquiry-based problem-solving activities.

4. DISCUSSION and RESULT

The aim of this study is to examine the effect of inquiry-based problem-solving activities on 60-72 months old children's problem-solving skills. As a result of the study, it was concluded that inquiry-based problem-solving activities increase the problem-solving skills of children. In other words, a statistically significant difference was observed in the posttest scores of the experimental group who performed inquiry-based problem-solving activities in the problem-solving skill scale compared to the posttest scores of the control group in the problem-solving skill scale. One of the most important reasons for this significant difference is considered to originate from the fact that the problem-solving activities were prepared in accordance with the inquiry-based education philosophy. It is suggested that inquiry-based education enables children to learn more actively since it is based on a child-centered approach and supports independent behaviour for children (French, 2004; Llewellyn et al., 2002; NRC, 2000; Plevyak, 2007). Furthermore, it was stated that the inquiry-based learning approach improves skills such as scientific thinking, problem-solving, communicating, and working cooperatively (Ireland, Watters, Brownlee, & Lupton, 2012; Luft, Bell, & Gess-Newsome, 2008; Pilitsis, & Duncan, 2012).

One of the most important reasons for the effectiveness of inquiry-based education applied to children in this study is that the program is a child-centered program. Inquiry-based programs are child-

centered programs (Mieg, 2019; Tunnicliffe, 2015). Every activity in the program starts with a question that children are curious about. Then, the children try to find solutions to the problems. Children generate hypotheses and apply their hypotheses (Krogh & Morehouse, 2020). According to Jorgenson (2005), children learn by experiencing and doing in inquiry-based programs. Learning by doing and experiencing is the basis of child-centeredness. According to Cornelius-White and Harbaugh (2010), inquiry-based teaching and collaborative teaching come first among child-centred teaching methods. Children play the role of active learners in inquiry-based teaching. Children start with a high motivation and acquire problem-solving skills. According to Mayer (2004), the success of inquiry-based programs is that the child solves many problems by himself. Teachers are not active in inquiry-based teaching. If the children ask for help, the teacher helps the child in the role of a guide.

Another reason for the effectiveness of the inquiry-based education program is that the program increases children's intrinsic motivation. Intrinsic motivation is the pleasure or satisfaction of an individual while performing a job or an activity (Gagne & Deci, 2005). According to Deci and Ryan (1985), he argues that there are different types of motivation and the most basic motivation is intrinsic motivation. The intrinsic motivation of children increases especially when young children are given enjoyable and interesting activities. For example, Froiland and Worrell's (2016) state that there is a significant relationship between students' intrinsic motivation and academic performance. In other words, as the intrinsic motivation increases, the academic performance also increases. In inquiry-based teaching, enjoyable and entertaining activities are included in the learning process of children. It is possible to say that children are more interested in enjoyable and entertaining activities, especially when preschool children are considered. In addition, while the source of information in traditional learning methods is seen as the teacher; The source of information in inquiry-based teaching is the curiosity and interest of the child. In inquiry-based teaching, children's interest in the learning process will increase, as the interests of children will increase (Reitinger et al., 2016; Deci & Ryan, 1985).

Another reason why the inquiry-based program is effective on children's problem-solving skills is that inquiry-based learning is a process that supports problem solving (Trna, Trnova, & Sibor, 2012). According to Sanjaya (2006) and Andrini (2016), children try to find their own answers to the problem posed in inquiry-based instruction. In the process of seeking solutions, the child puts his critical thinking into action. It activates a series of thinking processes and uses the critical and analytical thinking process. Thus, it provides an opportunity for children to access new information using their own knowledge. Most of the steps of problem-solving skills such as determining the problem, defining the target, choosing solutions, suggesting alternative solutions to the chosen solution, and making evaluation are parallel to the steps of inquiry-based applications.

As a result of the study, it was seen that inquiry-based problem-solving activities increased the problem-solving skills of children. In this context, inquiry-based teaching approach can be given in more detail to both preschool teachers and pre-school teacher candidates. Inquiry-based activities should be implemented in the form of workshops for both teachers and prospective teachers. In this way, teachers and prospective teachers can observe the inquiry-based teaching steps in more detail. In addition, an activity book can be prepared for teachers to increase inquiry-based activity applications. In addition, “How is an inquiry-based activity prepared for the content of teacher training programs? How is it applied? " can be discussed in more detail.

The biggest limitation of the study is the number of the participants. The study was prepared in an experimental design and was carried out with only a small group. Another limitation of the study is that the parents of the children are in the middle and upper socioeconomic level.

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