Yayın Geliş Tarihi (Submitted): Şubat/ February-2024 | Yayın Kabul Tarihi (Accepted): Ekim/October/2024

An Investigation of the Relationship Between Science Motivation and Pattern Skills in Children Aged 60-72 Months*

60-72 Aylık Çocukların Bilime Yönelik Motivasyonları ile Örüntü Becerileri Arasındaki İlişkinin İncelenmesi

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Abstract

The study comprehensively examines the motivation towards science and the mathematical patterning skill levels of children aged 60-72 months, the relationship between these scales, the extent to which the Interest in Learning Science and Independence Versus the Need for Support for Learning Science sub-dimensions predict preschool mathematical patterning skills, and the impact of gender on these scale scores. The research was conducted on 401 children attending kindergartens and preschool classes in the city center of Afyonkarahisar. In this relational survey study, the "Teacher Rating Scale of Children's Motivation for Science" was used to measure children's motivation towards science, and the "Preschoolers' Mathematical Patterning Skills Test" was utilized to assess their mathematical patterning skills. The findings indicate that children's motivation towards science shows positive and significant relationships with mathematical patterning skills and significantly predicts children's mathematical patterning abilities. Furthermore, it was determined that gender does not have a significant effect on children's motivation towards science and their mathematical patterning skills. These results suggest that children's motivation for scientific subjects contributes to the development of mathematical skills and that this process is independent of gender. The research highlights the importance of supporting motivation towards science and mathematical patterning skills during early childhood and suggests the need for further research in this area.

Keywords: preschool period, motivation towards science, preschool mathematical patterning skills

Paper Type: Research

Öz

Araştırma, 60-72 aylık çocukların bilime yönelik motivasyonları ve matematiksel örüntü beceri düzeylerini, bu ölçekler arasındaki ilişkiyi, Bilim Öğrenmeye İlgi ve Bilim Öğrenmek için Destek İhtiyacına Karşı Bağımsızlık alt boyutlarının Okul Öncesi Matematiksel Örüntü becerilerini ne düzeyde yordadığı ve cinsiyetin bu ölçek puanları üzerindeki etkisini kapsamlı bir şekilde incelemiştir. Araştırma, Afyonkarahisar il merkezindeki anaokullarına ve anasınıflarına devam eden 401 çocuk üzerinde gerçekleştirilmiştir. İlişkisel tarama modelindeki araştırmada, çocukların bilime yönelik motivasyonlarını ölçmek için "Çocukların Bilime Yönelik Mostivasyonları: Öğretmen Değerlendirme Ölçeği" ve matematiksel örüntü becerilerini ölçmek için "Okul Öncesi Matematiksel Örüntü Becerileri Testi" kullanılmıştır. Bulgular, çocukların bilime yönelik motivasyonunun, matematiksel örüntü becerileri ile pozitif ve anlamlı ilişkiler sergilediğini, bilime yönelik motivasyonun çocukların matematiksel örüntü becerilerini önemli ölçüde yordadığını göstermiştir. Ayrıca, cinsiyetin çocukların bilime yönelik motivasyonları ve matematiksel örüntü becerileri üzerinde anlamlı bir etkisi olmadığı tespit edilmiştir. Araştırma, erken çocukluk döneminde bilime yönelik motivasyonun ve matematiksel örüntü becerilerinin

* Bu çalışma Prof. Dr. Özgün UYANIK AKTULUN danışmanlığında yürütülen Pakize Merve YILMAZ'ın "60-72 Aylık Çocukların Bilime Yönelik Motivasyonları İle Örüntü Becerileri Arasındaki İlişkinin İncelenmesi" isimli yüksek lisans tezinden yararlanılarak hazırlanmıştır.

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Atıf için (*to cite*): Yılmaz, P.M. & Uyanık Aktulun, Ö. (2025). An investigation of the relationship between science motivation and pattern skills in children aged 60-72 months. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi,* 27(3), 883-899.

desteklenmesinin önemine dikkat çekerek, bu alanda daha fazla araştırma yapılması gerektiğini önermektedir.

Anahtar Kelimeler: okul öncesi dönem, bilime yönelik motivasyon, okul öncesi matematiksel örüntü becerileri

Makale Türü: Araştırma

1. Introduction

The preschool period is a time when children, as "natural scientists," explore their surroundings and ask questions. This curiosity offers them opportunities to perceive and make sense of the world. In early childhood, science is embedded in life. Children attempt to configure basic concepts and processes by observing the natural world, experimenting, and reflecting on the outcomes. This process enhances children's affinity towards science, facilitating the development of positive attitudes and the acquisition of scientific process skills (Kandır, Can Yaşar, İnal, Yazıcı, Uyanık, & Yazıcı, 2012, p. 5-6). Among the most fundamental affective factors that directly influence children's participation in these unique processes, learning, and success is motivation (Guay, Chanal, Ratelle, Marsh, Larose, & Boivin, 2010, p.711; Ryan & Deci, 2000, p. 54; Wolters & Rosenthal, 2000, p.801). Motivation is an affective factor that drives the human organism to act, determining the persistence and energy of these actions, directing them, and ensuring their continuation (Dunn & Stephens, 1972). According to Brophy (1998), "motivation is a theoretical concept used to explain the initiation, direction, intensity, and persistence of goal-oriented behavior". It has been determined that children who have captured the necessary motivation in a field exhibit continuity in attention, interest, desire, and effort. Characteristics such as focusing on the subject and being determined to overcome encountered obstacles are also traits exhibited by individuals with high motivation (Nguyen, 2015, p. 9; Stipek, 2011). Therefore, motivation, while being a complex psychological structure attempting to explain the behavior and effort related to a selected topic (Watters & Ginns, 2000, p. 277), is expressed as one of the key concepts affecting learning and success, and an area that should not be neglected in instructional environments (Ryan & Deci, 2000, p.55). This is because motivation affects three dimensions of learning: the sustainability of learning activities, the content of the performed learning activities, and the functional role of the child in the learning process (Schiefele & Rheinberg, 1997; p.251).

Developmental psychologists and motivation researchers emphasize that experiences in early years are critical for the development of self-beliefs, such as science motivation (Aschbacher, Li, & Roth, 2010, p.564; Daniels & Meece, 2007; p.528). Hence, the Ministry of National Education [MONE] (2024) Preschool Education Program has also focused on the acquisition of affective characteristics and suggested activities to increase children's motivation related to learning. Thus, positive experiences related to science at an early age play a decisive role in the development of children's motivation profiles and are determinants of their future interests in science. Simultaneously, the first steps that children take towards science by observing and exploring their environment during this period lay the solid foundations of motivational beliefs in the field of science (Oppermann, Brunner, & Anders, 2019, p.86).

Particularly, the development of motivation towards science is of critical importance for children's future interest in and positive attitudes towards science (Parlakyıldız & Aydın, 2011, p.166). Children with high curiosity and inquiry tendencies towards science from early ages, in other words, those with high motivation or enhanced motivation, are more inclined to ask questions about the world and think about the causes, processes, and mechanisms of scientific events, to exert effort, and to cope with difficulties (Stipek, 2011; Wolters & Rosenthal, 2000, p.802). This situation contributes to children's participation in scientific processes from an early age and to their hearing and using scientific language, as well as to their learning about the structure and functions of words and processes (Bluck, 2003, p.113; DeMarie, Norman, &

Abshier, 2000, p.241). This is of great significance in today's world, where science is rapidly advancing, for nurturing individuals interested in science.

From a cognitive perspective, the importance of introducing children to science and mathematics from an early age is emphasized in programs, and it is argued that the permanent learning of scientific concepts also develops attitudes and motivation towards science (Charlesworth & Lind, 2007). The pattern recognition skill acquired from an early age is among the precursor skills that form the foundation of success in science. To highlight the importance of pattern recognition, Steen (1990) defined mathematics as the "science and language of patterns." The National Council of Teachers of Mathematics (2000) has stated that patterns are the most fundamental subject of mathematics, recommending that preschool educational institutions work with children on simple repeating patterns. According to Fox (2005), arithmetic, geometry, metrics, and statistics knowledge are closely related to pattern recognition. Pattern recognition has been defined by Güven, Dibek, Bayındır, Saçkes (2019) as "a pattern can be defined as the arrangement of multiple elements according to a specific rule, and it is also considered a higher level of sequencing skill." (p. 549). Patterns vary in different forms and contexts, from carpet designs at home to building designs, from music rhythms to the games children play, and are frequently encountered in children's daily lives. Hence, research by Ginsburg, Lin, Ness & Seo (2003) in the United States early childhood education found that the most common mathematical activity for 4 and 5-year-olds during playtime was creating patterns. Clements & Sarama (2021) stated that in preschool and the early years of elementary school, children can copy, extend, and create simple patterns.

In the literature, patterns are commonly classified as repeating, expanding, and relational/spatial patterns (Mulligan & Mitchelmore, 2009, p.33-35; Sperry-Smith, 2012; p.149). This classification suggests that patterns can carry numerical or spatial characteristics based on their structure and can vary in complexity (Papic & Mulligan, 2005, p. 610; 2007, p. 592). During early childhood, children encounter repeating patterns (e.g., ABABAB) and expanding patterns (e.g., 2, 4, 6, 8), and these patterns are considered to be significant predictors of success in mathematics (Nguyen, Watts, Duncan, Clements, Sarama, Wolfe, 2016, p.560; Rittle-Johnson, Zippert, & Boice, 2019). The acquisition of pattern skills lays the foundation for children's understanding of more advanced mathematical concepts such as mathematical thinking, problem-solving, and generalization. At this point, Economopoulos (1998) proposed that "for generalization and prediction, children need to approach a pattern not as 'what comes next' but by analyzing the structure of the pattern, that is, by seeing it as composed of repeating units" (p. 230). Accordingly, patterns are among the essential skills that lay the groundwork for the development of mathematical thinking skills fundamental to generalization and abstraction. In conclusion, the development and evaluation of pattern skills during early childhood form the basis for children's mathematical thinking and reasoning abilities, essentially underpinning their cognitive development.

The preschool period is a critical stage in children's development, and foundational skills acquired during this phase, such as mathematical patterning abilities, significantly shape children's confidence and interest in mathematical topics. Research has demonstrated that children's motivation towards science is closely linked to their resilience in facing scientific challenges, their scientific achievements, and their interests (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005, p.397; Schunk, Pintrich, & Meece, 2008). In particular, studies conducted by Jacobs, Finken, Griffin, and Wright (1998); Simpkins, Davis-Kean, and Eccles (2006) have shown that children's motivation towards science is directly associated with their self-confidence in the field, their interest in it, and their future scientific careers and successes. However, the current literature suggests that these findings are predominantly related to children and adolescents in older age groups, and that research on the relationship between preschool children's motivation towards science and their patterning skills is considerably limited. This is noteworthy

considering the role of education and science in individuals' lives and the implications for national education quality and the future of scientific advancement.

An important point to be examined is the significance of gender in the relationship between motivation towards science and patterning. The perception of science as a field preferred by males and where they are deemed more competent (Andre, Whigham, Hendrickson & Chambers, 1999, p.720) underscores the importance of gender equality in early childhood education to ensure that girls are as competent and interested in science as boys (Wigfield, Battle, Keller, & Eccles, 2002, p.93). Although studies by Mantzicopoulos, Patrick, & Samarapungavan (2008) and Oppermann, Brunner, Eccles & Anders (2017), as well as Kesicioğlu (2013), suggest that there is no gender difference in terms of motivation towards science and patterning skills, research examining the impact of gender on these relationships during the preschool period is rare. This study aims to contribute to the knowledge base by investigating the effect of gender on the relationship between preschool students' motivation towards science and patterning. In this context, examining the relationship between preschool children's motivation towards science and their patterning skills can provide critical insights into how it might affect their interest in scientific processes and their success in these processes. Particularly, the early motivation towards science is significant in how it can influence children's attitudes towards science learning, their interests, and ultimately their academic achievements. This research can assist in better understanding the relationship between preschool children's motivation towards science, their self-efficacy perceptions in learning processes, and their academic achievements. Furthermore, it can offer significant insights into how science education should be designed for children in this period and what strategies should be followed to ensure that both girls and boys establish a positive relationship with science from an early age. Consequently, understanding this relationship and evaluating whether gender has an impact on it can contribute significantly to the development of interventions and strategies for science education in early childhood. From this perspective, the study aims to assess the relationship between the motivations towards science and mathematical patterning skills of children aged 60-72 months attending preschool education. To achieve the general objective of this study, the following questions have been explored.

1.What is the distribution of scores obtained by children aged 60-72 months from the Teacher Rating Scale of Children's Motivation for Science?

2.What is the distribution of scores obtained by children aged 60-72 months from the Preschoolers' Mathematical Patterning Skills Test?

3.Is there a relationship between the subscale and total scores of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months?

4.To what extent do the subscale scores of the Teacher Rating Scale of Children's Motivation for Science predict the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months?

5.Is there an effect of gender on the scores of children aged 60-72 months from the Teacher Rating Scale of Children's Motivation for Science and the Preschoolers' Mathematical Patterning Skills Test?

2. Method

In this section, information regarding the research design, population and sample, data collection instruments, data collection process, and data analysis is provided**.**

2.1. Research Design

This study aimed to examine the relationship between the motivation towards science and pattern skills among children aged 60-72 months. Therefore, a correlational research design, a quantitative research method, has been employed. The correlational research model not only

explains the relationship between variables but also contributes to making predictions about the predictor variables (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2018, p.16). An ethical approval document was obtained from the Afyon Kocatepe University Scientific Research and Ethics Committee, under the decision number 143312 dated November 29, 2022, indicating that there were no ethical concerns regarding the conduct of the study. The research was conducted in accordance with the Declaration of Helsinki, and necessary permissions for conducting the study were obtained. Parents of children attending preschool education were informed about the purpose of the study, and consent forms were collected from them before conducting the research.

2.1. Participants

The accessible population for this study consists of children aged 60-72 months attending kindergartens and preschool classes under the Ministry of National Education in the city center of Afyonkarahisar during the 2022-2023 academic year. According to data obtained from the Afyonkarahisar Provincial Directorate of National Education, approximately 4,800 children aged 60-72 months attending kindergartens and preschool classes constitute the study's accessible population. The sample was determined through a random sampling method from the accessible population. In the process of determining the sample, the first step involved acquiring a list of preschools and schools with kindergarten classes from the Provincial Directorate of National Education. Classes were then selected through a random sampling method, and all children within these classes who were showing normal development were included in the sample. Using this sampling method, a total of 414 children from 25 kindergarten classes were included in the sample. In this study, the confidence level for the sample to represent the population was set at 95%, and access was achieved to 414 children (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2018, p.96). After deleting missing data from the data collection tool 401 children were included in the sample group. Children from kindergartens and preschool classes with low, medium, and high levels obtained from the Afyonkarahisar Provincial Directorate of National Education were randomly selected to represent all three levels (Baştürk & Taştepe, 2013, p.131).

When examining the demographic characteristics of the children participating in the study; it was found that 54.1% (n=217) of the participants were girls and 45.9% (n=184) were boys; 30.6% (n=123) of the mothers had primary or middle school education, 24.9% (n=100) had high school education, 39.7% (n=159) had university education, and 4.7% (n=19) had postgraduate education; 23.4% (n=94) of the fathers had primary or middle school education, 26.7% (n=107) had high school education, 41.9% (n=168) had university education, and 8.0% (n=32) had postgraduate education.

2.2. Data Collection Instruments

To collect data about the children and their families, a "General Information Form" prepared by the researcher was used in the study. To determine the children's motivation towards science, the "Teacher Rating Scale of Children's Motivation for Science," developed by Patrick and Mantzicopoulos (2008) for measuring motivation towards science and adapted for Turkish children by Bulut Öngen and Ersay (2022), and the "Preschoolers' Mathematical Patterning Skills Test" developed by Güven et al., (2019) to measure children's patterning skills, were employed as data collection tools.

2.2.1. General Information Form:

The researcher developed this questionnaire to collect data on children and their families. It features queries aimed at obtaining details about the children' gender, age, and parents age and educational background. With the families' consent, general information sheets were completed for every child, utilizing data from the personal development records kept at their schools.

2.2.2. "Children's Motivation Towards Science: Teacher Assessment Scale:

Developed by Patrick and Mantzicopoulos (2008) to assess motivation towards science in early childhood, this instrument relies on teacher observations with a separate form filled out for each child. To evaluate a child's motivation towards science, teachers use a 5-point Likert scale (5=very much, 3=moderately, 1=very little). Exploratory factor analysis (EFA) conducted to reveal the original structure of the scale determined that it consists of two subscales. The first subscale is "Interest in Learning Science," and the second is "Independence Versus the Need for Support for Learning Science."

Interest in Learning Science: This subscale aims to uncover how much children are interested in science, with questions like "How much interest do they show in science subjects?" or "How often do they ask questions while doing something related to science?" consisting of a total of seven items. The original Cronbach's Alpha value for this subscale is .92.

Independence Versus the Need for Support for Learning Science: This subscale assesses children's independence during science learning with questions such as "How much do they need your support while doing something related to science?" or "How much do you need to praise or encourage the child while working on science-related activities?" consisting of a total of seven items. The original Cronbach's Alpha value for this subscale is .93.

In the adaptation study of the scale for Turkish children by Bulut Öngen and Ersay (2022), the Confirmatory Factor Analysis (CFA) results showed that factor loadings varied between 0.77 and 0.91 for the "Interest in Learning Science" subscale, and between 0.49 and 0.85 for the "Independence Versus the Need for Support for Learning Science" subscale. The calculated Cronbach's Alpha coefficients for both subscales were 0.95 and 0.89 respectively, while the Omega coefficients were 0.95 and 0.88 respectively. Accordingly, the measurement tool is deemed valid and reliable.

2.2.3. Preschoolers' Mathematical Patterning Skills Test (Long Form):

The "Preschoolers' Mathematical Patterning Skills Test" developed by Güven et. al., (2019) consists of 26 items. The test is divided into several subscales including Copying 1 item (K1), Transformation 4 items (D1, D2, DE, D4), Finding the Missing Part 4 items (E1, E2, E3, E4), Extending 4 items (U1, U2, U3, U4), Expanding 4 items (G1, G2, G3, G4), Hopscotch Extending 1 item (US1), Finding the Smallest Unit 4 items (BB1, BB2, BB3, BB4), and Pattern Creation 4 items (OO1, OO2, OO3, OO4).

The test kit comprises a booklet with instructions for the administrator, a booklet containing pattern-related visuals for the child, and an individual test score sheet. Additionally, various colored cubes, pictures of different objects, and various geometric shapes are provided for the children to use as materials while answering the pattern questions. The items in the test are arranged in increasing order of difficulty, from simple to complex. The test is administered individually to each child in a quiet environment without distractions. Before starting, the administrator sits face to face with the child, with only the materials related to the test item placed on the table. Each item and the corresponding materials are directed to the child. The responses given by the children to the questions are scored as correct or incorrect, taking into account the scoring criteria set for each question.

According to validity and reliability analyses, the 26 items in the test have an MSNQ value below 2, indicating appropriate internal and external values. The difficulty values (item measure) of the items in the test vary between -4.64 and 3.17. These results indicate that the instrument consisting of a total of 26 items is compatible with the Rasch Model. The Item Separation Index calculated for the Pattern Test is 5.07, and the Person Separation Index is 2.04. The test's person reliability coefficient is calculated as 0.81, and the item reliability coefficient as 0.96. The K-R20 reliability coefficient is found to be 0.86. These results suggest that the scores

obtained from the Preschoolers' Mathematical Patterning Skills Test have an acceptable level of reliability.

2.3. Data Collection

Following the acquisition of necessary permissions from the Afyonkarahisar Provincial Directorate of National Education and the approval of ethics and data collection tools, training sessions on both data collection instruments were conducted prior to their implementation. Specifically, pilot implementations were carried out on five children before administering the Preschoolers' Mathematical Patterning Skills Test. The Preschoolers' Mathematical Patterning Skills Test was administered by researchers in accordance with the scale application rules. To gather the children's attention and ensure their motivation, the test was conducted face-to-face in a quiet room, separate from educational settings, on tables and chairs suitable for children. Since the Teacher Rating Scale of Children's Motivation for Science needed to be filled out based on the observations of the children's teachers, information regarding the scale was provided to the teachers of the sampled children. The scale was filled out as a separate form for each child based on teacher observations. The data were collected between November and March of the 2022-2023 academic year. Prior to the implementation, it was clarified that participation in the study was not compulsory, ensuring that the research group consisted solely of volunteers.

2.4. Data Analysis

In this study, descriptive statistics such as frequency and percentage were used to evaluate the demographic characteristics of the children. The normality distribution of the scores obtained from the data collection tools, Multicollinearity, and outlier tests were conducted. Skewness and kurtosis coefficients were utilized to assess the suitability of the test scores for normal distribution. The skewness and kurtosis coefficients lying between +1.96 and -1.96 indicate that the data are normally distributed (Tabachnick & Fidell, 2007). It was determined that all variables in the study had skewness and kurtosis coefficients within this range.

The study provided mean and standard deviation values for the scores obtained from the Children's Motivation Towards Science: Teacher Assessment Scale and the Preschoolers' Mathematical Patterning Skills Test. The Pearson Correlation Test was conducted to determine the relationships between these tests. The results of the relationship analyses were evaluated according to the explanations of Pearson correlation test by Köklü, Büyüköztürk, & Bökeoğlu (2006). Furthermore, Multiple Regression Analysis was applied to examine the predictive power of children's motivation towards science on their patterning skills. Multicollinearity becomes a problem when the correlation coefficient between independent variables exceeds 0.80. Additionally, the variance inflation factor (VIF) for multicollinearity should be examined and the obtained value should be less than 10. A Cook's distance value of less than 1 indicates that outliers do not significantly affect the analyses (Pituch & Stevens, 2016, p.113). Since the Cook's distance values in the dataset ranged from 0 to 0.039, it was observed that outliers did not have a significant impact. The effect of gender on children's motivation towards science and patterning skills was analyzed using one-way MANOVA. One-way multivariate analysis of variance (one-way MANOVA) is used to determine whether multiple dependent variables vary between the groups of an independent variable (Balcı & Ahi, 2016, p.312). If the significance values meet the condition of $p \leq 0.05$, it is considered that there is a statistically significant relationship or difference on the subject, and determinations related to this are made.

3. Results

This section presents the findings and interpretations resulting from the statistical analysis of the data obtained through the application of data collection tools. The findings obtained for each research problem are displayed in tables and interpreted.

What is the distribution of scores obtained by children aged 60-72 months from the Teacher Rating Scale of Children's Motivation for Science?

Table 1. Mean, standard deviation, minimum, and maximum values for children's scores on the subscales and total scale of the Teacher Rating Scale of Children's Motivation for Science

Teacher Rating Scale of Children's Motivation for Science	$\bar{X}$	SD	Min	Max
İnterest in Learning Science	25,50	5,34	12,00	35,00
Independence Versus the Need for Support for Learning Science	22,42	5,67	8,00	35,00
Teacher Rating Scale of Children's Motivation for Science	47,92	9,54	25,00	70,00

Upon examining Table 1, it is observed that the mean scores of participants aged 60-72 months on the Interest in Learning Science subscale of the Teacher Rating Scale of Children's Motivation for Science are ($\bar{X}$ =25,50) with a standard deviation of (SD±5.34; the mean scores on the Independence Versus the Need for Support for Learning Science subscale are ($\bar{X}$=22.42) with a standard deviation of (SD=±5.67); and the mean scores on the total Teacher Rating Scale of Children's Motivation for Science are ($\bar{X}$=47.92) with a standard deviation of (SD=±9.54). Considering that the lowest possible score from the subscales is 7 and the highest is 35, it has been determined that the scores of children aged 60-72 months on the Interest in Learning Science dimension are above average, while scores on the Independence Versus the Need for Support for Learning Science dimension are below average. Given that the lowest possible total score on the Teacher Rating Scale of Children's Motivation for Science is 14 and the highest is 70, it can be said that the overall scale score is above the average.

What is the distribution of scores obtained by children aged 60-72 months from the Preschoolers' Mathematical Patterning Skills Test?

Table 2. Mean, standard deviation, minimum, and maximum values for children's scores on the Preschoolers' Mathematical Patterning Skills Test

Pattern Skill	$\bar{X}$	SD	Min	Max
Preschoolers' Mathematical Patterning Skills Test - Total Score	19,16	4,96	8,00	26,00

Upon examining Table 2, it is observed that the mean scores of the participants sampled from the Preschoolers' Mathematical Patterning Skills Test are ($\bar{X}$=19.16) with a standard deviation of (SD=±4.96). Considering that the lowest possible score on the Patterning Skills Test is 0 and the highest is 26, it can be stated that the average scores of the participants on the Preschool Patterning Skills are above the mean by 0.5 standard deviations.

Is there a relationship between the subscales and total score of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months?

Table 3. Results of the Pearson Correlation Test between the subscales and total score of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test

Variables	1	2	3	4
1. Interest in Learning Science	-	,498*	,857*	,509*
2. Independence Versus the Need for Support for Learning Science	,498*	-	,874*	,329*
3.Teacher Rating Scale of Children's Motivation for Science – Total Score	,857*	,874*	1	,481*
4. Preschoolers' Mathematical Patterning Skills Test - Total Score	,509*	,329*	,481*	1

*p<0.5

As indicated in Table 3, a positive moderate correlation was observed between the Interest in Learning Science subscale and the Independence Versus the Need for Support for Learning Science subscale of the Teacher Rating Scale of Children's Motivation for Science (r=.498;p<.01). A positive, linear, and high-level relationship was identified between the Interest in Learning Science subscale and the total score of the Teacher Rating Scale of Children's Motivation for Science (r=.857;p<.01). A positive moderate relationship was detected between the Interest in Learning Science subscale of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test (r=.509;p<.01). A positive, linear, and high-level correlation was observed between the total score of the Teacher Rating Scale of Children's Motivation for Science and its Independence Versus the Need for Support for Learning Science subscale (r=.874;p<.01). A positive moderate relationship was determined between the Independence Versus the Need for Support for Learning Science subscale of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test (r=.329;p<.01). Lastly, a positive moderate relationship was found between the total score of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test (r=.481;p<.01).

To what extent do the subscales and total score of the Teacher Rating Scale of Children's Motivation for Science predict the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months?

Table 4. The predictive power of the subscales and total score of the Teacher Rating Scale of Children's Motivation for Science on the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months

Variables	B	Std Error β	B	t	p	Zero-order	Partial
Constant	6,314	1,109		5,691	,000		
İnterest in Learning Science	,426	,046	,458	9,257	,000	,509	,421
Independence Versus the Need for Support for Learning Science	,088	,043	,101	2,036	,042	,329	,102
R=,516 R^2=,266 $F_{(2,398)}$=72.263 p=.000							

As seen in Table 4, the regression equation established between the subscales of the Teacher Rating Scale of Children's Motivation for Science and mathematical patterning skills is significant, with the Interest in Learning Science and Independence Versus the Need for Support for Learning Science dimensions being significant predictors (R=,516 R^2=,266 $F_{(2,398)}$=72.263 p=.000). These variables explain approximately 26.6% of the total variance in Preschoolers' Mathematical Patterning Skills Test scores. Additionally, an increase in the Interest in Learning Science subscale and an increase in the Independence Versus the Need for Support for Learning Science dimension are observed to cause an increase in the Mathematical Patterning Skills scores.

Is there an effect of gender on the motivation towards science and Preschoolers' Mathematical Patterning Skills in children aged 60-72 months?

Table 5: Results of the One-Way MANOVA Test on the Effect of Gender on the Teacher Rating Scale of Children's Motivation for Science and Preschoolers' Mathematical Patterning Skills Scores in children aged 60-72 month

Dependent Variables	Gender	N	$\bar{X}$	DF	F	p
Teacher Rating Scale of Children's	Female	217	47,839	1	,041	,840
	Male	184	48,033			
Preschoolers' Mathematical Patterning Skills – Total Score	Female	217	19,253	1	,160	.690
	Male	184	19,054			

p>.05

Upon examining Table 5, it was observed that there is no significant difference in the mean scores on the Teacher Rating Scale of Children's Motivation for Science and the Preschoolers' Mathematical Patterning Skills Test between children aged 60-72 months of different genders (p>.05). Accordingly, it can be said that gender does not have an effect on the scores of the Teacher Rating Scale of Children's Motivation for Science and the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months.

4.Discussion

The preschool period is a critical phase where children explore their environment with curiosity and engage in scientific inquiries. During this time, children acquire knowledge about the natural world through their daily experiences, learn fundamental scientific concepts, and

develop positive attitudes towards science (Kandır et. al., 2012, p.6). Motivation is at the heart of this learning process, enhancing children's interest and participation in scientific activities (Guay et al., 2010, p.712; Ryan & Deci, 2000, p.54). This study aims to address preschool children's motivation towards science and its relationship with mathematical patterning skills, presenting significant findings on the importance of scientific education at early ages.

In the study, the distribution of scores obtained by children aged 60-72 months from the Teacher Rating Scale of Children's Motivation for Science is first examined, revealing that children score above average on the Interest in Learning Science and Independence Versus the Need for Support for Learning Science subscales. These results indicate that children generally have a high interest in and motivation towards science. Additionally, the study finds that children also score above average on the total Teacher Rating Scale of Children's Motivation for Science, suggesting a high overall motivation towards science among children. When comparing these findings with the academic literature, studies by Mantzicopoulos et al. (2008) and Marsh, Ellis, & Craven (2002) have reported that children display positive attitudes towards learning science, perceive themselves as competent in science learning, enjoy it, and find it easy. Opperman (2017) and Opperman et al. (2019) have highlighted that preschool children are highly motivated towards scientific studies and begin to develop their initial beliefs about science, considering these beliefs as significant precursors to their future motivation to pursue science. The results of this research align with other findings in the literature, indicating that children's motivation and interest towards science are positively shaped from a very young age, and these positive attitudes play a crucial role in the process of learning science.

In the second sub-problem of the research, the distribution of scores obtained by children aged 60-72 months from the Preschoolers' Mathematical Patterning Skills Test has been examined. The average scores obtained from this test, considering the possible lowest and highest scores of the scale, indicate that the average is above 0.5 standard deviations. This result signifies that the children's patterning skills are generally at a good level. However, when compared with the results of studies conducted by Papic (2015) and Kesicioğlu (2013), it emerges that skills in this area need to be examined from a more detailed perspective. In the study by Papic (2015), the abilities to copy visible patterns and recreate patterns using visual memory to evaluate the pattern-based problem-solving abilities of indigenous and/or children from low socioeconomic backgrounds were examined. The results indicate that children possess various patterning skills. The study by Kesicioğlu (2013) investigated preschool children's abilities to create patterns with objects by looking at a model, complete an object missing in a pattern, and create an original pattern with objects. The findings suggest that children face some difficulties in acquiring these skills, particularly making mistakes in creating patterns with objects by looking at a model and in creating an original pattern with objects. The results of these two studies, when combined with the findings of the research, suggest that the patterning skills of preschool children vary. The development of patterning skills being contingent on the acquisition of comparison and sequencing skills (NCTM, 2000), and the reflection of deficiencies in other mathematical skills on patterning skills could be the reason for this variability. Given that patterning skills form the foundation of mathematical thinking and problem-solving abilities (Fox, 2005), strengthening these skills in the early stages can contribute to the overall development of children's mathematical abilities. Therefore, it is critically important for educators to focus on activities and methods that will develop children's patterning skills, ensuring that children acquire these fundamental skills.

In the third sub-problem of the study, the relationship between the subscales and total score of the Teacher Rating Scale of Children's Motivation for Science and the total score of the Preschoolers' Mathematical Patterning Skills Test for children aged 60-72 months was investigated. In the fourth sub-problem, the extent to which the Interest in Learning Science and Independence Versus the Need for Support for Learning Science subscales predict the Preschoolers' Mathematical Patterning Skills was examined. Upon reviewing the findings of the

third and fourth sub-problems, it is evident that there are positive and significant relationships between the Interest in Learning Science and Independence Versus the Need for Support for Learning Science subscales and the Preschoolers' Mathematical Patterning Skills Test. These relationships are of a moderate level, and a positive and moderate relationship was also identified between the total score of the Teacher Rating Scale of Children's Motivation for Science and the total of the Preschoolers' Mathematical Patterning Skills Test. Furthermore, according to the fourth sub-problem, the Interest in Learning Science and Independence Versus the Need for Support for Learning Science dimensions significantly predict the scores of the Preschoolers' Mathematical Patterning Skills Test, explaining approximately 26.6% of the total variance.

While research in the literature, especially with preschool children on these sub-problems, is quite scarce, studies by Mantzicopoulos et al. (2008), Edens and Potter (2013), Sing, Granville, and Dika (2002), and Simpkins et al. (2006) support the positive effects of concepts such as motivation, attitude, and academic engagement on mathematics and science achievement. These studies demonstrate that children's love for science and belief in their competence in this subject are significantly associated with academic success. Moreover, motivation and interest in mathematics are related to children's mathematical skills, and young people's participation in mathematics and science activities predicts their expectations and values. The findings of this study, in harmony with the literature, indicate that motivation and interest towards science can significantly support the development of children's mathematical patterning skills. This relationship has the potential to enhance children's overall academic success and highlights the importance for educators to develop strategies aimed at increasing children's motivation and interest towards science.

In the fifth sub-problem of the study, the effect of gender on the Teacher Rating Scale of Children's Motivation for Science and Preschoolers' Mathematical Patterning Skills in children aged 60-72 months was examined. The findings indicate that gender does not have a significant effect on these two areas. This result suggests that children's motivation towards science and mathematical patterning skills can develop independently of gender. In the literature on this subject, a study by Patrick and Mantzicopoulos (2014) revealed that boys and girls show equal interest in science subjects. A meta-analysis by Baysal, Mutlu, and Nacaroğlu (2023) determined that gender has an insignificant effect on motivation towards learning science. Although studies by Mantzicopoulos et al. (2008) and Leibham et al. (2013) presented varying findings regarding the effects of gender on science motivation and interest, they generally indicate that gender is not a determining factor in these areas. Research by Herbert and Stipek (2005), Opperman et al. (2017), and Ersay and Bulut Öngen (2021) also supports that gender does not significantly affect children's perceptions of mathematical ability and motivation towards science. The findings of the research indicate that gender does not have a significant impact on the motivation towards science and mathematical patterning skills of children aged 60-72 months. These results highlight the importance for educators and policymakers to implement initiatives that provide equal opportunities for supporting the scientific and mathematical skills of all children.

5.Conclusion and Recommendations

This research comprehensively examines the motivation towards science and mathematical patterning skill levels of children aged 60-72 months, the relationship between these scales, the extent to which the Interest in Learning Science and Independence Versus the Need for Support for Learning Science sub-dimensions predict Preschool Mathematical Patterning skills, and the impact of gender on these scale scores. The findings demonstrate that children's motivation towards science shows positive and significant relationships with mathematical patterning skills and significantly predicts children's mathematical patterning abilities. Furthermore, it was found that gender does not have a significant effect on children's motivation towards science and their mathematical patterning skills. These results indicate that children's motivation for scientific subjects contributes to the development of pattern skills and that this process is independent of gender.

Among the limitations of the research is the reliance on teacher observations for evaluating children's motivation towards science, which introduces the possibility of subjective interpretations influencing the results. In light of the findings and limitations of the research, activities should be organized to support children's motivation towards science and their mathematical patterning skills. Furthermore, considering the varied results in the existing literature, studies should be conducted to examine in more detail the effects of gender on children's motivation towards science and their mathematical patterning skills. Lastly, it is recommended that the findings of this research be replicated with different regions and larger sample groups to generalize the results. By doing so, the relationships between children's motivation towards science and their mathematical patterning skills can be understood from a broader perspective.

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No:143312

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