



## The Effects of Project Based Approach in Early Intervention Program on the Problem Solving Ability of Gifted Children \*

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### Abstract

The purpose of this study was to examine the effects of the early intervention program applied on potentially gifted children during the pre-school period on the problem solving abilities of the children. The intervention program was arranged according to project based approach. An identification study was carried out at four different kindergartens in the city of Izmir for determining potentially gifted children in the pre-school period. Candidate Form, Metropolitan Readiness Test and Colored Progressive Matrices test were applied during the identification study. A total of 114 children were nominated with the candidate form by their pre-school teachers. The verbal section of the Metropolitan Readiness Test was applied on the nominated children as a result of which 62 children displayed a higher performance than their peers. Afterwards, these children were subject to Colored Progressive Matrices Test in which 44 children displayed superior performance. A project based intervention program of 12 weeks and 48 hours was applied to the experiment group. Problem Solving Skills Scale was implemented on potentially gifted children before and after the program in order to determine their problem solving skills. It was determined at the end of the program that the problem solving skills of gifted children in the pre-school period increased at a statistically significant level.

### Keywords

Giftedness  
Identification  
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## Introduction

Early childhood is the most special period in the life of a child. It is one of the most important periods for both physical and cognitive development. Pre-school education that starts during this time period provides the child with the first experiences in academic life. These early learning experiences (concept development, mathematics etc.) may be limited subject to the cultural, linguistic, socio-economic variables of children. However, the quality of the education for providing access, opportunity and experience in order to increase the knowledge and skill levels of children may eliminate these limitations (Dobbins, McCready, & Rackas, 2016).

The application of quality pre-school programs may especially have a critical impact on children. Gorey (2001) analyzed 35 early intervention programs carried out during 1990 and 2000 as a result of which it was determined that these programs made a positive impact on intelligence and academic success. Westhues, Nelson, and MacLeod (2003) analyzed 34 intervention programs during 1970 and 2000 thereby determining the high impact of such programs. Similarly Camilli, Vargas, Ryan, and Barnett (2010) evaluated 123 early interventions thus putting forth that the programs made an impact on cognitive development, school and social life.

The brains of children continue to develop during the early childhood period which is accepted as a critical growth and development stage, thus it is possible that any intervention will make a higher impact (Hallahan, Kauffman, & Pullen, 2011). The effects of certain developmental risk factors for small children may be prevented, improved and reduced by way of early identification and intervention (Guralnick, 1998), or even skills may be improved in potentially gifted children (Brighton, Moon, Jarvis, & Hockett, 2007; Kaplan & Hertzog, 2016).

The performances of potentially gifted children during the pre-school period may be maximized via early intervention. However, it is asserted in the studies carried out that these children are affected more from insufficient education rather than skill development (Jolly & Kettler, 2008). Even though these children display significant development characteristics in the fields of language, memory, concept development and mathematics at an early age in comparison with their peers (Bildiren, 2018a), it is emphasized that this group does not receive an education that is in line with their performances (Chamberlin, Buchanan, & Vercimak, 2007; Jolly & Kettler, 2008; Koshy & Robinson, 2006). However, failure to improve early developed skills may result in negative emotional and social consequences in the middle and long run (Porter, 2005).

Even though there is a consensus with regard to the necessity of applying programs that are in accordance with the individual characteristics of children with superior performance (Robinson, Reis, Neihart, & Moon, 2002), potentially gifted children are neglected during the pre-school programs (Feiring, Louis, Ukeje, Lewis, & Leong, 1997). Moreover, the number of studies related with early intervention on such children is also limited (Jolly & Kettler, 2008; Robinson, 2008). A similar case can be observed in both national and international literature. These studies are based on the characteristics and determination of gifted children in pre-school period rather than early intervention. (Dağlıoğlu & Metin, 2002; Dağlıoğlu, Doğan, & Basit, 2017; Duran & Dağlıoğlu, 2017; Karadağ, Karabey, & Pfeiffer, 2016; Kroesbergen, van Hooijdonk, Van Viersen, Middel-Lalleman, & Reijnders, 2016; Miranda, Araújo, & Almeida, 2016; Pfeiffer & Petscher, 2008; Saranlı, 2017a; Saranlı, Sühendan, & Deniz, 2017).

It is among the goals of pre-school education to develop the skills of all children (Currie, 2001), however developing the skills of potentially gifted pre-school children is of significant importance with regard to developing the latent skills of such children and to ensure that their talents are used in the future. It is striking despite this importance that the number of applications in national and international literature is quite low. A recent study put forth that pre-school institutions do not have any official policy or applications for identifying or setting up learning environments for potentially gifted children in pre-school (Kettler, Oveross, & Bishop, 2017). It was also reported in the same study that educational institutions do not have an understanding of giftedness in early childhood and that the defenses set

forth by the National Association for Gifted Children in the United States for identifying and providing gifted education in early childhood are insufficient.

A similar situation is also valid for Turkey as well. There is no official application in Turkey for potentially gifted children during pre-school period. Even though it is asserted that such children should be first identified and should receive proper education in accordance with their performance in order to improve their already existing performances (Dağlıoğlu, 2004; Gormley, Phillips, & Gayer, 2008; Robinson, 2008; Saranlı, 2017b), there is no mention of a national application for the pre-school period. There is a need for experimental studies in order to put forth applications on a national basis. National programs may be organized with increasing number of proof based studies. In this study, the early intervention program based on project approach developed for gifted children in the pre-school period will be analyzed by way of an experimental study pattern.

#### *Education Approaches for Potentially Gifted Children in Pre-School*

Studies on early childhood period revealed the limited number of programs for potentially gifted children in pre-school education. Certain approaches are used for the education of potentially gifted children in pre-school despite the limited number of applications. It is stated in a program suited for the cognitive characteristics of potentially gifted children in early childhood education period that they should be provided with the chance to learn and apply knowledge in a faster, deeper and more complex manner than is required for their age. Acceleration approach is evaluated as a preference for this purpose (Walsh, 2014). The purpose of acceleration within the scope of gifted education is not to force gifted children to acquire more than they can succeed or to provide them with an advantage in comparison with average children. Acceleration aims to ensure that the development of gifted children is in accordance with their intellectual development and the speed at which they can learn (Colangelo, Assouline, & Gross, 2004).

Ability grouping is another approach preferred for pre-school gifted children in which children with similar intellectual abilities are brought together. With this approach, children come together at certain times of the day and work together (Pallas, Entwisle, Alexander, & Stluka, 1994; Jarosewich, 2001). Harrison (2004) asserts that gifted children should have the opportunity to meet with other gifted children in order to develop a healthy self instead of an inflated ego. It is indicated that providing opportunities to potentially gifted children in the pre-school period for working together for a whole day is actually a potentially effective intervention (Porter, 2005).

Integrated Thematic approach (Gould, Thorpe, & Weeks, 2001), Montessori education approach (Kaplan & Hertzog, 2016) and Project Based approach (Katz & Chard, 2000) are applied for potentially gifted children in the pre-school period. Harrison (2005) indicates that project based approach is especially beneficial for potentially gifted children in the preschool period.

All small children need intellectually stimulating environments simplified by the teacher which best blend the discovery initiated by the child. However, it is indicated that there is a need for developing application related problem solving skills especially for gifted children (Casa, Firmender, Gavin, & Carroll, 2017). Project studies and artistic activities enable children to think critically and creatively from different points of view (Kaplan & Hertzog, 2016). Hill-Anderson (2008) defends that it may be attained in potentially gifted children by way of projects. Project based approach was preferred in this study as an intervention approach since potentially gifted children participate actively in project studies during pre-school period (Davis & Rimm, 2004).

### ***Project Based Approach***

The project based approach put forth by Katz is comprised of studies carried out by teachers and children on preferred topics of study during the pre-school period. It is applied during a certain time interval in order to include the children in the study. It can be in the form of more comprehensive or smaller projects in weekly, daily or shorter time intervals (Katz & Chard, 2000).

Project based approach comprised of field trip studies, drama activities, research and presentation or exhibition stages enables the children to test their judgments experimentally, control their hypotheses with reality as well as analyze, evaluate and interpret the results (Katz & Chard, 2000). It supports the development of the skills of children such as organizing scientific processes, problem solving and analysis rather than direct teaching involving the direct transfer of scientific knowledge (Eggers, 2007).

It is thought that the intervention program developed in this study based on project based approach will support the educational needs of potentially gifted children in the pre-school period with discussion, field trip studies, drama activities, and research and presentation stages. It is indicated that potentially gifted children may face failure or even hide their abilities if their educational requirements are not met (Siegle & McCoach, 2005). Thus, there is a need for creative studies during the pre-school period for such studies in which they can carry out in-depth studies with cognitive processes.

Various studies have been carried out or are currently ongoing in Turkey for the individual, cognitive, emotional and social characteristics or requirements of potentially gifted children in the pre-school period (Alemdar, 2009; Alma, 2015; Bildiren, 2018a; Dağlıoğlu, 2002; Dağlıoğlu & Metin, 2002; Dağlıoğlu et al., 2017; Darga, 2010; Duran & Dağlıoğlu, 2017; Karadağ, 2015; Karadağ et al., 2016; Kurt, 2008; Saranlı, 2017a, 2017b; Saranlı et al., 2017; Selçuk-Bozkurt, 2007; Suveren, 2006; Yuvacı & Dağlıoğlu, 2016). However, there is a need for experimental studies in early intervention programs directed for potentially gifted children in the pre-school period.

The main problem of this study is examining the impact of the project based approach in early intervention program on the problem solving skills of children since no experimental intervention program was observed in the national literature for potentially gifted children in the pre-school period. The aim was to examine the impact of early intervention on potentially gifted children during the pre-school period. For this purpose, the study shall try to answer the question of whether the project based early intervention program is effective or not.

## **Method**

### ***Study Model***

The study was designed based on the pretest-posttest control group experimental model. Participants are assigned randomly in this model to experiment and control groups. Carrying out pretests for the groups prior to the experiment enables the determination of the degree of similarity. Measurements are made after the experiment and the results are arranged accordingly (Karasar, 2012).

Project based approach is the independent variable in the study, whereas the problem solving skills of potentially gifted children in the pre-school period is the dependent variable. The children continued their already ongoing programs at their respective education institutions while the experimental program was being applied by the researcher.

### ***Study Group***

Independent state kindergartens and private kindergartens with high student population in the city of Izmir were first determined while forming the study group. The reason for the requirement of high student population is the application of a three-stage identification. According to the intelligence test instructions used in the final stage, students in the 5% range are evaluated as potentially gifted. Therefore, it was aimed to have a large sample group for the identification stage since it is not easy to

be ranked in the top 5% of the intelligence norms. One state and one private kindergarten for the experimental group and similarly one state and one private kindergarten for the control group were determined by way of random assignment after determining the kindergartens with a large student population.

A 2 day and 4 hour long training was given by the researcher to the pre-school teachers at the selected kindergartens according to the characteristics of the potentially gifted children in the pre-school period. Afterwards, the Candidate Form prepared as part of the study was distributed to the teachers who were asked to evaluate and nominate potentially gifted children via this form. A total of 114 children with 54 from the experiment group and 60 from the control group were nominated by pre-school teachers. Understanding vocabulary test, sentences test and general information test from the verbal section of the Metropolitan Readiness Test were applied on these children in order to determine their verbal abilities. According to the results of this test, 62 children displayed a sufficient performance in the test (28 children in the control group, 34 children in the experiment group). Finally, the researcher applied Colored Progressive Matrices Test on these 62 children. According to the results of the application, 23 children from the experiment group, 21 children from the control group displayed superior performance in accordance with the norm study carried out on 640 children (Bildiren, Kargin, & Korkmaz, 2017). Of the children in the control group, 12 were female (%57.1), 9 were male (42.9). Whereas the experiment group was comprised of 23 children. Of the children in the experiment group, 7 were female (%30.4), 16 were male (%59.6). The age average of the children in the experiment group was 5.5, while the age average of the children in the control group was 5.6. Children identified in the experiment and control groups were in different classes. There were a total of 11 different classes in the state school in the experiment group and 3 different classes in the private school. Whereas there were 18 different classes in the state school in the control group and 3 classes in the private school. The children are educated at different classes. The children were taken from their respective classrooms during program application and gathered together at a different classroom where the application took place.

It was decided to apply the Colored Progressive Matrices Test for determining the cognitive abilities of potentially gifted children in the pre-school period which is a non-verbal cognitive test independent of culture. Walsh, Bowes, and Sweller (2017) carried out a study in which they applied the Peabody Picture Vocabulary Test-4 (PPVT-4) and the Colored Progressive Matrices test for determining the potentially gifted children during the pre-school period. Vocabulary test was preferred for verbal skills and Colored Progressive Matrices Test was used for cognitive skills. The purpose of our study and that of Walsh et al. (2017) was to evaluate the verbal and non-verbal abilities together. This identification model is suggested by many different researchers (Lohman, Korb, & Lakin, 2008; Mills, Ablard, & Brody, 1993; Porter, 2005). Hence, Metropolitan Readiness Test was applied for determining verbal performances.

#### ***Data Acquisition Tools***

Candidate Form, Metropolitan Readiness Test and Colored Progressive Matrices Test were applied for identifying potentially gifted children. The Scale for Problem Solving Skills was applied for determining the problem solving skills of children before and after the program.

#### ***Candidate Form***

Candidacy is the first stage for identifying gifted children. Children may be nominated during this stage by families, teachers or the children themselves (Bildiren, 2018b; Sak, 2017). Since teacher nominations are frequently used in literature (McWilliam, 2005; Sak, 2017) it was decided to use teacher nominations. For this purpose, a national and international literature survey was carried out as a result of which a candidate form was prepared based on the characteristics of gifted children in the pre-school period. The prepared candidate form was presented for expert opinion and a form comprised of 14 items was developed based on the opinions of experts.



The candidate form is comprised of 14 items and two factors. It was determined that the factor load values of the items in the first factor varied between 0.611 and 0.811, those of the second factor varied between 0.553 and 0.843. KR-20 reliability coefficient was determined as 0.88 for the first factor of the form and as 0.87 for the second factor. The total KR-20 reliability coefficient for the form was determined as 0.92.

#### *Colored Progressive Matrices Test (RPM)*

Colored Progressive Matrices Test is a non-verbal test applied to evaluate the cognitive processes of children in pre-school and elementary school periods which is comprised of 3 different sets with 12 problems in each. The test provides an opportunity to develop the consistent thought structure of the child and thereby enables cognitive performance evaluation (Raven, Raven, & Court, 1998). Since a norm study has not been carried out in Turkey, the researcher carried out a reliability and validity study on 640 children between the 48-60 month age group from 15 different kindergartens in the city of Izmir as a norm study (Bildiren et al., 2017).

Firstly, item difficulty levels for the A section, AB section and B section of the RPM Test were examined according to six month periods in calendar ages and it was determined that the correct answer percentage proceeded from difficult to easy between the age groups in accordance with age. RPM test-retest was applied to the sample group with a one month interval (n=54). A statistically significant relationship was determined between the RPM test total test and test-retest results ( $r=0.55$ ,  $p<.01$ ). A statistically significant relationship was not determined between the RPM scores and gender according to the t-Test results carried out for testing whether the RPM scores vary with gender or not [ $t(638)=10$ ,  $p>.01$ ] (Bildiren et al., 2017).

**Table 1.** ANOVE Results for the RPM Scores According to Calendar Ages

	Source of variance	Sum of squares	sd	Average of squares	F	p	Significant Difference
<b>Section A</b>	Intergroup	29.89	2	14.945	11.427	.000	4.9-5.2-5.3-5.8
	Within Groups	833.13	637	1.308			4.9-5.2-5.9-6.2
	Total	863.02	639				5.3-5.8-4.9-5.2 5.9-6.2-4.9-5.2
<b>Section AB</b>	Intergroup	107.88	2	53.941	15.905	.000	4.9-5.2-5.9-6.2
	Within Groups	2160.36	637	3.391			5.3-5.8-5.9-6.2
	Total	2268.24	639				5.9-6.2-4.9-5.2 5.9-6.2-5.3-5.8
<b>Section B</b>	Intergroup	00	2	65.476	27.872	.000	4.9-5.2-5.3-5.8
	Within Groups	00	637	2.349			4.9-5.2-5.9-6.2
	Total	00	639				5.3-5.8-4.9-5.2 5.3-5.8-5.9-6.2 5.9-6.2-4.9-5.2 5.9-6.2-5.3-5.8
<b>Whole Test</b>	Intergroup	0	2	369.256	31.940	.000	4.9-5.2-5.3-5.8
	Within Groups	0	637	11.561			4.9-5.2-5.9-6.2
	Total	0	639				5.3-5.8-4.9-5.2 5.3-5.8-5.9-6.2 5.9-6.2-4.9-5.2 5.9-6.2-5.3-5.8

It was determined according to the analysis results that there is a statistically significant difference between the RPM test total scores subject to calendar ages and that the scores vary with age [ $F(2-637)=31.94$   $p<.01$ ] (Bildiren et al., 2017).

**Table 2.** Correlations of RPM Test Scores Between Sections A, AB and B

	<b>A</b>	<b>AB</b>	<b>B</b>
<b>A</b>	1	.35**	.30**
<b>AB</b>	.35**	1	.42**
<b>B</b>	.30**	.42**	1

\*\* p < 0.01

As can be seen from Table 2, there is a statistically significant relationship between the results of Section A and Section B of the RPM Test ( $r=0.35$ ,  $p<.01$ ) and Section B ( $r=0.30$ ,  $p<.01$ ). There is also a statistically significant relationship between the RPM Test Section AB and Section B results ( $r=0.42$ ,  $p<.01$ ) (Bildiren et al., 2017).

Bender test RPM test validity study was applied on 56 children and a statistically significant relationship was determined between the RPM total test scores and Bender test scores ( $r=0.70$ ,  $p<.01$ ). WISC-R test was applied on 30 children aged 72 months and a moderate relationship was determined between the WISC-R test and RPM Test ( $r=0.62$ ,  $p<.01$ ). TONI-3 test was also applied on 30 children for the same purpose and a statistically significant relationship at a high level was determined between the TONI-3 test and RPM test ( $r=0.834$ ,  $p<.01$ ) (Bildiren et al., 2017).

### **TONI-3**

It is a non-verbal intelligence test developed by Brown, Sherbenou and Johnsen (1997) comprised of A and B parallel forms with 45 items. Norm study for the 6-11 age group was carried out by Korkmaz et al. (2012). According to the internal consistency reliability analyses for the TONI-3 test, KR-20 coefficient was determined to vary between 0.86 and 0.95 for the A Form and between 0.90 and 0.93 for the B Form, the test-retest reliability coefficient was determined as  $r= 0.63$  for the A Form and as  $r= 0.72$  ( $n= 117$ ,  $p<.01$ ) for the B Form. A relationship level of 0.79 was determined between the Standard Progressive Matrices Test and TONI-3 A form within the scope of criteria related validity, while the relationship level was 0.82 for the B form.

### **Bender-Gestalt Test of Visual Motor Perception**

The Bender Test used for predicting visual motor development and related memory, time and space concept, organization skill was developed by Wertheimer. Bender Test can also be used as an intelligence test (Yalın & Sonuvar, 1987). Standardization study was carried out on 701 children. Test-retest reliability was determined to vary between .80 .73 .81 according to age (Somer ,1988; Yalın & Sonuvar 1987).

### **WISC-R (Wechler Intelligence Scale for Children)**

WISC-R which is an intelligence test applied individually as verbal and performance test is comprised of 12 sub-tests. Turkey norm study was applied on 1638 students with the standardization carried out by Savaşır and Şahin. Reliability coefficient for the verbal intelligence section was determined as .98, for the performance intelligence section as .98, and for the total intelligence section as .98. The relationships between the sub-tests of WISC-R were calculated for construct as a result of which it was observed that the values vary between .51 and .86 (Öner, 1997).

### **Metropolitan Readiness Test**

Metropolitan Readiness Test was designed by Hildreth, Griffiths and McGauvran (1965) for analyzing the success levels of children who have completed the pre-school period and will start the 1<sup>st</sup> grade of elementary school. The test was adopted into Turkish by Oktay (1980). The correlations between the parallel forms of the test were analyzed and the reliability coefficients were observed to vary between .53 - .83 (Öner, 1997).

### ***The Scale for Problem Solving Skills (SPSS)***

It is a scale developed by Aydođan, Ömerođlu, Büyüköztürk, and Özyürek (2012) within the scope of a TUBITAK project for determining the problem solving skills of children in the pre-school and elementary school periods. It is comprised of 50+2 sample questions. The KR-20 coefficient calculated for the internal consistency of SPSS scores was determined as .81 and the test-retest reliability value was determined as .75 (Aydođan et.al., 2012). Scales of the exploratory factor analysis carried out for the validity study of the scale indicated that the load value varied between .39 and .72.

### ***Program Preparation***

Early intervention programs in literature were examined prior to preparing the program. Individualized programs were determined which were focused on functionality, self, creativity and task commitment, on academic success and school adjustment, on reading and mathematics, on self, creativity and verbal skills, on enrichment, on enrichment in ability groups and on analytical, creative and practical abilities (Jolly & Ketler, 2008). The common feature of these programs was determined as transforming the performance into a product and focus on creativity.

After it was decided that the program would be project based, the acquisitions for potentially gifted children were determined from among those that are already present among the Ministry of Education pre-school acquisitions and additional acquisitions were included. All stages of project based approach, general characteristics of potentially gifted children in the pre-school period and environmental conditions were taken into consideration when forming the program. The program was presented for expert review after which it was finalized accordingly.

The project based early intervention program includes Science-Nature, Turkish, Mathematics, Game, Drama, Literacy Preparation and Musical Activities. Four different project topics were determined. The first was Planets, the second Fossils, the third Scientists and the final project was determined as Different Cultures. Each project was applied for 3 weeks as 4 hours per week. The whole program application lasted 48 hours.

### ***Program Application***

Following the PBCÖ test application, the intervention program was applied on the experiment group during the dates of December 14, 2015-March 18, 2016 by the researcher and a pre-school teacher appointed at the schools. The teachers who provided support to the researcher at the state school and the private school received a total of 16 hours training with 4 hours in 4 days on the characteristics of gifted children, their instruction and project based approach. The children in the control group continued their regular applications at their schools while the intervention program was being applied on the children in the experiment group. Since the identified children were in different classes, those in the experiment group were taken from their classrooms and the program application was carried out after classifying them in the special education classroom in the kindergarten. Speech and discussion, field trip studies, drama activities, research and presentation or exhibition stages were included in all project studies.

### ***Data Analysis***

It was observed as a result of the Shapiro Wilks normality test carried out for understanding whether the experiment and control group SPSS data fit the normal distribution or not; the fact that both the control group level of significance (0,096) and the experiment group level of significance (0,463) are higher than 0,05 has indicated that the distribution of the total scores does not differ from the normal distribution at a statistically significant level (George & Mallery, 2001). Moreover, the coefficient of skewness of the control group was determined as “-.320”, while the coefficient of skewness of the experiment group was determined as “.263”. According to the acquired data, it is possible to state that the scores have a normal distribution. T-test was used for the pre-test and post-test analyses of the SPSS experiment and control group scores since normal distribution of data in comparative tests has been determined as a pre-condition for the t-test (Büyüköztürk, 2009).



## Results

In this section, the results for the experiment and control groups acquired before and after the intervention program have been tabulated which are then discussed in the next section.

**Table 3.** Control and Experiment Group SPSS Pretest Average Scores t-Test Results

Measurement (SPSS)	N	X	S	sd	t	p
Control Group	21	32.66	5.10	20	.10	.920
Experiment Group	23	32.52	3.98			

It can be understood upon examining Table 3 that there is no statistically significant difference between the SPSS pre-test average scores of the control and experiment groups [ $t(20)=.10$ ,  $p>.01$ ] and that the PBCÖ total pre-test scores of the potentially gifted children in the experiment and control groups are close to each other.

**Table 4.** t-Test Results for the Experiment Group SPSS Pre-test and Post-Test Score Averages

Measurement (SPSS)	N	X	S	sd	t	p
Pretest	23	32.52	3.91	22	-6.67	.000
Post-test	23	40.65	8.07			

The PBCÖ score average for the potentially gifted children in the pre-school period was  $X=32.52$  before the experiment and  $X=40.65$  after the experiment. A statistically significant difference was determined between the pre-test and post-test scores of the experiment group [ $t(22)=-6.67$ ,  $p<.00$ ]. Accordingly, it can be stated that the early intervention program has an impact on improving the problem solving skills of potentially gifted children (Table 4).

**Table 5.** t-Test Results for SPSS Pre-test and Post-Test Average Scores of the Control Group

Measurement (SPSS)	N	X	S	sd	t	p
Pretest	21	32.66	5.10	20	-1.26	.220
Post-test	21	33.66	5.20			

As can be understood from Table 5, no statistically significant difference was observed between the PBCÖ pre-test and post-test scores of the control group [ $t(20)=-1.26$ ,  $p>.00$ ]. Accordingly, it can be stated that the routine programs of the children in the control group have no impact on improving the problem solving skills.

**Table 6.** t-Test Results for the SPSS Post-test Score Averages of the Control and Experiment Groups

Measurement (SPSS)	N	X	S	sd	t	p
Control Group	21	33.66	5.20	20	-3.76	.001
Experiment Group	23	40.65	8.07			

The PBCÖ post-test score average of the children in the experiment group after the application was  $X=40.65$ , whereas the PBCÖ score average for the children in the control group was  $X=33.66$ . A statistically significant difference was observed between the PBCÖ post-test scores of potentially gifted children in the experiment and control groups [ $t(21)=-3.76$ ,  $p<.01$ ]. This result indicates that the early intervention program has an impact on the problem solving skills of potentially gifted children during the pre-school period (Table 6).

**Table 7.** t-Test Results for the Experiment Group SPSS Post-test and Permanence Test Score Averages

Measurement (SPSS)	N	X	S	sd	t	p
Pretest	23	40.65	8.07	23	-1.89	.071
Post-test	23	41.04	7.55			

PBÇÖ was applied again on the experiment group 4 weeks later in order to understand whether the impact of the program is ongoing or not. The score average of the children after the experiment was 40.65 and the permanence test score average was 41.04. No statistically significant difference was observed between the PBÇÖ post-test and permanence test scores of the potentially gifted children in the experiment group [ $t(23)=-1.89, p>.01$ ]. This result indicates that the early intervention program has made a permanent impact on the problem solving skills of potentially gifted children in the pre-school period and that the impact of the application is still ongoing. Following the testing of this impact, the program applied after the project based early intervention program was transferred to the teachers in the control group schools and the activities were applied by the teachers in the classrooms of potentially gifted children.

### Discussion, Conclusion and Suggestions

The purpose of this study was to examine the impact of the early intervention program applied on potentially gifted children as a result of which it was determined that the improves the problem solving skills of potentially gifted children. The impact of early intervention on potentially gifted children has been put forth in many studies. Similar results have been observed in majority of the studies even though different interventions have been preferred.

Robinson, Adelson, Kidd, and Cunningham, (2018) applied early intervention program in the field of engineering on potentially gifted children at a low socio-economic level. Starting level STEM (Science, Technology, Engineering and Mathematics) project program with a focus on problem solving was applied during the study on 1387 children from 62 different schools. An effective increase was observed in engineering abilities in the intervention group after the program. Moreover, the intervention group displayed a high level of participation in engineering studies. Walsh and Kemp (2012) applied an intervention program with a single subject pattern on potentially gifted children in the pre-school period. Peabody Picture Vocabulary Test and Colored Progressive Matrices Test were applied for determining the subjects. It was determined during the early intervention program that potentially gifted children in the pre-school period were able to answer advanced thinking questions and that they were even able to be successful in complex and challenging questions. Similarly, Wash (2014) carried out an early intervention program involving the reading of a story book with gifted children in the pre-school period identified via Peabody Picture Vocabulary Test and Colored Progressive Matrices Test as a result of which it was determined that asking advanced level questions improved the use of complex language structures in addition to improving the problem solving skills in three out of five children. Questions were asked to the children for higher order thinking skills during the project based early intervention program and they were given the opportunity for research in order to answer these questions. It can be indicated that providing extensive opportunities has a positive impact on the problem solving skills of children.

Casa et.al., (2017) applied an early intervention program related with the difficult concepts of geometry and measurement focused on the pre-school period. An advanced training based on practice was applied on 217 experiment group and 197 control group children during this experimental pattern study carried out in 11 different kindergartens. It was observed that the performance of the experiment group especially on open-ended questions increased significantly after the intervention. Casa et.al. (2017) primarily suggests a difficult curriculum environment during the pre-school period for potentially gifted children. The enrichment and differentiation of the

environment for potentially gifted children has a positive impact on the development of the abilities of such children. Robinson et al. (2002) set forth that displaying performance is related with the education environment and applications. In this study, above peer level stimulants were presented to the children during each project with discussions, field trip studies or researches and thus the education environment was differentiated. It leads us to think that presenting a wide range of stimulants may have increased the effectiveness of the program.

Different intervention programs for potentially gifted children support the findings of this study. Robinson, Abbott, Berninger, Busse, and Mukhopadhyay (1997) determined a significant level of impact in both quantitative and verbal factors after the program. The non-verbal and verbal abilities of potentially gifted children during the pre-school period along with their academic success increased following the intervention applied by Hodge and Kemp (2000). Similarly, Aljughaiman and Ayoub (2012) applied an early intervention program as a result of which it was observed that the analytical and creative abilities of potentially gifted children increased. Early intervention results put forth an impact that is similar with these findings. It can be stated that the impact of this study is similar with those of other intervention programs since the children carried out brain storming activities throughout the program, devised creative and different solutions in an environment where their ideas were supported by both the implementer and their friends in the ability group, that they carried out trial-error studies to test their hypotheses, designed and presented products.

It is apparent that Project Based Approach has a positive impact on normal developing children. In this study, a different application in comparison with that used for children with normal development was used intended for thinking differently, questioning, analytical and creative thinking. A field trip was organized to the Planetarium within the scope of the planet project. The experts at the Planetarium made a presentation to the children and answered their questions. The children found answers to their questions on the Universe and the Solar System while also receiving explanations from the experts that enable them to think analytically. Activities were carried out in the kindergarten using the Solar System model intended for making them question. Similarly, they designed solar system models. They were asked to imagine a space trip as part of a project for creativity and a planet discovery activity was arranged. They designed different living things after the discovery. They organized a trip to the Ege University Museum of Nature as part of the fossil project and received the support of experts. The children made contact with the experts and received information on fossils. The children were also able to examine fossils in detail. The children designed fossils in the classrooms. They asked questions and carried out discussions on fossils during the activities. The designed fossil samples were buried after which fossil excavation activities were conducted. Experiments were carried out followed by related discussions during the Scientist project. A researcher from the university was invited as a guest speaker. The guest researcher gave information to the children on the studies carried out at the research departments in universities and explained how scientists work. Questions were determined in the kindergarten together with the children which they can ask their peers. They determined research topics such as, "Which is your favorite cartoon character?". They made estimations on the possible outcomes of this study prior to starting the research. They prepared survey sheets with pictures to collect the answers to the question. The children asked the questions to the children in the kindergarten who are not in the experiment group and marked their responses on the survey sheets. Afterwards, the results were entered on the related tables and interpreted the results together. All studies carried out as part of the projects were presented to their peers or their families. The children made up problems in each stage of these activities and devised means to solve the problems. Diffily and Sassman, (2002) and Laminack and Lawing (1994) argue that project based approach increases the abilities of children to transfer knowledge, generate new information while also improving their problem solving skills since they put forth new products at the end of the process. Kogan (2003) and Mettas and Constantinou (2007) determined that the problem solving skills of children are increased after project based training.

The children participated in the research study during the project based early intervention program with their own free will and stated their opinions. Thus, they solved the problem based on their own experiences.

It was observed during the project applications that the level of knowledge of the children is higher in comparison with other children. For example, it was observed during the study on the solar system that majority of the children knew about the satellites of the planet Saturn. It is thought that bringing together the children with such a performance at certain times during the week for a group study will be beneficial. Relevant literature also supports bringing together gifted children with similar performances. It is expressed that ability groups are beneficial since they allow for in-depth learning while also providing an environment for advanced level of knowledge and skills (Jarosewich,2001; Walsh, 2014). McCoach, O'Connell, Levitt, and Reis (2006) formed skill groups in the kindergarten and indicated that it is effective on the early literacy skill of children. Morgan (2007) applied an early intervention program on potentially gifted children in their skill groups and put forth that the children participated more actively in the activities and that the teachers who took part approved of the application. In this study, activities were carried out for identifying potentially gifted children in the pre-school period as well as teaching activities in their respective skill groups. Children with similar cognitive performance were included in a creative research process by way of project applications. This process is thought to have a positive impact on the development of children in the experiment group.

Observations were carried out for 1 week in the classrooms of potentially gifted children in the experiment and control groups prior to applying the intervention program. It can be indicated based on the observation results that potentially gifted children do not receive an education that suits their capacities and characteristics. The fact that children in the control group are subject to activities such as cutting, painting and sticking which do not force their performance lead us to think that the problem solving skills handled in the study do not effectively support the problem solving skills. The display of the already existing performance is related with the education environment provided to the children (Sak,2017). It has been put forth by many different studies that gifted children may tend to hide their abilities in order to adopt to the other children and thus be unsuccessful if they are not identified at an early age and do not receive a proper education related with their needs (Harrison, 2005; Siegle & McCoach, 2005). Neihart and Olenchak (2002) report that the gifted children lose their motivations and get bored when they receive continuing education during the pre-school period together with children with average abilities. Conversations were carried out with the children in the control group during the post-test studies and majority of the children stated that they are bored at school. In this regard, it seems possible that children with a high performance in the pre-school period may contribute more actively to the programs by way of methods such as discussion, research, trial-error, drama and presentation etc. based on their performance levels. The inclusion of such processes in project based approach may increase the participation of potentially gifted children in the pre-school period.

Early intervention programs applied on potentially gifted children in the pre-school period not only improves their certain skills but may also decrease the impact of negative factors such as growing up in an inadequate environment. Little, Adelson, Kearney, Cash, and O'Brien (2018) applied an early intervention program for mathematics education on potentially gifted children from low socio-economic income levels during the summer school as a result of which it was determined that the mathematic skills of the children increased. The intervention program was focused on providing support to small children with high academic development potential during the pre-school period. Accordingly, it is thought that project based approach can make a significant contribution in terms of enriching the lives of potentially gifted children from low socio-economic income levels during the pre-school period.

The study was designed with potentially gifted children in mind and an early intervention program was applied on such children. There are certain limitations that affect the study. The identification process for potentially gifted children in the pre-school period is limited with Candidate Form, Metropolitan Readiness Test and Colored Progressive Matrices Test. At this point, it may be suggested to develop verbal and non-verbal tests for measuring the cognitive processes of children during the pre-school period. The study is limited with an education program of 48 hours. It may be suggested to apply programs with different approaches on potentially gifted children. The impacts of project based early intervention program on different abilities may be tested. The impacts of both project based approach or other approaches on potentially gifted children and children with typical development may be examined comparatively. The impacts of early intervention programs may be examined via longitudinal studies.



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