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Analysis of the Effects of Project-Based Education on the Visual Perceptions of Five-Year-Old Children (60 -72 Months) *

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Abstract

The current study aimed to identify whether the project-based approach affects the visual perception skills of five-year-old preschool children (60-72 months). The universe of the study was constituted of five-year-old (60-72 months) children enrolled in preschools affiliated with the Turkish Ministry of National Education in the provincial centre of Kayseri during the 2012-2013 academic year. The study was performed using a control group, pretest-posttest and retention test study design. The study was conducted in two preschools selected through the simple random sampling method, and with one class selected from each one of these kindergartens. 22 children in these classes formed the study group, while 22 children formed the control group. Children in the control group continued their normal education, while children in the study group took part in a project work that lasted for 41 days, and which they performed for three hours a day. A general information form and the Motor-Free Visual Perception Test 3 (MVPT-3) developed by Colarusso and Hammill (2003) – the reliability and validity study for which was performed by Metin (2014) – were used as data collection tools in the study. The obtained data were analyzed using covariance analysis (ANCOVA) and ANOVA. The study results indicated that the project-based approach led to a significant difference ($p<0.001$) between the groups in terms of visual perception skill levels, with the study group exhibiting a higher level of visual perception.The study results also showed that the difference between the mean scores for the post-test and retention test was not significant ($p>0.05$) for children in the study group, thus indicating that the education provided to the study group had a lasting and continuous effect.

Keywords

Project approach

Project-based education

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Introduction

Project-based education, which is certainly not a new or recent concept, constitutes one of the central elements of the progressive education movement. Project-based education, which has been implemented in many preschool education institutions in the United Kingdom between 1960 and 1970, was once again revisited in Katz and Chard's work entitled "Engaging Children's Mind:The Project Approach," in 1989 and drew significant attention with practices based on Reggio Emillia's approach (Helm & Katz, 2016). The project-based education is an approach centering on the child in which children are, either on their own or together with their group or entire classroom, required to answer questions relating to a particular subject that is deemed to be worth learning. This approach also relies on experience and research (Capraro & Slough, 2009; Demirel, 2003; Helm, 2015; Helm & Katz, 2016; Katz, Chard, & Kogan, 2014; Newell, 2003; Sargent, 2011; Thode, 1997). Katz et al. (2014, p. 9) describes that the project-based approach aims to support and promote the lively and developing minds of children, and that the word mind in this context refers not only to knowledge, concepts, skills, and learning, but also to social, emotional, ethical and esthetic understanding and sensitivity. Project-based education supports the social and emotional development of children, while the success they achieve during the project helps reinforce a positive sense of self. In addition, project-based education also develops the independence, knowledge and thinking skills children need for lifelong learning, and enhances their existing skills (Beneke & Ostrosky, 2009; Katz & Chard, 1998; Jacobs, 2012; Sargent, 2011). Beneke and Ostrosky (2009), Cohen and Uhry (2007), Dickinson (2001), and Donegan, Hang, Trepainer-Street, and Finkelstein (2005), Hertzog (2007) stated in their studies that the project work contributes positively to children's social development and academic achievements, while Bowman, Donovan and Burns (2001), and Gallick (2000) revealed that project work enhances the quality of their social interaction. Bezrukikh and Terebova (2009) also noted that the project-based approach is effective in guiding and controlling the behavior of children. Güven, Zembat, and Şahin (2003), Kurt (2007), Oğuz (2012) stated that the project work supports children's cognitive skills; Dresden and Lee (2011), and Wilson (2001) stated that the project work makes a positive contribution to children's language development, while Yıldız Bıçakçı (2009) stated that it supports all areas of development of children. Project-based education is also believed to be important in promoting visual perception which is one of the important skills guiding the child in every area throughout his/her life and which should be developed in early years.

Visual perception is the perception of what is seen with the eye depending on the reception and interpretation of visual stimuli, and has a broad meaning that is on the same axis as cognitive function (Brown & Elliott, 2011; Grieve & Gnanasekaran, 2008; Ho, Chung, & Lin, 2012; Lai, 2012; Muinos-Duran et al., 2009; Wagemans et al., 2012). Visual perception is process requiring different types of skills such as the perception and coding of an object, and analysis of the characteristics of an object through recognition, evaluation and decision-making (Akdemir, 2006; Bezrukikh & Terebova, 2009; Bruce, Green, & Georgeson, 2010; Kurtz, 2006; Mercier, Desrosiers, Hebert, Rochette, & Dubois, 2001; Poon, Li-Tsang, Weiss, & Rosenblum, 2010). Visual perception is generally defined as the sum of processes that begin with a perceptual process transmitted from the visual process fields of the brain and continue successively. This process is followed firstly by the classification of the perceptual output, then by the decision-making process, namely the interpretation and organization of information and then post perception, and the organism acts in light of these processes (Bruce et al., 2010; Radel & Clement-Guillotin, 2012; Reum-Han, Kim, Yang, & Pyun, 2014). Nearly 80% of the information reaching the brain is acquired through sight, which has a more dominant position compared to the other human senses. Farroni and Menon (2008) stated that an important portion of the cerebral cortex is mainly reserved for visual processing, that seeing enables obtaining information about the environment without the need for senses that involve touch, taste, and smell and that its importance predominates every aspect of daily life. Akaroğlu and Dereli (2012) describe that visual perception develops rapidly in early childhood, and that all visual perception skills are fully developed by the time a child reaches nine years of age.

There are many studies stating that visual perception that plays a significant role in child's development and adaptation to life has an effect on daily life skills, academic skills such as reading, writing and mathematics, and learning. Colarusso and Hammill (2003), Brown (2008), and Gabbard (2012) stated that daily life skills depend on visual perceptual abilities. Visual perception forms a basis for an individual's perception of spatial location and self-positioning in space, and many of the routine daily skills such as walking, eating, dressing and the like required to be used by an individual at a simple level. It is described that visual perception has an effect on skills such as writing speed, copying words correctly, spacing words and letters properly, writing, drawing and the like (Akaroğlu & Dereli, 2012; Barnhardt, Borsting, Deland, Pham, & Vu, 2005; Christian, 2010; Fletcher, 1997; Gabbard, 2012; Tseng & Chow, 2000). Barnhardt et al. (2005), Christian (2010), Kurtz (2006), Sortor and Kulp (2003) stated in their studies that visual perception has an effect on reading mathematical expressions, writing and understanding mathematical symbols properly, recognizing geometrical figures, arranging numbers in order, and organizing and solving mathematical problems.

Visual perception assumes an important place in the life of individuals, playing a significant role in their interactions with the world, and showing rapid development during childhood years. Consequently, visual perception problems negatively affect the ability of individuals to interact safely and effectively with the surrounding world (Christian, 2010). Visual perceptual deficits in childhood can negatively impact children's writing and drawing skills, which require manual abilities, as well as their math and reading-writing skills (Akaroğlu & Dereli, 2012; Çağatay, 1985). These problems that first manifest themselves in childhood with the inability to recognize geometric shapes, the tendency to mix figure with background, and the difficulty in changing and orienting objects may later cause difficulties in reading letters and words, and thus seriously affect the children's learning process. In addition to their adverse effect on academic skills, visual perception problems also have a negative effect on children's basic life skills, such as their ability to control or manage their behaviours, use a phone, find objects, dress up, undress, eat, climb stairs, leap, run, climb and ride a bicycle (Akdemir, 2006; Bernspang, Viitamen, & Eriksson, 1989; Brown & Elliott, 2011; Dankert, Davies, & Gavin, 2003; Gabbard, 2012; Sanghavi & Kelkar, 2005). In addition, visual perception deficiencies can also cause language problems (Bezrukikh & Terebova, 2009) or difficulties in learning (Tekok-Kılıç, Elmastaş-Dikeç, & Can, 2010).

Many researchers have demonstrated that activities supporting the development of visual perception starting in pre-school years contribute positively to the reading-writing, math and basic living skills of children in their later years (Bezrukikh & Terebova, 2009; Brown & Elliott, 2008; Colarusso & Hammill, 2003; Gabbard, 2012; Memiş & Harmankaya, 2012; Poon et al., 2010; Sağol, 1998). There are only a limited number of studies in which the project approach is applied to the development of visual perception, which plays a significant role in the development of children. In these studies using the project approach, it was determined that this approach influenced all areas of development of children (Yıldız Bıçakçı, 2009; Dixon, 2001), supported the development of cognitive skills in children (Helm & Gronlund, 2000; Oğuz, 2012), and contributed to the visual discrimination (Dizman Özaslan, 2010) and figure-ground constancy as a subfield of visual perception (Temel, Çiftçibaşı, & Ünal, 2003). Studies focusing on improving visual perception – an ability that begins to develop at an early age – will help children acquire and develop many basic skills that are essential for life (Akaroğlu, 2014; Brown & Elliott, 2011; Luoa, Chena, Deaconb, Zhangc, & Yind, 2013; Hacısalihoğlu-Karadeniz, 2015; Ho et al., 2012; Memiş & Harmankaya 2012; Poon et al., 2010; Sağol 1998). This context, project-based education is an approach that relies on observation, examination and investigation, and which is based on giving children the opportunity to learn through their own experiences and to make active use of all their skills. As such, it is expected that this approach will contribute significantly to promoting visual perception. Based on this idea, this study aimed to identify the effect of project-based education on the visual perception of five-year old children.

Materials and Methods

The aim of this study was to determine whether project-based education led to any changes in the visual perception of children of five years of age (60-72 months).

Design of the Study

In this study, 2x3 mixed experimental design was used to determine the effect of project-based education on the visual perception skills of children of five years of age (60-72 months). In split-plot factorial designs (a type of mixed design), there were at least two variables whose effect on the dependent variable is examined, one of them representing the distinct experimental conditions formed by the unbiased groups, and the other representing the repeated measurements (pre-test - post-test – retention test) of the subjects at different time points (Büyüköztürk, 2013). In the present study, the dependent variable was the visual perception skills of five-year-old (60-72 months) children, while the independent variable was the "Project-Based Education Program," the effects of which were examined on the visual perception skills of children.

Study Group

Eight independent kindergartens affiliated with the Ministry of Education in the city centre of Kayseri constituted the universe of the study. Among these schools, two were selected using the random sampling method, and one class was then selected from each school using this same method. From the selected classes, an experimental group of 22 children with 10 girls and 12 boys and a control group of 22 children with 12 girls and 10 boys were formed to obtain a study group of 44 children. Forty-five point five percent of the children in the experimental group were female, 54.5% were male, 54.5% were the only child in their family, and 90.1% had not received pre-school education previously; while in the control group, 54.5% were female, 45.5% were male, 45.4% came from two children families and 86.9% had not received pre-school education previously. The majority of the parents of the children included in the study were between 25-35 years of age (experiment group: mothers: 72.7%, fathers: 77.2%; control group: mothers: 50.0%, fathers: 54.6%). The majority of the mothers of children in the experiment and control groups were primary school graduates (experiment group: 46.0%; control group: 50.0%), while the fathers were secondary school graduates (experiment group: 68.8%; control group: 45.4%). And concerning the employment status of the mothers and fathers, it was observed that the majority of the mothers were not working (experimental: 95.1%; control: 90.7%), while all the fathers were employed.

Data Collection Tools

A "General Information Form" was developed to obtain information on the children and their families. The Motor-Free Visual Perception Test 3- MVPT-3 developed by Colarusso and Hammill (2003) with the aim of evaluating the visual perception skills of children, and for which a validity and reliability test for 5-year-old Turkish children was conducted by Metin and Aral (2014) was also used, along with a semi-structured "Family Observation Form" developed by researchers to monitor the changes exhibited by the children throughout the project.

The General Information Form consists of five questions about the age and gender of the children and the age, their educational status, the employment status of their parents, and on whether the child has received any pre-school education before.

The Motor-Free Visual Perception Test was first developed in 1972 by Colarusso and Hammill is a scale which assesses visual perception without requiring any motor skill-related evaluations. The first scale consisted of 36-items that assess the visual perception of children aged between four years and eleven years eleven months. The Motor-Free Visual Perception Test was reviewed in 1996 to create a new version (Motor-Free Visual Perception Test-Review, MVPT-R) with 36 items that are applicable for all persons between 4 and 55 years of age. The scale was reviewed once again by Colarusso and Hamill (2003). In the Motor-Free Visual Perception Test-3, the applicable age range was broaden to include all persons from the age of 4 to 95, while the number of items were increased to 65, and a response time test was also introduced (Metin & Aral, 2014).

The Motor-Free Visual Perception Test-3 (MVPT-3) was designed by taking into account the difficulties encountered by scale requiring motor skills, and to allow the rapid assessment of visual perception. It includes seven sub-fields on visual perception skills, which are visual discrimination, shape forming, visual memory, visual proximity, visual discrimination, spatial location, and form and background perception. Although the scale contains items for each sub-field, it does not give individuals scores for each sub-field, providing instead a total visual perception score. The first 40 items of this 65-item scale are administered to children between the ages of 4 and 11, while items number 14 to 65 are administered to all individuals aged 11 and above. The administration of the scale takes about 15 to 20 minutes, and does not require any motor skills since the implementer asks the respondent to show or mark one of the shapes shown in each item. By subtracting the obtained wrong answers from the correct answers in the scoring of the test, the raw score is obtained, which is then calculated as a percentage (Brown & Elliott, 2011; Christian, 2010; Colarusso & Hammill, 2003; Geldof, Van Wassenaer, De Kieviet, Kok, & Oosterlaan, 2012; Poon et al.,. 2010; Reum-Han et al., 2014).

The reliability and validity study for the MVPT-3 was performed by applying the scale to 2005 children and adults of various socio-economic and ethnic groups in 118 cities in 34 states and Alaska between 2001 and 2002. The reliability coefficient of the test was calculated as 0.69 and 0.87 for individuals aged 4-10 years and 0.86, and as 0.90 for 11 years and older. The test-retest method was used to examine the external consistency of the Motor-Free Visual Perception Test-3 (MVPT-3), in order to determine the test's reliability in terms of stability. After 34 days, the test was administered once again to 103 participants, and the reliability coefficient for the data set obtained from the subject's retest scores was 0.82 for ages 4-10 and 0.72 for 11 years and older (Christian, 2010; Colarusso, 2005; Colarusso & Hammill, 2003; Reum-Han et al., 2014). Metin and Aral (2014) previously conducted a study assessing the validity and reliability of the MVPT-3 for Turkish five-year-old children. The Cronbach Alpha value for the test scores was calculated as 0.85, while the Spearman Brown coefficient calculated using the test halving method was 0.80. The test-retest reliability coefficient of the Motor-Free Visual Perception Test-3 was 0.98, while the difficulty value of the items found in the test was found to vary between 0.26 and 0.95 and the average item difficulty was determined to be 0.61.

In the Family Observation Form, there are questions allowing families to record the changes and development they observe in their children within the period of one week. Questions included in the form are "What has your child told you about the project this week?", "What has your child asked you about the project this week?", and "What changes in your child and in your child's behaviours have you observed this week?" The answers to these questions were recorded by the families and sent to the researchers.

Data Collection Method

The data collection period of the study began after the necessary permissions were obtained from the Provincial Directorate of National Education of the Kayseri Governorship. Between 15 and 23 November 2012, in the first semester of the 2012-2013 academic year, personal information regarding the children in the experiment and control groups, as well as their parents, were obtained from their files and recorded onto the personal information form, and the MVPT-3 was administered to the children as a pretest. Before applying the study procedures, the teachers and parents of the children in the experiment group were trained about project-based education. To improve the level of interaction between the researcher and the children, the researcher periodically carried out in-class activities together with the classroom teacher, and also participated to the implementation of study-related activities. The project-based education program was applied by the researcher between November 2012 and January 2013 to the experiment group on a five days a week, three hours a day basis. In total, the program was applied for 41 days. Once the study procedures were completed, children in the experiment and control group completed the MVPT-3 once again and, to test whether their learning experience was lasting; a posttest administration of the MVPT-3 was repeated five weeks for the experiment group.

The Project-Based Education Program developed for supporting the visual perception of five year-old children (60-72 months) was, in accordance with aims and intended gains of the Education Program for Preschool Children Aged 36-72 Months (Anonymous, 2006), designed as an eight week program to be implemented on a five days a week, three hours a day (i.e. half-day) basis over a period of 41 days. The preparation of the program was finalized based on the views of seven subject experts (one specialising the education program development, two in preschool education and two in child development, while the remaining two were preschool teachers). The education program consisted of three projects, which were the Sugar Project (10 days), House Project (15 days), and Toys Project (16 days). The education activities were integrated into the regular preschool education program, and carried out by taking into account the different stages of the applied project-based approach.

Data Analysis

The Covariance analysis (ANCOVA) and ANOVA were used to determine whether receiving Project-Based Education led to any differences in the visual perception of the children participating to the study in the experiment and control groups. The former of these analysis methods was preferred because it reduces the error variance to ensure greater statistical power, and also due to the correlation between the control variable and the dependent variable (Büyüköztürk 2013).

Results and Discussion

An evaluation of the mean and standard deviation results obtained with the MVPT-3 for children in the experimental and control group's shows that the experiment group had a mean pretest score of 15.68 ± 2.51, while the control group had a mean pretest score of 15.27 ± 1.80. This indicated that the MVPT-3 pretest scores were not very different between the two groups. Considering the pre-test and post-test scores of children in the experimental and control groups, it was determined that the mean posttest score of the children in the experiment group was 27.00 ± 3.92, while the posttest score of the children in the control group was 20.68 ± 2.07. When the pretest scores of the groups were controlled, the adjusted posttest scores were determined as 26.04 for the experiment group, and 20.83 for the control group (Table 1). These results indicated that children in the experiment group receiving Project-Based Education had a higher visual perception score than children in the control group.

Table 1. The Mean Scores and Standard Deviation Results of Children in the Experiment and Control Groups Pertaining to the Motor-Free Visual Perception Test-3

	Pre-test		Post-test		Follow-up Test		Adj.Post-test
	M	**SD**	**M**	**SD**	**M**	**SD**	
Experimental	15.68	2.51	27.00	**3.92**	28.50	3.54	26.04
Control	15.27	1.80	20.68	2.07	_	_	20.83

Ho et al. (2012) in their study evaluating a computer version of the Motor-Free Visual Perception Test through a 10-hour training program implemented over a five day period, Ho et al. (2012) demonstrated that the training program had a positive effect on children's cognitive skills, which included their visual perception. Poon et al. 2010) stated that the computer games based on daily life skill topics such as supermarket, family, picnic, and school had an effect on the visual perception abilities of first grade students. Luoa et al. (2013) In their study involving the application of three different visual perception training programs to children aged four to six years with developmental delay, Luoa et al. (2013) determined that the multiple visual perceptual group education and had a more positive effect on children's visual perceptions than individual education and education on paper (Bezrukikh and Terebova, 2009). The study conducted by Şahin, Güven, and Yurdatapan (2011) demonstrating the effect of project-based education on preschool children, as well as the study of Engin (2015) demonstrating the effect of this approach on mothers' reasoning and cognitive stimulation behaviour, show a positive impact of the children's visual perception skills. It is seen in similar studies that project work that provides children with an opportunity for interaction with visual stimuli and in which children actively participate makes a positive impact on the visual perception skills of children.

An evaluation of Table 2 shows a significant difference was observed to exist between the post-test mean scores adjusted to the pre-test scores received by children in the experimental and control groups on the Motor-Free Visual Perception Test-3 [F (1.41) = 52.58, p < 0.001]. Results for the pretest, posttest and retention test scores (Table 3) indicated that the group and measurements factors had a significant combined effect on the test scores [(F(1-41)=203,92, p<.001)]. These results show that project-based education program had a positive effect on the visual perception of children in the experiment group. Beneke and Ostrosky (2009) stated in their study that project-based education enhances many of the existing skills the children have. The study of Helm (2015) involved a project on seeds conducted, which allowed the participating children to accurately draw seeds after observing them for 45 minutes. Katz et al. (2014) conducted a project on buses in which children made observations through the study, and shared their observations through artistic means. During project activities, children focus on a specific subject, perform observations in a continuous manner, and examine a particular topic, which gives them the opportunity to develop many skills, especially their visual perception skills. Josman, Abdullah, and Engel-Yenger (2006), and Yıldırım, Akman, and Alabay (2012) revealed that the Montessori and Mandala education in which children actively participate just as in project work and the environment in which social interaction is experienced positively contribute to the development of motor and visual perception skills.

Table 2. The ANCOVA Results Pertaining to the Post-Test Scores Adjusted to the Pre-Test Scores Received by Children in the Experimental and Control Groups on the Motor-Free Visual Perception Test-3

Sources of variance	SS	df	MS	F	p	Eta-Square
Pre-test	104.40	1	104.40	13.88	0.001	**0.253**
Group (Experimental-Control)	395.48	1	395.48	52.58	0.000	**0.562**
Error	308.37	41	7.52			
Total	851.88	43				

Table 3. ANOVA Results Pertaining to the Pre-Test, Post-Test, and Follow-Up Test Scores on the Motor-Free Visual Perception Test-3

Sources of variance	SS	df	MS	F	p	Eta-Square
Between Subjects	97.75	21	23.60			
Measurement	**2160.81**	**2**	**1080.40**	**203.92**	**0.000**	**0.90**
Error	222.51	42	5.29			
Total	2658.57	44				

Akaroğlu and Dereli (2012), Aral and Erturan (1999), Cengiz (2002), Demirci (2010), Gül Ercan and Aral (2011), Tuğrul, Aral, Erkan, and Etikan (2001), Koç (2002), Yıldırım et al. (2012) and Yücelyiğit (2014) previously conducted studies on the visual perception level of five-year-old children, where they determined that the education programs in these studies had a positive effect on the children' visual perception. Dizman Özaslan (2010) indicated that project-based education positively affected the visual perception required for the school readiness of children attending preschool. Katz (1999) carried out a Ball Project with four- and five-year-old, where he observed that the project gave children the opportunity to practice their examination, research, measurement, drawing, reading, narration, tabulation, reporting, analysis, hypothesis development, estimation, observation, and record-keeping skills, which are all skills that contribute significantly to the development of visual perception. Tepeli (2013) determined that art education programs that involve open-ended activities and support higher cognitive skills – such as analysis, synthesis, evaluation and problem-solving skills – have a positive effect on the development of visual skills. It is observed that the cognitive skills which children acquire through project activities have a positive effect on their cognitive processes.

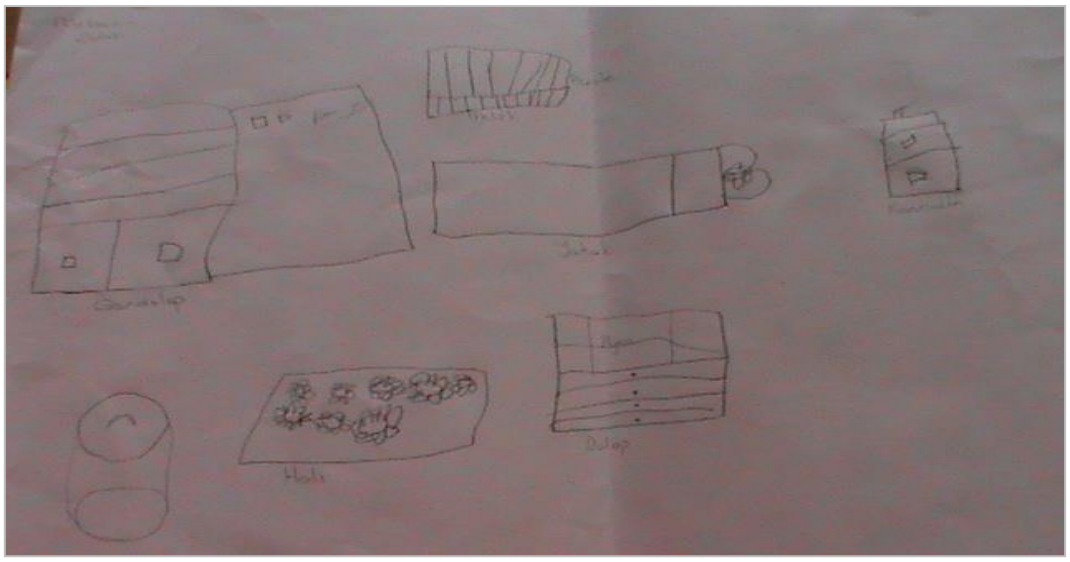

Figure 1. A Hand Drawing of M's Room, Which He/She Drew as part of the Home Project

It was determined that "Family Observation Form" made significant contributions to the children's visual perception skills. On the family observation form, S's mother noted that after a visit to their old Kayseri home, S asked her, "Why is the ceiling of our house not higher?" (S)he noticed the different homes that (s)he saw on the street and described these differences. D's mother reported on the observation form that D noticed the details in her environment and was amazed at these, on the other hand, E's mother noted that (s) he pointed at parts of the house needing repair, while offering help in repairing them and that (s) he suggested that placing the wardrobe on the other side of his/her bedroom that would not obstruct the curtain. M's mother reported that M drew his/her room while at home (Figure 1) and that when she/he looked at his (her) drawing, every object had been drawn in its proper place was significant in terms of indicating that the visual perception of the children improved. These findings indicate that the project-based education program promotes the development of visual perception and serves to demonstrate its success over the development of children's visual perception. Serrano, Alfaya, and Garcia (2015) revealed in their project studies including 485 children at the age of 3-6 that project approach imparts many behaviours required for learning to children, according to the findings they obtained on the basis of the observations of teachers, families, researchers and university students participated in the study. Project-based education is an approach that promotes the visual perception skills of children by providing rich visual experiences to children in the process of investigation, examination and discovery initiated by a topic that attracts their attention (Metin, 2014). When it is considered that visual perception skills increase with age and that it shows a more rapid development around the ages of 5 and 6 (Bezrukikh & Terebova, 2009), the inclusion of projects that both enrich the preschool curriculum and contribute positively to all areas of development of children is believed to be quite important.

Based on the study results, it is possible to recommend instructors to make greater use of children-centred educational practices, methods and techniques such as project-based education, which supports the visual perception of children by giving them the opportunity to participate actively and interact with their peers, and also allows them to learn through trial-and-error. Instructors can effectively support preschool educational programs by using the project-based approach – which is known to have a positive effect in all areas of development in children in addition to their visual perception skills – and also by taking part in educational activities that help enhance the knowledge and skills of children. Educational institutions could also implement the necessary measures and steps to support instructors in the use children-centred educational approaches, and particularly the project-based education approach. Researchers could conduct further and more comprehensive studies on the effect of the project-based education on the development of children, and take steps for ensuring that such studies' findings provide benefit to actual educational practices. In addition, the project-based

approach could be applied to children of different age groups with visual perception problems in order to determine and share results regarding the effectiveness of this approach. Educational programs involving active participation by children could be developed and implemented to promote the development of visual perception, and these programs could be widely applied at a larger scale.

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