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# The Effect of Play Method on Creating Pattern Ability to Children in the Preschool Educational Institution

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ABSTRACT

*The purpose of this research is to demonstrate the effectiveness of the game method in acquiring pattern skills for children who attend the pre-school education institution. The working group of the study consisted of 44 children, including 21 trials and 23 control groups attending a pre-school education institution in the city center of Istanbul. The study was conducted using an experimental design with pre-test post-test control group. The "Personal Information Form" was used to get information about children and their families, and the "Pattern Competency Test" developed by Kesicioğlu (2013) was used to evaluate the pattern skills of children. The "Game Based Pattern Skills Program" prepared by the researcher for the children in the experimental group was applied three times a week for seven weeks and six days. Meanwhile, the children in the control group continued their current training. The data obtained in the study were analyzed using the SPSS 23 program. In the analysis of the data, Shapiro-Wilk test, Mann-Whitney U test and Wilcoxon Marked Rank test were used. As a result of the research, it was both seen that after the game-based pattern skills program, the children in the experimental and control groups did not make any difference in the ability of Pattern-Based Object-Oriented Patterning (p> 0.05); and that the children in the experimental group had a significant difference in the ability to complete the Missing Object in a Pattern and to Create an Original Pattern by Objects compared to the children in the control group (p <0,05). As a result, it was observed that the game-based pattern skills program given to children positively affected the development of pattern skills of the children in the experimental group.*

## INTRODUCTION

Mathematics is a branch of science that includes concepts such as arithmetic, geometry, algebra, space, weight, volume, graphs and numbers as well as their direct interrelationships and symbols (Güven, 1998: 121). Prior to school, children learn basic concepts such as understanding their environment, differentiation, observing etc, during which time the children's mathematical ability in skills such as ordering, counting, matching, classifying and establishing relationships between parts vis-a-vis the whole develop (İncikabı and Tuna, 2012: 94). Identifying when to introduce mathematical concepts and skills, via which methods and techniques as well as how they will be taught gain importance as mathematical development involves complex processes (Orçan, 2013: 2). Games, projects as well as fun, daily activities should be made use of while mathematical concepts are being introduced and taught to children (Uyanık and Kandır, 2010: 127).

The role of the educator in the creation of an environment conducive to the learning of mathematics is very important and hard to successfully accomplish in the extreme due to the greater

acceptance and spread of the idea that the early years are critical for mathematical development (Ktoridou, Eteokleous and Gregoriou, 2005: 787). In countries where there is the tradition of social pedagogues in early childhood education, mathematical learning generally occurs via game-based activities (Oppermann, Anders and Hachfeld, 2016: 174). Besides the advantage of mathematical thinking that appears in game skills, they can also increase intellectual development. (Trawick-Smith, Swaminathan and Liu, 2016: 716). The educational process coalesces around games or is given in the form of game when mathematics is taught via the game method. (Fauvel and Maanen, 2000; in Kılıç, 2007: 82). Children are not passive but active in mathematical education with games. Concepts related to mathematics are learned via trial and error and mathematics becomes fun and interesting. Information becomes permanent when it is concretised as mathematics is an abstract science (Hoşgör, 2010: 31). Research conducted asserts the importance of mathematical education given via the game method in pre-school education (Güven, 1989; Peters, 1998; Ciancio et. al., 1999; Türkmenoğlu, 2006; Şirin, 2011; Akkuş Sevigen, 2013, Karaman and İvrendi, 2015).

Mathematics is a part of all branches of science, is applied throughout the world and is termed as the science of patterns, not only of numbers and operations. Patterns appear before us in many ways, such as in the arrangement of sunflower seeds, the spots and stripes of leopards and zebras respectively, the flow of water, rug patterns, the shape of Earth, the shape and layout of tiles, mosaics and leaves, golf courses, weather forecasts, computer operations, dance and rhythm. (Devlin, 1998; in Yaman, 2010: 1).

Patterns are defined as the rule between a mathematical object (numbers, shame etc) and their constituent parts in a configured series (Guerrero and Rivera, 2002: 263), numerical or spatial regularity (Papic and Mulligan, 2005: 609) and a strong arrangement that can be distinguishable with words, numbers and shapes (Birken and Coon, 2008: 9). Patterns carry critical importance for the integration of mathematical learning, the abstraction of mathematical ideas and relationships as well as the development of mathematical reasoning in young children (Papic, 2015: 519). They are a fundamental aspect for the mathematical development of young children and are seen as a central pillars of mathematical inquiry (Waters, 2004: 565).

The skill of creating patterns or understanding them is a skill that is often taught to young children as part of a school's mathematics curriculum (Schmerold et. al., 2017: 207). Starting in pre-school education, the use of patterns continues during the first step of primary education and they are an important factor in the formation of the keystone of algebra (Herbert and Brown, 1997: 123). Patterns develop children's skills in matching, contrasting, classifying, grouping, creating direct sequences from short to long, small to large, recognising similarity and difference, repetition, arranging and predicting (Akman, 2002: 245).

Patterns given in pre-school have been grouped in different ways by various researchers. Repetitive, changing, relational and musical patterns are found in research in the field. According to Papic (2007: 9-10), there are three different ways in which repetitive patterns are found: linear, cyclical and hopscotch. One of the first patterns introduced to children are patterns that are made up of repetitive (●▲▲●▲▲) units, are in linear form and can generally be formed focusing on a single dimension (form or colour) (Miller et al, 2016: 85). Various methods of presentation are used in different ways for repetitive patterns. For example patterns utilising letters such as ABABAB, actions such as stand, sit, stand, sit, stand, sit, sounds such as drum, bell, drum, bell, drum bell, geometric shapes such as ▼●▼●▼●, via tactile stimuli such as smooth, rough, smooth, rough, smooth, rough (Warren and Cooper, 2006: 10).

Children in pre-school education are able to copy simple patterns. Continuing and creating patterns as well as learning how to realise the different relationships between the different expressions of the same pattern (visual and motoric or movement patterns and red, blue, red, blue etc) is ensured with pre-school activities (Clements and Sarama, 2014: 216). Children gain information about patterns and pattern relationships with activities regarding identifying, reading, explaining and expanding patterns as well as identifying their rules, transmitting, enlarging and narrowing them (Ontario, 2007: 11-13).

Pattern-based activities should be carried out with pre-school children beginning with the easiest and moving on to increasingly harder ones using real objects, body movements and pattern cards. Pattern-based activities in the 2nd and 3rd grades of primary school are of a more complex level using odd and even numbers, multiplication and numerical tables (Yıldırım Hacıibrahimoğlu, 2014: 127). Beginning as of pre-school, there is a variety of research available for patterns that are given at higher levels of education.(Hargreaves et al, 1998; Blanton and Kaput, 2004; Warren, 2005; Pilten and Yener, 2009; Yaman, 2010; Kesicioğlu, 2013; Gök Çolak, 2016).

According to the Pre-school Education Programme (2013) published by the Ministry of Education Pre-school Directorate, the skill pre-school children should be able to obtain, and the indicators of successful learning, are as follows:
Skill 14: Forming patterns with objects
Indicators:
Forming patterns with objects with reference to a model.
Saying the rule regarding patterns made up of at most three components.
Identifying the missing component of a pattern.
Completing a pattern by placing the missing component.
Creating a unique pattern with objects.

In light of this information, it has been decided to investigate the effect of the game method on children in pre-school education.

## 1. METHOD AND TECHNIQUE

### 1.1. Research Design

Pre-test, final test control group experimental design has been used in this research.

### 1.2. Macrocosm and Sample

The system used in this research is made up of five to six-year old children who were attending nursery at primary schools connected to the Ministry of Education in Istanbul Province during the second half of the 2014-2015 academic year, who were showing normal development and had yet to be given game-based pattern skills education.

The research's sample is made up of 44 children attending nursery at Kazlıçeşme Abay Primary School located in the centre of Zeytinburnu District of Istanbul Province, which was selected completely at random. 21 of the children were placed in the test group and the remaining 23 in the control group. The necessary permissions required for this research was obtained from Istanbul Governor's Office Provincial National Education Directorate.

### 1.3. Data Collection Tools

A "Pattern Skills Test" developed by Kesicioğlu (2013) to evaluate the patterns skills of children was used to obtain some information about the children in the research and their families.

#### 1.3.1. Personal Information Form

Questions in the Personal Information Form pertaining to the children included in the research asked for the children's sex, age, prior pre-school and length of time there, the number of siblings, birth order, ages, education levels and employment statuses of mother and father.

#### 1.3.2. Pattern Skills Test

"The Pattern Skill Test" was used as the pre-test and final test in the research. In this test, made by Kesicioğlu (2013) with validity and reliability tests on 100 children, materials prepared by the researcher were used. This material is comprised of three dimensions: "1st dimension: The skill of forming patterns with objects with reference to a model," " 2nd dimension: The skill of completing a pattern by placing the missing component," and "3rd dimension: The skill of creating a unique pattern with objects" and each dimension has two stages, "the number of objects is three," "the number of objects is four." "1" point is given when the children correctly do a pattern made up of three objects, "0" points are given if done incorrectly. KR-20 (Kudher Richardson-20) was used as to measure reliability and the article: question rate 1:8 was paid attention to for the reliability results. The KR-20 factor for the first dimension is .85, the KR-20 factor for the second dimension is .83 and the KR-20 factor for the third dimension is .79.

### 1.4. Data Collection Period and Analysis

#### 1.4.1. Pre-Test Implementation

The "Pattern Skills Test" was given to the test and control groups before the Game-based Skills Programme was begun.

#### 1.4.2. Implementation of Game-based Skills Programme

The "Game-based Skills Programme" aimed at developing the pattern skill of the children in the research's test group was prepared by the researcher. Literature related to game activities, pattern skills and the pre-school educational programme was combed through while the Game-based Skills Programme was being prepared. The developmental characteristics of 60-72 month-old children were paid attention to in line with the pre-school educational programme. The prepared programme was inspected by a field expert who made the necessary corrections, bringing it to its final form. The Game-based Skills Programme is made up of twenty-four child-centric game activities aimed especially at supporting cognitive development and developing pattern skills. The games were separated into three categories: eight games related to the skill of forming patterns with objects with reference to a model, eight games related to the skill of completing a pattern by placing the missing component and a final eight games related to the skill of creating a unique pattern with objects. Two games related to object number two, three games related to object number three and three games related to object number four were planned for the games within each category. Care was taken to make sure the object numbers increased in difficulty from the easiest to the most difficult. Together with all of the games being related to pattern skills, skills and indicators that would support social-emotional, motor development and self-care skills were included.

The Game-based Skills Programme was run with the test group three days a week for a total of seven weeks and six days after the Pre-test was given. The control group carried on with the current educational programme.

#### 1.4.3. Implementation of Final Test

The "Pattern Skills Test" was given to the children in both the test and control groups in the same environment and under the same conditions the pre-test was given after the Game-based Skills Programme was completed by the teacher.

#### 1.4.4. Data Analysis

The data obtained from this research was evaluated using the SPSS 23 programme which operated with a .95 reliability rate. When the data under analysis was $p<0,05$ it indicated there was an

important discrepancy, if p>0,05 it indicated there was not an important discrepancy. The mean points the children in the test and control groups obtained in both the pre-test and final test were analysed with the Shapiro-Wilk test to determine whether or not these point were normally distributed, the Mann Whitney U test was used when there was an indication the pre-test and final test scores were different according to group and the Wicoxon Signed-Ranks Test was used for internal group repeated measurements.

## 2. FINDINGS AND DEBATE

**Table 2.1. Differentiation Analysis According To Pre-test Group - Mann Whitney U**

| Group | | n | Mean Rank | U | p |
|---|---|---|---|---|---|
| First Dimension Object Number Three Before | Test Group | 21 | 22,50 | 241,500 | 1,000 |
| | Control Group | 23 | 22,50 | | |
| First Dimension Object Number Four Before | Test Group | 21 | 22,50 | 241,500 | 1,000 |
| | Control Group | 23 | 22,50 | | |
| Second Dimension Object Number Three Before | Test Group | 21 | 25,64 | 175,500 | 0,097 |
| | Control Group | 23 | 19,63 | | |
| Second Dimension Object Number Four Before | Test Group | 21 | 24,29 | 204,000 | 0,349 |
| | Control Group | 23 | 20,87 | | |
| Third Dimension Object Number Three Before | Test Group | 21 | 21,36 | 217,500 | 0,514 |
| | Control Group | 23 | 23,54 | | |
| Third Dimension Object Number Four Before | Test Group | 21 | 24,88 | 191,500 | 0,131 |
| | Control Group | 23 | 20,33 | | |
| First Dimension Total Before | Test Group | 21 | 22,50 | 241,500 | 1,000 |
| | Control Group | 23 | 22,50 | | |
| Second Dimension Total Before | Test Group | 21 | 25,33 | 182,000 | 0,152 |
| | Control Group | 23 | 19,91 | | |
| Third Dimension Total Before | Test Group | 21 | 22,95 | 232,000 | 0,804 |
| | Control Group | 23 | 22,09 | | |
| General Dimension Before | Test Group | 21 | 24,79 | 193,500 | 0,254 |
| | Control Group | 23 | 20,41 | | |

When Table 2.1. is examined, there is no important statistical difference between the children in the test and control groups in the First Dimension Object Number Three Before, First Dimension Object Number Four Before, First Dimension Total Before, Second Dimension Object Number Three Before, Second Dimension Object Number Four Before, Second Dimension Total Before, Third Dimension Object Number Three Before, Third Dimension Object Number Four, Third Dimension Total Before and General Dimension Before categories (p>0,05).

The individual characteristics, development levels, levels of intelligence, interests and abilities of children attending pre-school education may show differences due to what they have previously learned and the experiences they have obtained. It can be said when looking from this perspective that

the children do not display any differences on the cognitive level and that the pre-learning and readiness levels are similar.

**Table 2.2. The First Dimension in the Test and Control Groups: Forming Patterns With Objects With Reference To A Model - Pre-Test Final Test Wilcoxon Analysis**

| Group | Score | X | ss | Z | p |
|---|---|---|---|---|---|
| Test Group | First Dimension Object Number Three Before | 2,00 | 0,00 | .000 | 1.000 |
| | First Dimension Object Number Three After | 2,00 | 0,00 | | |
| Control Group | First Dimension Object Number Three Before | 2,00 | 0,00 | .000 | 1.000 |
| | First Dimension Object Number Three After | 2,00 | 0,00 | | |
| Test Group | First Dimension Object Number Four Before | 2,00 | 0,00 | .000 | 1.000 |
| | First Dimension Object Number Four After | 2,00 | 0,00 | | |
| Control Group | First Dimension Object Number Four Before | 2,00 | 0,00 | .000 | 1.000 |
| | First Dimension Object Number Four After | 2,00 | 0,00 | | |
| Test Group | First Dimension Total Before | 4,00 | 0,00 | .000 | 1.000 |
| | First Dimension Total After | 4,00 | 0,00 | | |
| Control Group | First Dimension Total Before | 4,00 | 0,00 | .000 | 1.000 |
| | First Dimension Total After | 4,00 | 0,00 | | |

When Table 2.2. is examined, the highest possible score in the first dimension object number three and object number four categories is 2.00 and in the first dimension total category the highest possible score is 4.00. There is no important statistical difference between the test and control groups' before and after values ($p>0,05$). It can be said from these results that game-based pattern skills programme given to the children in the test group did not affect their skill in the dimension of forming patterns with reference to a model. Eight game activities related to the skill of forming patterns with reference to a model were included in the game-based pattern skills programme. The games were divided as thus: two games for object number two, three games for object number three and three games for object number four. Care was given to make sure the number of objects were arranged from easiest to most difficult. In addition to forming a pattern with reference to a model, matching, attention skills and visual awareness development were given particular importance, as children had to focus their attention, use their visual awareness skill and be capable of matching in order to correctly form a pattern with reference to a model. When considered from this angle, it can be surmised that since the scores of the children in both the test and control groups are the same their attention and visual perception skills as well as their ability to match are the same.

The skills pre-school children are expected to obtain with regard to patterns, matching, attention and visual perception, as well as the indicators thereof, are found in the Pre-school Education Programme (2013) published by the Ministry of Education Pre-school Directorate. In this connection, it has been seen that the teachers of the test and control groups had given them exercises concerned with matching, attention, visual perception and forming a pattern with reference to a model as per the requirements of the pre-school educational curriculum. When the children's ages and developmental level are too taken into consideration, it can be thought that the fact the games related to forming patterns with reference to a model applied as part of the Game-based Pattern Skills Test did not affect the children in the test group is a natural result of the teachers including activities that support this skill in the curriculum.

**Table 2.3. The Second Dimension In The Test And Control Groups: Completing A Pattern By Placing The Missing Component Skill - Pre-Test Final Test Wilcoxon Analysis**

| Group | Score | X | ss | Z | p |
|---|---|---|---|---|---|
| Test Group | Second Dimension Object Number Three Before | 1,19 | 0,93 | -3017 | .003* |
| | Second Dimension Object Number Three After | 2,00 | 0,00 | | |
| Control Group | Second Dimension Object Number Three Before | 0,74 | 0,81 | -2952 | .003* |
| | Second Dimension Object Number Three After | 1,78 | 0,42 | | |
| Test Group | Second Dimension Object Number Four Before | 1,19 | 0,87 | -3342 | .001* |
| | Second Dimension Object Number Four After | 2,00 | 0,00 | | |
| Control Group | Second Dimension Object Number Four Before | 0,96 | 0,82 | -3869 | .000* |
| | Second Dimension Object Number Four After | 1,57 | 0,66 | | |
| Test Group | Second Dimension Total Before | 2,38 | 1,63 | -3819 | .000* |
| | Second Dimension Total After | 4,00 | 0,00 | | |
| Control Group | Second Dimension Total Before | 1,70 | 1,49 | -2667 | .008* |
| | Second Dimension Total After | 3,35 | 0,83 | | |

*p<0,05

When Table 2.3. is examined, the highest possible score in the second dimension object number three and object number four categories is 2.00 and in the second dimension total category the highest possible score is 4.00. There is a significant difference between the test and control groups' Second Dimension Object Number Three Before and Object Number Three After categories' values (p<0,05). While the value of the test group's Second Dimension Object Number Three scores rose from 1.19 to 2.00, the control group's rose from 0.74 to 1.78.

There is a significant difference between the test and control groups' Second Dimension Object Number Four Before and Object Number Three After categories' values (p<0,05). While the value of the test group's Second Dimension Object Number Four scores rose from 1.19 to 2.00, the control group's rose from 0.96 to 1.57.

There is a significant difference between the test and control groups' Second Dimension Total Before and Second Dimension Total After categories' values (p<0,05). While the value of the test group's scores rose from, 2.38 to 4.00, the control group's rose from 1.70 to 3.35. It was observed that while the children in the control group were not able to score maximum points, the children in the test group were able to. It can thus be said based on these results the games given to the children in the test group caused an increase in the completing a pattern by placing the missing component skill level of the children. Eight game activities were prepared for the completing a pattern by placing the missing component skill. Two of the games were for two objects, three games for three objects and a further three for four objects. Care was given to make sure the number of objects were arranged from easiest to most difficult. In addition to completing a pattern by placing the correct component, priority was given to attention and visual perception skills. The children had to focus their attention and use their visual perception skills to correctly complete the incomplete pattern. When seen from this perspective, it can be said that the attention and visual perception skills of the children in the test group is higher (p<0,05) than those in the control group. The research results of relevant literature support these findings.

Bursaoğlu (2010), investigated the effects of pattern and decoration activities on sixth grade students' demeanour and academic success vis-a-vis mathematics by analysing the teaching methods.

Pattern and decoration activities were given to the test group. As for the control group, they carried on with the activities mandated by the education programme. At the end of the study, it was determined that positive developments in the test group's demeanour and academic success had been obtained and that there was a significant difference in final test for mathematic attitude measurement. As in this experiment, the students' level of knowledge with regard to patterns can be increased and their demeanour towards mathematics positively improved if patterns are taught via activities has been attempted. In this connection, it has been observed that the game activities given as part of the Game-based Pattern Skills Programme affected the rise in the children's success.

Cengiz (2002), conducted a study with thirty children from the five-six-year old age range with the aim of investigating the affect the "Visual Perception Development Supportive Education Programme" has on the development of the children's visual perception. Conversation, music, art, drama and game activities prepared for the sub-dimensions of visual perception's eye-motor coordination, figure-ground relationship and place relationships were in the programme. The "Visual Perception Development Supportive Education Programme" prepared by the researcher was given to children in the test group. As for the children in the control group, they continued with the activities in the curriculum prepared by their home-room teacher. The findings of the research are as follows: The "Visual Perception Development Supportive Education Programme" reached a successful result upon the visual perception development of the children. This situation shows that structured actives and games had a bolstering effect on the children's visual development.

In a study conducted by Semrud-Clikeman and friends (1999) on children identified with attention deficit problems by their teachers and parents They investigated the effect of an attention education programme had on children in the second-sixth grades and in the eight-twelve age range and with whom teachers had difficulty in holding their attention and in completing their tasks. Positive visual and audio development results were obtained from those receiving attention training whereas those who, despite their attention deficits did not receive this training, did not show any development. The Game-based Pattern Skills Programme given to the children includes attention-related games. When an education programme concerning attention is given or is given in a game form, it is observed that the children's attention levels are positively supported.

**Table 2.4. The Third Dimension In The Test And Control Groups: Creating A Unique Pattern With Objects - Pre-Test Final Test Wilcoxon Analysis**

| Group | Score | X | ss | Z | p |
|---|---|---|---|---|---|
| Test Group | Third Dimension Object Number Three Before | 1,19 | 0,93 | -3017 | .003* |
| | Third Dimension Object Number Three After | 2,00 | 0,00 | | |
| Control Group | Third Dimension Object Number Three Before | 0,74 | 0,81 | -2952 | .003* |
| | Third Dimension Object Number Three After | 1,78 | 0,42 | | |
| Test Group | Third Dimension Object Number Four Before | 1,19 | 0,87 | -3342 | .001* |
| | Third Dimension Object Number Four After | 2,00 | 0,00 | | |
| Control Group | Third Dimension Object Number Four Before | 0,96 | 0,82 | -3869 | .000* |
| | Third Dimension Object Number Four After | 1,57 | 0,66 | | |
| Test Group | Third Dimension Total Before | 2,38 | 1,63 | -3819 | .000* |
| | Third Dimension Total After | 4,00 | 0,00 | | |
| Control Group | Third Dimension Total Before | 1,70 | 1,49 | -2667 | .008* |
| | Third Dimension Total After | 3,35 | 0,83 | | |

*p<0,05

When Table 2.4. is examined, the highest possible score form third dimension object number three and object number four is 2.00 while the highest possible score for the third dimension total is 4.00. A significant difference between the values of the test and control group's Third Dimension Object Number Three Before and Third Dimension Object Number Three After values was found (p<0,05). The test group's Third Dimension Object Number Three value rose from 0.57 to 2.00 whereas that of the control group rose from 0.74 to 1.30.

A significant difference between the values of the test and control group's Third Dimension Object Number Four Before and Third Dimension Object Number Four After values was found (p<0,05). The test group's Third Dimension Object Number Four value rose from 0.67 to 2.00 whereas that of the control group rose from 0.30 to 0.57.

A significant difference was found between the test and control groups' Third Dimension Total Before and Third Dimension Total After values (p<0,05). The test group's Third Dimension Total value rose from 1.24 to 4.00 whereas the control group's rose from 1.04 to 1.87. It is observed that while the children in the control group was not able to achieve the maximum score, those in the test group were. In light of these results, it can be said that the game-based pattern skills programme given to the children in the test group caused the increase in their creating a unique pattern with objects skill. Eight game activities related to skill of creating a unique pattern with objects in the game-based pattern skills programme. Two of these were related two object number two, three were related to object number three and a further three for object number four. Care was given to ensure the number of objects were arranged from the easiest to most difficult. In addition to crating a unique pattern with objects, priority was given to attention and visual perception skills as the children had to focus their attention and use their visual perception skill in order to successful use objects to create a unique pattern. For this reason, it can be said that the attention and visual perception skills of the children in the test group are higher (p<0,05) than those in the control group.

Creativity is a concept as important as games. These two concepts cannot be considered to be separate from one another. The place where children continually enriches their imaginary world and use their creativity is that of game. It is possible to observe children's creative ideas in their handwork, drawing and painting, conversations, music, dance, drama and game activities (Sevinç, 2009: 111-112). Thus, the development of children's creativity was given importance in the research through the games prepared for the creating a unique pattern with objects in the Game-based Pattern Skills Programme.

In research conducted by Warren (2005), he aimed to determine how children generalise repetitive and variable patterns and how they symbolised these generalisations. The study was conducted on a total of forty-five children (their mean age being 9 years, six months) in two different classes in a primary school. A pre-test was given to the children before any teaching had been done to determine their ability with regard to repetitive and variable patterns. With regard to repetitive patterns during the period of teaching, pattern activities including pattern formation and continuation, identifying repeating units and placing them in a table, identifying relationships within the table and their usage stages were used. At the end of the study it was seen that the children experienced more difficulty with variable patterns compared to repetitive patterns. It was identified that the majority of the children were able to create a repetitive pattern, were able to place the letters K and Y in a repeating KYYKYYKYY pattern in a function table and focused mostly on the output values in this table. Changes in the tendencies regarding output values after the education, aimed the investigation concerning the relationship between the input and output values in a function table, had been given and that correct answers were obtained in large numbers such as the one-hundredth step. This research's findings show similarity with the research's results where it was observed that the game activities in the Game-based Pattern Skills Test of the research influenced the increase in the ability levels of the children who formed the test group to create patterns and continue them.

Karaduman (2004) conducted a study with the aim of investigating the effect concentration focusing education and motivation programmes have on the ability to focus concentration, sense of self and level of success of fourth and fifth grade students. Programmes entitled "Concentration Education" and "Concentration Games" were used in the education programme. Various jigsaw puzzles and mental arithmetic exercises were given in addition to these programmes. Concentration gathering and motivation education programmes composed of twenty-four sessions were given to the students in the test group while no activities were given to those in the control group. At the end of the research, significant differences were found between the concentration gathering levels, academic sense of self and school success of the children in the test group and those in the control group. The results of this research show too that the Game-based Pattern Skills Programme secured a positive affect on the children's concentration.

Ercan (2009) investigated in his research the effect visual perception education given to children at nursery had on the development of their visual-motor coordination. This education programme included work-pages and language, art, drama, music and game activities which supported their visual-motor coordination. The visual perception programme was given to the children in the test group while the children in the control group carried on with the pre-school education programme. The results of the research showed a significant difference between the visual-motor coordination development scores of the children in the test and control groups. As seen, these research results support these findings when the related literature is examined.

## CONCLUSION AND RECOMMENDATIONS

The aim of this research was to investigate the effect the Game-based Pattern Skills Programme had on the pattern skills of children attending pre-school education programmes.

The differentiation situation of the pattern skill pre-test was examined according to group and no significant differences were found in the groups' pre-test skills. This result shows the groups' pattern skills were well-matched before the experiment.

When the pre-test and final-test results of the test and control group children for the sub-dimension of the Pattern Skill Test's First Dimension: Forming a Pattern With Objects With Reference To A Model are examined, it was found that the difference between the before and after values of first dimension object number three, object number four and the first dimension total was not significant.

When the pre-test and final-test results of the test and control group children for the sub-dimension of the Pattern Skill Test's Second Dimension: Completing a Pattern With The Missing Component are examined, it was found that the difference between the before and after values of second dimension object number three, object number four and the second dimension total was significant ($p<0,05$). It was foundthat the completing a pattern with the missing component skill of the children in the test group was higher than that of the children in the control group.

When the pre-test and final-test results of the test and control group children for the sub-dimension of the Pattern Skill Test's Third Dimension: Creating A Unique Pattern With Objects are examined, it was found that the difference between the before and after values of second dimension object number three, object number four and the second dimension total was significant ($p<0,05$). It was found that the creating a unique pattern with objets skill of the children in the test group was higher than that of the children in the control group.

In conclusion, the more successful adoption of the game-based pattern skills programme by the children in the test group asserts the importance of game-based education.

The following recommendations are given in light of the data obtained via this research:

- Presentations and seminars for various methods and techniques can be prepared for teachers while the place and importance of patterns in the lives of children, pattern skill stages and pattern skills are being taught to the children. Magazines, books, e-books, brochures and bulletins regarding these can be sent to teachers.

- Games, drama, science, mathematics, music and area tours that ensure that children will develop pattern skills can be included in the pre-school education programme.

- Computer games for pattern skills can be developed and used.

- Relationships with the real world can be established, provisions for big and small groups made and progressively more difficult work can be given while activities related to mathematical concepts and pattern skills are given.

- Games support children's development and skills; they give the opportunity to learn while having fun and ensure that what is learned is learned permanently. For these reasons other activities can be combined with games and given to children.

- Teachers can be made more aware of the game method and related training via in-school educational seminars and conferences. Teachers can be encouraged to participate in various activities.

- Supporting home activities can be given to families to support children's pattern skills and to make what is learned permanent.

- Families can participate with their children in pattern skills activities, create different games and provide the opportunity for their children to learn from their first first-hand experiences in educational institutions.

- Research can be conducted using other methods instead of the game method for the learning of pattern skills.

- An education programme where families are included can be prepared and can be applied as an experiential programme by developing the Game-based Pattern Skills Programme.

- A test to measure the permanence of the of the given game-based education programme can be given to the test group's children.

- The Game-based Pattern Skills Programme was given over a period of seven weeks and six days. It can be applied over a year and the results of which can be compared with the results of this study.

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