Families' Role in Guiding Children Toward Science and Children's Perception of Science

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Abstract: This study aims to investigate how families guide their children toward science and how children perceive science within a holistic framework. The research used a mixed methods approach. Using criterion and convenience sampling, 168 parents with preschool-aged children participated in the study. For the qualitative part of the research, the study group included 11 families with children aged 3-6 years. Three different data collection instruments were used. A 5-point Likert scale was used for quantitative data collection, while a researcher-developed semi-structured interview form and children's drawings were used for qualitative data collection. The study found that families' efforts to engage children in science varied significantly based on the level of education and the child's age. In addition, the extent of these family efforts had a significant impact on children's perceptions of science. Therefore, it is recommended that families engage in science activities with their children at home, outdoors, or in other settings and encourage their children to use scientific process skills such as reasoning, inquiry, and observation.

Keywords: Science, preschool period, family orientation, science capital

Ailelerin Çocukları Bilime Yönlendirmeleri ve Çocukların Bilim Algısı

Öz: Bu araştırmada okul öncesi dönem çocuğu olan ailelerin çocukları bilime yönlendirme düzeyleri ile çocukların bilim algısının bütüncül bir çerçevede incelenmesi amaçlanmıştır. Araştırma karma yöntem kullanılarak yürütülmüş, bu bağlamda nicel ve nitel verilere araştırma içerisinde yer verilmiştir. Bu kapsamda ölçüt ve ulaşılabilir örneklem yöntemleri kullanılarak üç farklı çalışma grubu belirlenmiştir. Nicel çalışma grubu, okul öncesi dönem çocuğu olan 168 ebeveynden oluşmaktadır. Nitel çalışma grubunda ise 11 ebeveyn ve 3-6 yaş aralığında 11 çocuk yer almaktadır. Araştırmada üç farklı veri toplama aracı kullanılmıştır. Nicel veri toplama aracı olarak 18 maddeden oluşan bir ölçek kullanılmıştır. Nitel veri toplama aracı olarak ise araştırmacı tarafından geliştirilen yapılandırılmış görüşme formu ve çocuklardan elde edilen çizimler kullanılmıştır. Analizlerin sonucunda ailelerin çocukları bilime yönlendirme düzeylerinin eğitim düzeyi ve çocuk yaşı değişkenlerine göre anlamlı farklılık gösterdiği ve ailelerin çocukları bilime yönlendirme düzeylerinin çocukların bilim algısı üzerinde önemli bir etkiye sahip olduğu belirlenmiştir. Bu bağlamda aileler evde, dışarıda ya da herhangi bir ortamda çocukla beraber bilimsel etkinlikler yapmalı, çocukları düşünme, araştırma, gözlem yapma gibi bilimsel süreç becerilerini kullanmaya yönlendirmelilerdir.

Anahtar kelimeler: Bilim, okul öncesi dönem, aile yönlendirmesi, bilim algısı

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Introduction

In today's era of rapid advancement and change, the need for continuous progress has elevated the global importance of science and fostered widespread scientific awareness. Science is recognized as a key driver of societal progress, capable of facilitating development and change (Burke et al., 1985). The proper understanding, application, and communication of scientific knowledge is critical now and will remain so in the future, as it has been throughout history. Thus, developed and developing countries need individuals who can accurately understand and apply scientific knowledge (Saraç, 2012). Therefore, countries are investing in the development of scientifically literate citizens and increasing their scientific acumen (Archer et al., 2021). Establishing a strong foundation in the early years is essential to cultivating these individuals (The World Bank, 2020).

In early childhood, children are naturally inclined to question, analyze, investigate, and explore everything around them (NRC 2007, 2012, 2013). The extent to which a child can explore and learn, and the rate at which they do so, is strongly influenced by the supportiveness of their environment and the opportunities available to them (Archer et al., 2012). Nurturing these traits in children, who have an innate curiosity and eagerness to learn, through their social environment helps them develop scientifically and form an early perception of science (Joyce et al., 2016). Every emotion thought, and behavior a person acquires in early childhood shapes their understanding and lifestyle later in life. Therefore, the early childhood years are critical for effective and high-quality learning in science, as in other fields. Children who are exposed to science in their early years will develop positive attitudes toward science and improve their scientific process skills as they grow older (Caspi et al., 2020).

To cultivate individuals capable of understanding, using, and communicating scientific knowledge, it is essential to provide education and support that encourages inquiry and discovery, promotes creativity, emphasizes active learning, and integrates scientific process skills from an early age (Brooks, 1996). The family, as the initial provider of this critical education and support and as the child's first social environment, plays a central role. Numerous studies (e.g., Raynal et al., 2021; Munn et al., 1969) show a strong correlation between the attitudes of parents and children. It is crucial for families to support children in using scientific process skills and to use these skills themselves in everyday life to foster children's scientific understanding (Aktamış et al., 2008). The daily conversations between adults and their children provide a wealth of information that helps children learn about the physical, natural, and psychological world (Beals, 2001; Callanan and Jipson, 2001; Crowley et al., 2001; Crowley and Jacobs, 2002). With this supportive guidance, these young, inquisitive minds, naturally inclined to observe, investigate, and experiment, can develop into true scientists (Çavuş Güngören, 2019).

There are numerous studies in different fields related to science in early childhood. These can be categorized into several areas: perceptions of scientists and science (e.g., Andersson and Gullberg, 2012; Güler and Akman, 2006), acquisition of scientific process skills in early childhood (e.g., Büyüktaşkapu et al., 2012), activities or infrastructure for science education in the classroom (Akman et al., 2017; Ceylan et al., 2015); and parent-child relationships related to science (Tenenbaum and Leaper, 2003). However, studies that focus on parent-child relationships in the context of early science education are less common. One notable study in this area, conducted by Tenenbaum and Callanan (2008), analyzed the science conversations of 40 parents of Mexican origin living in the United States and their children. The study found that parents with higher levels

of education provided more causal explanations, scientific principles, and encouraging explanations than those with primary education. When discussing science at home, the higher-education group used more encouraging concepts than the lower-education group. Another study by Goldman et al. (2020) examined family science experiences by providing opportunities to engage in inquiry-based approaches to science learning. They found that some families tended to solve a problem immediately when children encountered it.

In contrast, some parents encourage their children to solve problems, investigate, and explore on their own. This approach revealed that parents themselves have a considerable amount of knowledge and curiosity as science learners and educators, creating a rich learning environment for their children. Another study by Fragkiadaki and Ravanis (2021) examined the integration of science into daily routines, focusing on the interplay of reason, emotion, and action in a child's science learning and development. They found that children develop their understanding of natural phenomena through cognitive, emotional, and physical experiences in their daily educational environment, shedding light on the nature and qualities of science learning in early childhood (Fragkiadaki and Ravanis, 2021).

Previous research has mainly focused on children's scientific process skills (Andersson and Gullberg, 2012; Büyüktaşkapu et al., 2012) and perceptions of scientists (e.g., Güler and Akman, 2006; Ayvacı et al., 2016; Akman et al., 2017). Recently, there has been an increased focus on the role of family and environment in science education. For example, Archer et al. (2015) explored the factors that influence the development of students' science capital, noting that career choices begin to form in childhood and continue until around the age of 16. Additionally, Ceylan, Kahraman, and Ülker (2015) examined how well teachers and mothers understood and guided children's scientific curiosity, categorizing interests into eight areas: earth, sky, subterranean, underwater, animals, plants, space, and machines. The study found that many mothers were unaware of their children's curiosity about the world, which included interests in celestial bodies, underwater and subterranean creatures, different types of animals, planetary and space conditions, plant growth, and how machines work. In a 2008 study, Tenenbaum and Callanan observed 40 Mexican-origin parents in the United States to understand their children's science-related discussions. The parents were divided into two groups based on their level of education and were videotaped interacting with science exhibits in a museum and at home. The results showed that parents with higher levels of education provided more causal, scientific, and encouraging explanations than those with lower levels of education. While these studies highlight childhood experiences, there is a gap in the literature regarding families' orientations of preschool children toward science, the interplay between family orientations and children's perceptions of science, and the use of scientific skills in everyday life from a comprehensive perspective. The OECD's 2030 Learning Compass (2019) highlights the importance of fostering continuous scientific development and education and emphasizes the crucial role of families in this process. This study aims to identify the practices families use to build their children's science capital, and the relationship between these practices and children's perceptions of science, which lays the foundations for science capital (PISA, 2024). In this context, this research focuses on examining how families guide their preschool children toward science and how these children perceive science and aim to fill gaps in the literature, raise awareness among families about science education and guidance, and provide valuable insights for researchers and educators interested in this area.

Method

Research Design

This study, which aims to comprehensively examine families' guidance of children toward science and children's perceptions of science, used an explanatory design, a type of mixed research method. An explanatory design aims to collect qualitative data to support and enhance the quantitative data collected (Fraenkel et al., 2012). First, a scale was administered to families to assess how they guide their children toward science. Interviews were then conducted with the families and children, and the data were analyzed holistically. Mixed methods research combines qualitative and quantitative data, allowing for a deeper exploration and explanation of the relationships between variables (Fraenkel et al., 2012). In this study, the focus was not solely on the family or the child, but on the dynamic between the two in children's science orientation. Since the role of the family in this orientation was a central aspect of the research, the family dimension was included in the study design. However, considering only the family dimension without understanding its impact on the child would be incomplete. Therefore, data from the children were also included to provide a multidimensional perspective to answer the research questions. This comprehensive approach led to the choice of this mixed method.

Participants

The quantitative part of the study involved 168 parents of preschool children living in the Province of Kastamonu during the period 2020-2021. The qualitative part included 11 parents and their children. A criterion sampling method was used to ensure that the families included had children aged 3-6 years. In addition, convenience sampling was used to facilitate easy access to participants for qualitative data collection. The demographic characteristics of the parents and children who participated in the study are detailed in Table 1.

Table 1
Demographic Characteristics of the Quantitative Study Group

Variables		Frequency
Gender	Female	147
	Male	21
	Total	168
Age	18-25	13
	26-30	42
	31-39	95
	40 and above	18
Education Level	Primary School	10
	Secondary School	18
	High School	44
	Associate degree	29
	Undergraduate and above	67
Child's Age	3	21
	4	29
	5	60
	6	58

Number of Children	1	63
	2	67
	3 and above	38

According to the data in Table 1, most of the parents who participated in the study were mothers. The majority of participants were between the ages of 31 and 39. In terms of education, over 50% of the group had either a Bachelor's degree or at least an associate degree. During the qualitative research process, detailed information about the participants was provided to better interpret the data collected. At this stage, only parent information was collected. Pseudonyms were used to protect the identity of the participants and to enhance the readability of the data. The demographic characteristics of the parents who participated in the qualitative dimension of the study are presented in Table 2.

Table 2
Detailed Profiles Of The Participants For The Qualitative Dimension

Code	Details
Arya	A 32-year-old woman with a Ph.D. is currently working in her field. She has a 5-year-old daughter.
Ezgi	A 35-year-old woman with a Master's degree (non-thesis) is currently employed. She has two sons, ages 6 and 2.
Büşra	A 36-year-old woman with a Ph.D. is currently working in her field. She has a 6-year-old daughter.
Esra	A 30-year-old woman with a Bachelor's degree is currently not working. She has a 6-year-old daughter.
Ayşe	A 46-year-old woman with a Ph.D. and an associate professorship in psychology is actively working. She has 6-year-old twin boys.
Şeyma	A 32-year-old woman with a bachelor's degree in economics is currently employed. She has a 5-year-old daughter.
Duygu	A 37-year-old woman and she is actively working as a forestry engineer. She has two boys aged 5 years and 8 months.
İbrahim	A 43-year-old man with a Ph.D. and he is actively working. He has two sons, aged 5 and 14.
Burcu	A 38-year-old woman with a bachelor's degree and she is currently working. She has a 5-year-old son.
Merve	A 31-year-old woman with a bachelor's degree. She has a 4-year-old daughter.
Neşe	A 34-year-old woman with a bachelor's degree in science education and she is currently employed. She has a 4-year-old daughter.

Data Collection

Four data collection tools were used to collect the quantitative and qualitative data for this study: a demographic information form, the Families' Guidance in Children's Engagement with

Science Scale, a structured interview form, and a mind map. In the quantitative phase, the demographic information form and the Families' Guidance in Children's Engagement with Science Scale, developed by Bal and Kaya (2022), were used. The demographic information form, designed by the researcher, collected general information about the parents and their children, including questions about the parents' gender, age, education level, child's age, and number of children, which was filed by the families. The 18-item scale developed by Bal and Kaya (2022) assesses the level of family orientation toward science in three dimensions: "Practical Applications (Activities and Experiments)", "Introduction to Science" and "Building Scientific Foundations". This scale has demonstrated validity and reliability, with a Cronbach's alpha reliability coefficient of .91. The reliability coefficients for the sub-scales were 0.83 for Practical Applications, 0.92 for Introduction to Science, and 0.88 for Building Scientific Foundations. The corrected item-total correlation values range from .34 to .74, and the comparison of the scores of each scale item with the lower and upper group independent samples t-tests showed significant results ($p<.01$). In the initial phase of the research, this scale was used to determine the level of parents' orientation of their children toward science. Subsequently, 11 participants were selected from those who completed the scale for the qualitative dimension of the study using the convenience sampling method.

In the qualitative phase of the study, a 6-question structured interview form designed by the researcher was first administered to the families. These interview questions were designed to align with the items on the scale used to assess how families orient their children to science and expert feedback was obtained to refine the form. The purpose of the interviews was to assess the families' level of guiding their children toward science and to explore the topic in greater depth. Families were given time to answer the questions in the form thoughtfully and comprehensively to ensure that they felt comfortable and relaxed during the process. In the second part of the qualitative study, a picture mind map was used to interview one preschool child from each of the 11 participating families. This method was designed to uncover children's perceptions of science. During the drawing activity, children were asked questions such as "What comes to your mind when you think of science?" and "What do you think science is?" They were then asked to draw their thoughts, revealing their mental images of science. To facilitate clear communication and expression, children aged 3-6 years were selected for this activity. While the children were given sufficient time to complete their drawings, the duration was kept short to capture their immediate concepts. After the drawings were completed, a discussion of the drawings ensued, with the researcher taking notes on the children's explanations. In addition to the drawings, the children's concepts of science were also documented.

Data Analysis

This research used a mixed methods approach, integrating both quantitative and qualitative data analysis techniques. Initially, the data were cleaned by outlier and missing data analysis. Following these adjustments, a normality test was performed to assess whether the data followed a normal distribution, which is critical for subsequent analyses. After confirming normality, a one-way analysis of variance (ANOVA) was used to examine the data, with post hoc tests performed as needed. One-way ANOVA was chosen because it compares means across multiple groups, such as variations in number of children, parental education level, and child age, and meets the assumptions of normality, equal variance, and independence (Judd et al., 2008). The purpose of this test was to identify any similarities or differences in the way families engage their children in science based on these variables. Content analysis was used to analyze the qualitative data. The

purpose of content analysis is to organize similar data into specific themes and uncover concepts and relationships that elucidate the collected data (Çepni, 2014). (Çepni, 2014). In this study, the data were coded and categorized into relevant themes for interpretation.

Findings

In this section, the results were analyzed according to the objectives of the study and are presented under three main headings. First, the findings from the families were examined. Next, the findings from the children were analyzed. Finally, the relationship between families' efforts to engage their children in science and children's perceptions of science was explored.

Findings Obtained from Families

This section discusses separately the quantitative and qualitative data collected from families as part of the research.

Findings Related to Quantitative Data

The quantitative data from the families were first analyzed for outliers, missing data, and normality. The results indicated that the data followed a normal distribution and were suitable for parametric tests. Scores on the Families' Guidance in Children's Engagement with Science Scale were then analyzed using one-way analysis of variance (ANOVA). This analysis examined differences based on independent variables such as gender (mother, father), parental age, parental education level, number of children, and child age. The analysis revealed no statistically significant differences in scale scores based on gender ($F(1,159)=0.688$, $p>.05$), parental age ($F(3,158)=1.525$, $p>.05$), or number of children ($F(2,159)=2.98$, $p>.05$). However, there were statistically significant differences related to parental education level (Table 3) and child age (Table 5) in terms of science orientation.

Table 3

One-Way Analysis of Variance (ANOVA) Results According to the Families' Guidance in Children's Engagement with Science Scale Scores and Parental Education Level Variable

					ANOVA Results					
Score	Group	*N*			Source					
Orientation to Science	Primary School	10	51.30	12.12	Between G.	3519.966	4	879.991	6.787	.000
	Secondary School	16	56.37	10.67	Within G.	20357.176	157	129.664		
	High School	43	59.25	11.47	Total	23877.142	161			
	Associate Degree	28	62.89	12.99						
	Undergraduate and Above	65	66.84	10.63						

Total	162	62.15	12.17

As shown in Table 3, the one-way analysis of variance based on the education level variable revealed a significant difference between the means of the different education level groups ($F(4,157)=6.787$, $p<.05$). A post hoc test was performed to determine which groups were significantly different. The results of this post hoc test are shown in Table 4.

Table 4

Results of post-hoc Tests Following One-Way ANOVA on the Educational Level Variable for the Families' Guidance in Children's Engagement with Science Scale

Education Level (i)	Education Level (j)	$\bar{x}_i - \bar{x}_j$	$Sh_{\bar{x}}$	p
Primary School	Secondary School	-5.075	4.590	.271
	High School	-7.955	3.997	.048
	Associate Degree	-11.592	4.194	.006
	Undergraduate and above	-15.546	3.867	.000
Secondary School	Primary School	5.075	4.590	.271
	High School	-2.880	3.334	.389
	Associate Degree	-6.517	3.568	.070
	Undergraduate and above	-10.471	3.117	.001
High School	Primary School	7.955	3.997	.048
	Secondary School	2.880	3.334	.389
	Associate Degree	-3.637	2.765	.190
	Undergraduate and Above	-7.590	2.238	.001
Associate Degree	Primary School	11.592	4.194	.006
	Secondary School	6.517	3.568	.070
	High School	3.637	2.765	.190
	Undergraduate and above	-3.953	2.574	.127
Undergraduate and Above	Primary School	15.546	3.867	.000
	Secondary School	10.471	3.177	.001
	High School	7.590	2.238	.001
	Associate Degree	3.953	2.574	.127

The results of the post hoc tests showed statistically significant differences ($p<.05$) between the groups with undergraduate and graduate education and those with primary, secondary, and high school education, in favor of the higher education groups. In addition, there were significant differences between most of the lower educational levels. This suggests that science orientation increases with higher levels of education. However, the differences between the other levels of education were not statistically significant ($p>.05$).

Table 5
One-Way Analysis of Variance (ANOVA) Results According to the Families' Guidance in Children's Engagement with Science Scale Scores and Child's Age Variable

					ANOVA Results					
Score	Group				Var. K.					
Orientation to Science	3	21	58.14	12.18	Between G.	1315.953	3	438.651	3.072	.029
	4	29	67.44	9.33	Inside S.	22561.189	158	142.792		
	5	55	62.60	12.69	Total	23877.142	161			
	6+	57	60.50	12.28						
	Total	162	62.15	12.17						

The one-way analysis of variance based on the child's age revealed a significant difference between the groups ($F(3,158)=2.072$, $p<.05$). To determine which age groups showed these differences, a post hoc multiple comparison test was performed. The results of this test are shown in Table 6.

Table 6
Results of post-hoc Tests Following One-Way ANOVA on Child Age Variable for the Families' Guidance in Children's Engagement with Science Scale

Child Age (i)	Child Age (j)	$\bar{x}_i - \bar{x}_j$	$Sh_{\bar{x}}$	p
3	4	-9.305	3.423	.007
	5	-4.457	3.065	.148
	6+	-2.365	3.050	.439
4	3	9.305	3.423	.007
	5	4.848	2.742	.079
	6+	6.939	2.725	.012
5	3	4.457	3.065	.148
	4	-4.848	2.742	.079
	6+	2.091	2.258	.356
6+	3	2.365	3.050	.439
	4	-6.939	2.725	.012
	5	-2.091	2.258	.356

Post-hoc test results for the Families' Guidance in Children's Engagement with Science Scale indicated a significant difference between the 3-4 age group ($p=0.007$) and the 4-6+ age

group (p=0.012) (p< .05). No significant differences were found between the other age group comparisons (p> .05).

Findings Related to Qualitative Data

Following the research objectives, interviews were conducted to uncover the routines and activities that families perform to engage their children in science. The findings from these interviews formed the qualitative data for the family component of the study and were subjected to content analysis. Data analysis identified 30 codes from 11 parents that were categorized under the themes of "science, science communication, science field trips, magazine/book reviews, and experiments/activities" (Table 7).

Under the "science" theme, parents responded to the question, "What do you think science is?" This theme aimed to understand parents' perceptions of science and how they guide their children toward science. "Science communication" provided insights into the content of science conversations between parents and children. The "science field trips" theme included parents' accounts of visiting places such as science centers, fairs, and festivals with their children. The "Magazines/Book Reviews" theme explored parents' interactions with their children while reviewing magazines or books. The final theme, "Experiments/Activities," included parents' descriptions of experiments and activities they did with their children. The themes and subthemes that emerged from the coding process are detailed in Table 7.

Table 7
Themes and sub-themes from the interview data related to families' guidance in children's engagement with science

Themes	Sub-themes	*f*
Science	Investigate	6
	Inquiry	5
	Discover	4
	Method	4
	Analysis	3
	Experiment/Observation	3
	Path for learning	2
	Finding the truth	2
	Curiosity	2
Science Communication	Satisfying curiosity	5
	Searching for scientific answers to questions	5
	Conversations about nature and events in nature	5
	Discussion of scientific studies	3
Scientific Field Trips	It is fun	5
	We rarely go because of the city we live in	5
	Traveling/examining in line with interest and curiosity	4
	No, we will not	4
	Experiencing	3
	Discovering	2

Magazine/Book Reviews	Conducting an investigation/research together	7
	Conversation about the topics	6
	Trying to understand the content	4
	Questioning what they do not know/what they are curious about	4
	Buying magazines/books according to their interests and curiosities	3
	Leaving them in places that will attract their interest/attention	2
	Waiting for children to open a conversation	2
Experiment/Event	Experiments and activities in book sets	8
	Various experiments found on the Internet	6
	Making self-mixtures	3
	Sky observation (earth, moon, sun, stars)	2

The distribution and representation of the codes obtained are presented with frequencies. The codes from the interviews about families' guidance in children's engagement with science are explained within the relevant themes. To illustrate these themes and support the credibility of the analysis, quotations from the interview transcripts are included.

Science

According to the findings, several codes that were frequently emphasized by parents in response to the question, "What is science?" were grouped under the theme of science. This theme was designed to capture parents' conceptual views of science before guiding their children toward it. Parents shared their thoughts on what science means to them, which led to the identification of concepts such as research, discovery, analysis, experimentation, and learning. For example, Neşe described science as *"Science is the effort to understand and discover everything we are curious about by using observation, questioning, and experimental methods".*

Similarly, İbrahim defined science as *"criticizing, questioning, researching, and striving to reach the truth."* Büşra, who approached science from a theoretical perspective, stated, *"Science is a system that includes systematic and cumulative progressive disciplines that are studied with various techniques based on cause-and-effect relationships that are not absolute truths."* Ayşe expressed that *"Science is a quest for knowledge. It involves looking at people, nature, and everything that results from their interaction with innate curiosity and then examining them systematically and objectively."*

Science Communication

How parents engage their children in conversations about science was analyzed through responses to the question, "Do you talk to your child about science? What is the content of these conversations?" This topic revealed that parents primarily discuss topics that arouse their children's curiosity or make them think. For example, Büşra explained that she encourages her child to think by asking questions rather than discussing scientific concepts directly:

> *"I don't talk about science conceptually, but I ask questions that make him think. I ask questions like, "Why do you think this happened?", "Who do you think discovered it?", "Why was it made?", "Why did the ice melt?", "Why does it snow?", "Why do we sweat when it's hot?", "Why do cats have fur?", "Why do bears hibernate? I also ask imaginative questions related to science"* (Büşra).

Similarly, Şeyma mentioned that she discusses scientific topics based on her child's curiosity:

> *"I often talk to my daughter about things she's curious about. We usually talk about nature and natural events, the rotation of the earth, what happens when the distance from the sun changes, whether there's life on other planets and why, the color of water, the differences between living and non-living things, how we breathe, how trees produce oxygen, our organs and body structure, and what vitamins are in what we eat and drink"* (Şeyma).

In addition to nurturing curiosity and encouraging critical thinking, another important aspect was for parents to explore with their children topics that they didn't fully understand or couldn't explain in conversation. This approach helps children develop skills in research, questioning, and discovery, which naturally leads them to science. Duygu, one of the participants, mentioned: "She is curious about scientists and asks questions about them. I usually answer to the best of my knowledge and we do research and experiments together".

However, it was generally observed that parents engage their children in scientific discussions by intuitively incorporating science into daily conversations, raising topics that their children are curious about or ask questions about, and exploring natural phenomena encountered in everyday life. However, some parents reported not having such conversations with their children.

Science Field Trips

This theme explored whether parents took their children to places such as science centers, fairs, or festivals, and how these trips were experienced. Most parents described these trips as opportunities to explore and engage with what the children were curious about, involving mutual questions and answers. Arya described such days as "fun, exploring, learning new things by doing and experiencing". Neşe mentioned, "In such field trips, we visit parts she is curious and interested in, let her experience them, and try to answer her questions." In addition, it was noted that these trips had a positive impact on the children's observational skills and their ability to apply what they learned later. For example, Ezgi observed, "... as we walk, he observes with interest and silently in such environments. He prefers to be an observer rather than an active participant, and later I notice that he records what he has learned and applies it in his life".

Parents also emphasized the importance of their city of residence when discussing visits to such places, noting that they rarely had the opportunity to visit science centers, fairs, or festivals.

> *"I have not had the opportunity in the city where I live. However, we try to visit the science centers, if there are any, in the cities we visit during our vacations. It is fascinating and fun. The concrete learning needs of preschool children are best met in such environments. Therefore, we will try to visit them if possible."* (İbrahim)

Magazine/Book Reviews

This theme explores how parents use science magazines and books to introduce their children to science and how they engage with their children while reviewing these materials. Common responses indicated that parents frequently discussed the topics in magazines and books with their children, often analyzing and researching the content together. Neşe stated, "We buy the 'Meraklı Minik (Curious Little)' magazine every month, read it together, and do the activities in the magazine together. She asks questions like 'why' and 'how' about the parts she is interested in and we try to answer these questions together".

It was also noted that parents often place magazines and books in visible places to attract their children's attention, hoping to spark interest and start discussions. Ayşe explained this approach with examples:

> *"I try to buy a children's science magazine almost every month. ... When I buy it, I leave it in their room or on the table or coffee table we use together so they can look at it first. If something interests them, they should be the first to talk about it. If they are not interested, I pick it up and try to get their attention. ... Besides magazines, they have a lot of books. ... I choose these books according to their interests. When I bought the books, we looked at them together. If they want me to read something or if there is something they cannot understand from the pictures, we talk together. They draw pictures based on what they see and we talk about them."* (Ayşe)

As in the other themes, parents in this theme emphasized following their children's interests and curiosities. Şeyma mentioned that they studied, researched, and discussed topics together based on her child's interests and curiosities.

> *"My daughter is interested in astronomy. Since she wants to be an astronaut when she grows up, we often buy books about space and planets. My daughter does not hesitate to ask me about what she is curious about; she is interested in cause-and-effect relationships. She helps me with the subjects I know; if we don't know, we research together. When we do research together, my daughter's interest in the subject increases and she wants to do more research and learn more."* (Şeyma)

Experiments/Activities

This theme focused on how families use experiments and activities to introduce children to science, what kinds of experiments and activities they do, and how they communicate during these activities. The most frequently mentioned aspect was "experiments and activities from book sets". In addition, experiments and activities found on the Internet were also frequently mentioned by families.

Parents explained this topic by giving different examples in their responses. Ezgi stated, "Yes, we do it from time to time. We occasionally do fun experiments at home that I learn from monthly magazines or social media. We often do experiments like black pepper, vinegar, baking soda, strength, balance, and stability that are appropriate for his age and safe to do at home." Duygu added, "Yes, we do. We do experiments like the volcano experiment and the rain experiment together. There are experiments we do especially in the kitchen. We mix dry beans with water and see if they sink to the bottom or stay on top. We make paint to explore colors, mix it, and watch what color it becomes; he uses his little microscope to see what objects look like." She stated that they research the experiment/activity with her child and then do it together.

Parents also engaged in observational activities, such as observing nature and natural phenomena, along with the experiments they did with their children at home.

> *"I do science experiments and activities with my daughter. We have done experiments such as the light reflection experiment, the scattered colors experiment, the dancing corn experiment, the candle without oxygen experiment, the unexploded balloon experiment, and the rain formation experiment together at home. My daughter also likes to observe the stars, the moon, and the sun."* (Şeyma)

However, some parents mentioned that no experiments or activities were carried out at home except those carried out at school. Overall, the results of the content analysis revealed that the parents in the study group generally considered children's curiosity and interests when introducing them to science. They favored learning through fun activities, encouraged children to think critically, supported questioning, research, and discovery through reciprocal questioning and answering, and provided opportunities for experiential learning at any time and place.

Findings Obtained from Children

This section discusses the research data related to the question, "What are early childhood children's perceptions of the concept of 'science'? To accomplish this, the findings from the illustrated mind maps created by 11 children were analyzed using content analysis, a qualitative method, resulting in 20 codes. These codes were categorized under the themes of technology, science, world and space, and education. The distribution of these themes and codes among the participants is presented separately under each theme heading.

Table 8

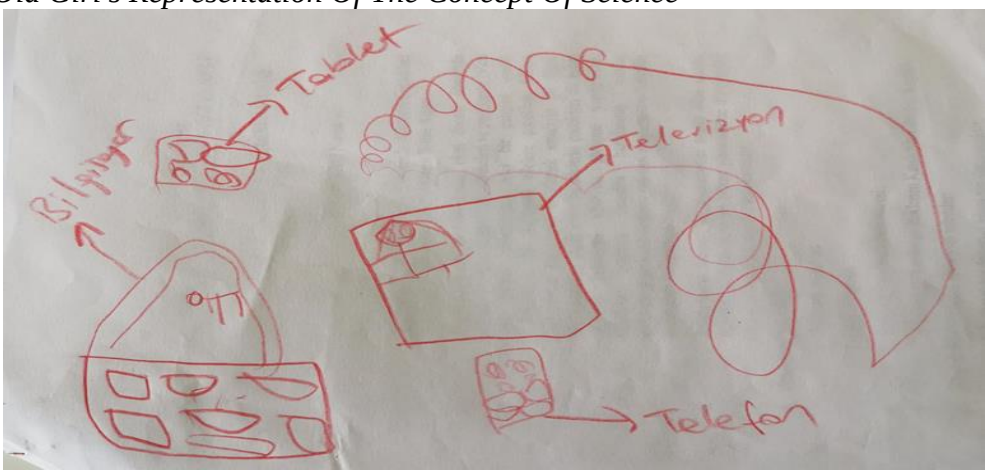
Themes and codes obtained from preschool children's drawings about science

Themes	Sub-themes	*f*
Technology	Robot	2
	Computer	2
	Tablet/Telephone	2
	TV	1
Science	Experiment	3
	Mixture	2
	Elixir	5
	Laboratory materials (tube, needle, overalls, acid, lava, microscope, etc.)	9
	Maths	2
	Robotic coding	1
	Scientist	2
Earth and Space	Sky (moon, sun, stars)	3
	Space (planets, asteroids, earth, astronauts)	5
	Fish	2
	Nature (tree, flower, house, soil, etc.)	2
	Human	2
Education	Child	2
	Teacher	1
	Book/Pencil	2
	Science Magazine	2

Technology

As shown in Table 7, preschool children often associate science with technological concepts. Within this theme, "robots" (f=2) and "computers" (f=2) were the most frequently mentioned concepts. An example of this theme is shown in Figure 1.

Figure 1
A 4-Year-Old Girl's Representation Of The Concept Of Science

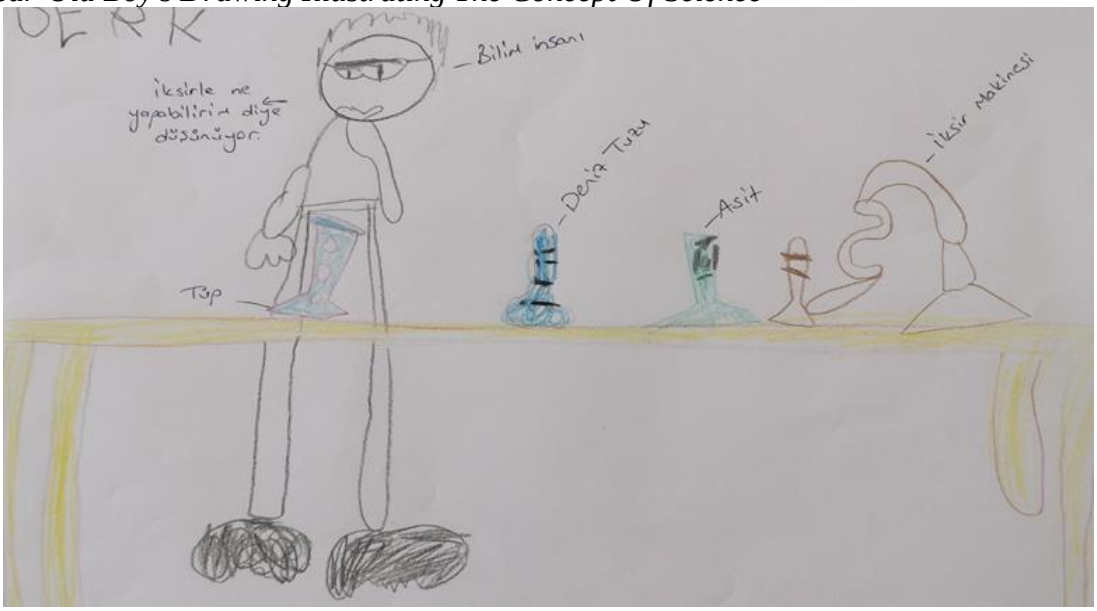


It is likely that children who illustrate concepts such as computers, tablets, and televisions when thinking about science are frequently exposed to these devices at home. As shown in the image above, most of the codes under the technology theme were drawn by a single child, indicating a strong relationship with technological devices.

Science

When preschoolers were asked about science, the most frequently mentioned concepts were categorized under the science theme. The most frequently mentioned concepts across all themes were laboratory supplies (f=9), flask (f=5), and experiment (f=3), respectively. An example of this theme is shown in Figure 2 below.

Figure 2
A 6-Year-Old Boy's Drawing Illustrating The Concept Of Science



When science was mentioned, most children drew a laboratory environment and related

materials, as shown in the picture above. These drawings included items such as tubes, sea salt, and needles, which were considered laboratory materials. In addition, children often depicted a scientist using these materials. S5, who made this drawing, said, "The scientist is thinking, what can I do with these flasks?" This suggests that children generally associate science with concepts they encounter in science and math activities at school.

Earth and Space

Some preschoolers associated science with the Earth and the universe by making various related drawings. These illustrations included the moon, meteorites, stars, and the sun, an astronaut representing people traveling into space. They also associated their immediate environment, such as trees, houses, and soil, with science. Interestingly, the concept of a fish (f=2) appeared under this theme. Figures 3 and 4 show drawings related to the world and the universe in this theme.

Figure 3
Drawing By A 5-Year-Old Boy Depicting The Concept Of Science

As seen above, children associate science with the living and non-living things they often observe in nature.

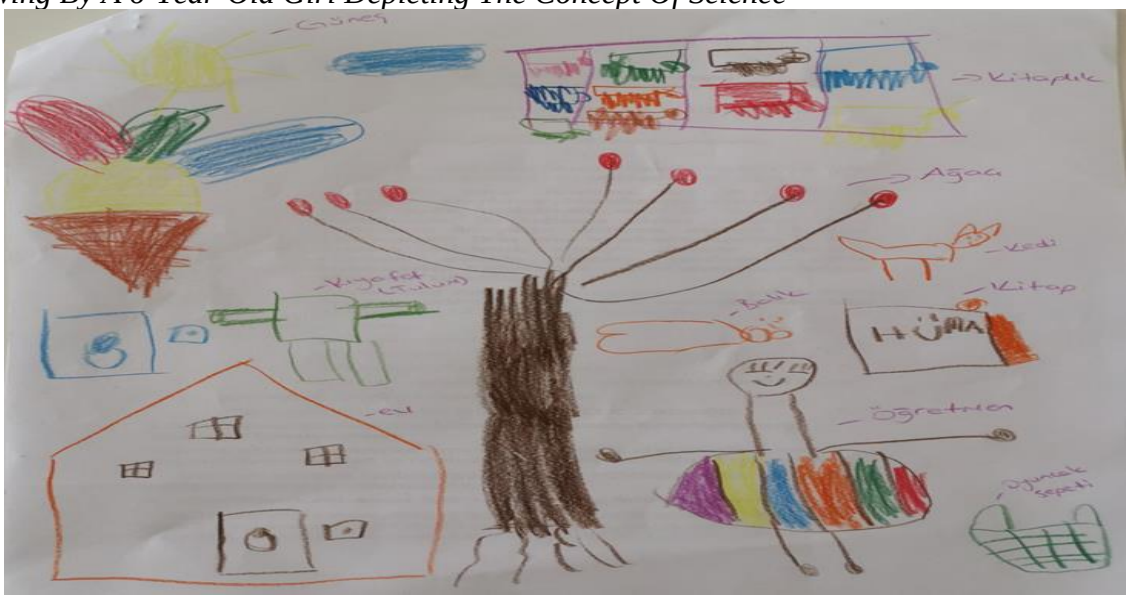
Figure 4
Drawing By A 5-Year-Old Boy Depicting The Concept Of Science

In Figure 4 above, science is associated with universal concepts such as the sun, space, and planets.

Education

The analysis revealed that preschoolers associated science with educational concepts such as children, teachers, pencils, and books. In addition, some children included science magazines directly in their drawings (f=2). It was also observed that those who associated science with education also associated it with nature. Figure 5 illustrates this relationship.

Figure 5
Drawing By A 6-Year-Old Girl Depicting The Concept Of Science



In the drawing above, a student associates science with educational elements such as books and teachers, while also including natural elements such as houses and trees. This suggests that the child sees science as a phenomenon that is present in both school and the natural environment.

Discussion, Conclusions, and Recommendations

The purpose of this study was to examine the extent to which families direct their children toward science and how children perceive science, considering these aspects within a holistic framework. The quantitative analysis revealed that the extent to which families guide their children toward science varies significantly according to the level of education and the age of the child. It was found that as parents' level of education increased, so did their involvement in directing children toward scientific activities. This finding is supported by the qualitative data, which highlights the role of parental education in shaping children's perceptions and interactions with science (Raynal et al., 2021). Böyük et al. (2011) demonstrated that parental educational status significantly influences children's use of scientific process skills. Tenenbaum and Callanan (2008) found that parents with higher levels of education provided more causal explanations, scientific principles, and encouraging explanations about science, which increased children's scientific literacy. This study concluded that as parents' education and science awareness increased from elementary school to college and beyond, children's understanding of science became more comprehensive. This suggests that parents' involvement in science has a significant impact on their children's relationship with science. Children whose parents engaged in science trips, conversations, experiments, observations, and magazine/book reviews primarily associated science with concepts such as experiments, laboratory materials, space, planets, elixirs, and formulas. Arnot et al. (2024) examined the sources of opinions about the climate crisis among students aged 12-16 and found that family, school, and social media were the primary sources of knowledge for children. They also found that misinformation was more prevalent among children who relied on social media for information not provided by their families. In their study of children's interaction with artificial intelligence and their perceptions of science and engineering, Su and Yang (2024) note that knowledgeable families can better monitor their children's development of AI knowledge, skills, and attitudes.

In addition to higher levels of education, the research highlights the importance of science awareness and guidance for children. While parents with higher levels of education are generally more likely to expose their children to science, the qualitative data reveal exceptions, such as highly educated parents not exposing their children to science or less educated parents doing so. This suggests that other factors influence the relationship between parental education and children's orientation to science. What seems to matter is how much parents invest in and prioritize their scientific knowledge and their children's education. Raynal et al. (2021) found that parents' attitudes and behaviors toward science, as well as their involvement in science activities with their children, significantly influence children's perceptions of science. In this study, it was observed that children's perceptions of science in families that do not engage in scientific interactions are generally shaped by technological concepts such as tablets, televisions, and computers, or nature-related concepts such as trees, houses, fish, and flowers. These children are typically exposed to technological devices and environments rather than family interactions. When asked to draw a picture based on a concept, they tend to draw the things they interact with frequently. In addition, when asked about science, these children often say "I don't know" and move on to other topics, supporting the idea that their understanding of science is limited. Looking at these two types of families within the framework of science, parents can empower children to actively participate in science through exploratory, playful, and inquiry-based methods by engaging deeply with their children (Goldman et al., 2020).

The results of the study also showed that families generally engaged in science activities

with their children ages four and older, with significant differences based on age. Parents with children under four tended to spend more time at home in activities such as book or magazine reviews and had less communication about science or did not engage in science activities at all. For children ages four and older, parents who engaged their children in science preferred activities such as traveling, exploring nature and natural phenomena, and experimenting outdoors. It was also observed that communication between parents and children aged 4-6+ on science topics was more intense. In activities and daily interactions with children of this age, parent-child communication often involves inquiry, questioning, establishing cause-and-effect relationships, and exploring through investigation and discussion. These interactions usually stem from the child's curiosity and questions. In this age group, it was observed that most families actively engage their children in science in a variety of settings.

Conversely, some families believe that what their children learn and experience in school is sufficient and therefore do not incorporate science activities into the family environment. While school plays a critical role in early childhood development, the home environment is where children first learn and develop their perspectives on the world. Activities within the family, whether at home or outside, have a significant impact on a child's development and worldview. The understanding of science that children develop, particularly through their personal, family, and civic experiences, influences how they later perceive science (Goldman et al., 2020). The experiences children have while engaging with science influence their thinking and foster their understanding of scientific phenomena (Fragkiadaki and Ravanis, 2021). Research suggests that in families where scientific development is limited to school, children's perceptions of science are generally shaped by educational themes, such as teachers and pencils, and are often associated with their immediate environments, such as houses, fish, and flowers. This suggests that it is not enough to rely solely on school for a child's development in science; a foundation needs to be built within the family, which is then supported by school activities. Cian et al. (2022) examined the impact of childhood conversations with family on the STEM identities of university students. They found that these conversations played a critical role in shaping STEM identities and that students still remembered them. This underscores the importance of educational institutions recognizing the role of family in fostering an affinity for STEM, while also addressing institutional barriers to true STEM engagement.

The study's quantitative findings revealed no significant differences in children's science attitudes based on gender, parental age, or number of children. Instead, parental education levels were found to be the primary influence on these efforts of parents in guiding their children toward science. However, combined qualitative and qualitative data suggested that fathers often delegated the responsibility of guiding children in science activities to mothers, believing that mothers were more effective in this area. Fathers were less likely to participate in research. A related study found that mothers were more involved with their children, while fathers focused more on family protection and material needs and spent less time with their children (Hossain et al., 2005). From this perspective, it appears that fathers generally have less responsibility and awareness regarding their children's science education compared to mothers. In addition, it was found that the parents participating in the study had similar levels of involvement in their children's science education.

A significant finding of the study is the impact of where families live on their ability to engage their children in science. Many families expressed a desire to take their children on science-related trips and activities. However, due to the limitations of their city's facilities, they either could not participate in such activities at all or could only do so while traveling to other cities. Parents'

attitudes toward science education are influenced by personal factors such as education level and gender, as well as the area where they live (Başaran, 2004). The characteristics of one's living environment affect people's attitudes, behaviors, and interests (Coşkun, 2022). Even parents with a high level of education and a strong commitment to their children's development are significantly influenced by the availability of supportive educational resources in their city. According to Nacak et al. (2011), the context and environment in which parents live, along with their level of education, shape their goals for their children and influence their attitudes and expectations during parenting (p. 86). This study illustrates that parents' attitudes toward their children's involvement in science and children's perceptions of science are significantly influenced by where they live.

Overall, the study concludes that children's perceptions of science are shaped by family attitudes and behaviors as well as the broader life experiences to which they are exposed. This finding is consistent with Raynal et al. (2021), who demonstrated that parents' attitudes and behaviors toward science significantly influence their children's engagement in science. Similarly, Goldman et al. (2020) found that families play a critical role in children's science education. Active parental involvement expands children's understanding of science, through integrating science into daily life, engaging in science conversations, and participating in activities such as field trips, experiments, and observations. As per the study findings, this involvement is not just about verbal interactions, but also about parents' active participation and role modeling. Consistent with these findings, Simunovic and Babarovic (2020) found a positive correlation between parents' active participation in STEM and students' success in scientific fields.

Children develop their understanding of science through cognitive, emotional, and physical experiences in their daily educational environment (Fragkiadaki and Ravanis, 2021). Accordingly, early exposure to science can significantly influence their future understanding of the subject. Studies by Güler and Akman (2006) and Ayvacı et al. (2016) have shown that children's perceptions and interests in science begin in preschool and are shaped by their social environment. In this study, it was observed that science-oriented development in early childhood is supported by family involvement and an appropriate environment, which shapes their science perceptions.

Overall, analysis of the results of this study, along with other research, suggests that families play a critical role in influencing children's science learning, just as they do in other areas of development. It was observed that children's understanding of science is significantly influenced by families that prioritize their curiosity and interests. Families that provide opportunities for inquiry, exploration, questioning, and experimentation help shape children's scientific minds. This allows children to learn by establishing cause-and-effect relationships in different environments and conditions. Conversely, children who are not exposed to such enriching family environments have weaker perceptions of science, and their understanding is based primarily on their immediate environment and school experiences.

In this context, it is recommended that families should take the first step in fostering science skills such as exploration, inquiry, making, experimentation, comprehensive perspective, and solution-oriented thinking. They should engage in scientific activities with their children, both at home and in other settings, and encourage the use of scientific process skills such as reasoning, inquiry, and observation. In addition, integrating these skills into everyday life can help children develop a broad perspective on science. The literature suggests that there is limited research on early childhood science education and the role of the family in guiding children toward science. Future research can address this gap by exploring different aspects of the topic. In addition,

discourse analysis of family interactions during science activities with their children can help determine the scientific nature of these engagements. Longitudinal studies should also be conducted to explore how the early childhood science experiences of the children in this study influence their later engagement with science. As the preschool years are a critical period for developing skills that will be used throughout life, it is important to integrate science education and research more thoroughly at this stage. This study, which examines the role of families in shaping children's orientations toward science, also highlights the impact of early childhood practices on children's perceptions of science. Therefore, teachers who plan science activities or curricula in early childhood should provide more opportunities for such activities in their classrooms. Incorporating science as both material and content into preschool activities can support family practices and enhance children's learning. Moreover, policymakers and families should work together to facilitate early participation in science by creating necessary facilities. Increasing access to science centers, parks, and playgrounds that encourage inquiry and exploration will help build children's science capital from an early age.

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Geniş Özet

Problem Durumu

İçinde bulunduğumuz çağ, bilimin toplumsal ilerleme için önemini vurgulamakta ve önemi konusunda küresel bir farkındalık yaratmaktadır. Gelişmiş ve gelişmekte olan toplumlar, erken çocukluk döneminde güçlü bir temelden başlayarak bilim okuryazarı bireyler yetiştirmek için yatırım yapmaktadır. Çocukların erken yaşlarda doğuştan gelen merakı ve öğrenmeye açıklığı, bilimsel anlayışın gelişmesi için çok önemlidir. Aile, çocukların bilimsel süreç becerilerini geliştirmede, bilime yönelik olumlu tutumlarını şekillendirmede ve genel bilimsel gelişimlerine yardımcı olmada çok önemli bir rol oynar. Bu alandaki çalışmalar genellikle çocukların bilimsel becerilerine ve bilim insanı imajlarına odaklanırken, çocukların bilim sermayesine ve bilim algılarına katkıda bulunan aile uygulamalarını keşfetmeye yönelik artan bir ihtiyaç vardır. Bu çalışma, ailelerin okul öncesi çağdaki çocuklarını bilime nasıl yönlendirdiklerini ve bunun çocukların bilim algısı üzerindeki etkisini inceleyerek bu boşluğu doldurmayı ve bilim sermayesi gelişiminin daha geniş bir şekilde anlaşılmasına katkıda bulunmayı amaçlamaktadır.

Yöntem

Bu çalışmada, ailelerin çocuklarını bilime yönlendirmesini ve çocukların bilim algısını kapsamlı bir şekilde incelemek için karma bir araştırma yöntemi olan açıklayıcı bir tasarım kullanılmıştır. Nicel veriler ailelerin bilime yönelimini değerlendiren bir ölçek aracılığıyla, nitel veriler ise görüşmeler ve zihin haritaları aracılığıyla toplanmıştır. Çalışmaya Kastamonu'dan 168 ebeveyn ve 11 ebeveyn-çocuk çifti katılmıştır. Nicel veriler ANOVA kullanılarak analiz edilirken,

nitel veriler için içerik analizi kullanılmıştır. Bulgular, çocukların bilim sermayesini ve algısını etkileyen aile uygulamalarının daha iyi anlaşılmasını amaçlamaktadır.

Bulgular

Çalışmada bulgular ailelerden, çocuklardan ve ailelerin çocukları bilime yönlendirme çabaları ile çocukların algıları arasındaki ilişkiden elde edilen veriler olmak üzere üç alt başlıkta incelenmiştir. Aile bulgularında hem nicel hem de nitel veriler incelenmiştir. Niceliksel olarak, tek yönlü ANOVA, ebeveynlerin eğitim düzeylerine ve çocukların yaşlarına bağlı olarak aile rehberliği puanlarında anlamlı bir fark olduğunu ortaya koymuştur. Post-hoc testleri, daha yüksek eğitimin daha fazla rehberlikle ilişkili olduğunu ve yaş grupları (3-4 ve 4-6+) arasında anlamlı farklılıklar bulunduğunu göstermiştir. Bu çalışma, ebeveynlerin eğitim düzeyleri, çocukların yaşları ve ailelerin çocukları bilime yönlendirme çabalarının etkinliği arasında pozitif bir ilişki olduğunu göstermektedir.

Araştırma, ailelerin çocuklarını bilime nasıl yönlendirdiklerini anlamaya odaklanıyor ve eylemlerini ve rutinlerini keşfetmek için görüşmelerden yararlanıyor. Toplam 11 ebeveynden elde edilen nitel veriler içerik analizine tabi tutulmuş ve "bilim", "bilim iletişimi", "bilimsel geziler", "dergi/kitap incelemeleri" ve "deneyler/etkinlikler" gibi temalar altında kategorize edilen 30 kod elde edilmiştir. Temalar ayrıntılı olarak incelenerek ebeveynlerin bilim hakkındaki görüşleri, iletişim yöntemleri, bilimsel gezilerle ilgili deneyimleri, bilim temalı materyallerin kullanımı ve çocuklarıyla birlikte deney ve etkinliklere katılımları ortaya konmuştur. Ebeveynler genel olarak çocukların ilgi alanlarıyla uyumlu olmayı, merakı teşvik etmeyi ve etkileşimli ve deneyimsel yaklaşımlarla olumlu bir öğrenme ortamı yaratmayı vurgulamışlardır.

Çocukların Bilime Yönelik Algıları. Çalışma, 11 katılımcının resimli zihin haritalarının içerik analizi yoluyla erken çocukluk dönemindeki çocukların "bilim" kavramına ilişkin algılarını araştırmaktadır. Nitel analiz sonucunda Teknoloji, Bilim, Dünya ve Uzay ve Eğitim temaları altında 20 kod belirlenmiştir.

Teknoloji. Okul öncesi çocuklar bilimi ağırlıklı olarak teknolojik kavramlarla, özellikle de robotlar ve bilgisayarlarla ilişkilendirmiştir. Teknolojik cihazların çizimlerdeki yoğun temsili, çocuklar ile bu cihazlar arasında güçlü bir bağ olduğunu göstermektedir.

Bilim. Bilim hakkında düşünürken çocuklar sıklıkla laboratuvar ortamlarını ve tüpler, deniz tuzu ve deneyler gibi malzemeleri tasvir etmiştir. Bir bilim insanının bu malzemelerle ilişkilendirilmesi, bilim ile okulda, özellikle de fen ve matematikte deneyimlenen faaliyetler arasında bir bağlantı olduğunu göstermektedir.

Dünya ve Uzay. Bazı çocuklar bilimi dünya ve evrenle ilişkilendirerek ay, meteorlar, yıldızlar ve astronotlar gibi kavramları resmetmiştir. Çizimlerde ayrıca ağaçlar ve evler gibi yakın çevre unsurlarıyla da ilişkilendirmeler yapılmıştır.

Eğitim. Okul öncesi çocuklar, çocuklar, öğretmenler, kalemler ve kitaplar gibi kavramları resmederek bilim ve eğitim arasındaki bağlantıyı vurgulamışlardır. Bilim dergilerinin çizimlere dahil edilmesi, bilim ve öğrenme arasında bir bağlantı olduğunu göstermiştir. Çizimler, çocukların bilimi hem okul hem de doğal çevre ile iç içe algıladıklarını göstermektedir.

Bu çalışma, küçük çocukların bilimi nasıl kavramsallaştırdıklarına dair içgörüler sunmakta, teknoloji, laboratuvar etkinlikleri, doğal dünya ve eğitim ortamlarıyla olan ilişkilerini ortaya koymaktadır.

Sonuçlar ve Tartışma

Bu çalışma, aile dinamiklerinin çocukları bilime yönlendirme üzerindeki etkisini araştırmakta ve çocukların bilim algılarını kapsamlı bir şekilde incelemektedir. Hem nicel hem de nitel analizler, ebeveynlerin eğitim düzeyleri, bilimle ilgili faaliyetler ve çocukların bilim algıları arasında anlamlı ilişkiler olduğunu ortaya koyuyor. Ebeveynlerin eğitim seviyesinin yüksek olması, çocukların bilimsel faaliyetlere katılımını olumlu yönde etkiliyor. Çalışma, çocuklarda bilimsel merak ve bilginin teşvik edilmesinde ebeveyn katılımının önemli rolünün altını çizmekte ve aile ortamlarında aktif katılım, keşif ve diyaloğa duyulan ihtiyacı vurgulamaktadır. Ayrıca, coğrafi konumun ailelerin bilimsel faaliyetlere erişimi ve bunun sonucunda çocukların bilime maruz kalması üzerindeki etkisinin altını çiziyor. Genel olarak bulgular, ailelerin çocukların erken dönem bilim algılarını şekillendirmedeki önemli rolünü vurguluyor ve ebeveynleri, en iyi bilişsel ve gelişimsel faydalar için bilimsel etkinlikleri günlük hayata aktif olarak entegre etmeye çağırıyor. Bu bağlamda çocukların bilimi tanıması, araştırması, sorgulaması, üretmesi, deneme yanılma yoluyla öğrenmesi, kapsamlı bir bakış açısıyla düşünmesi, sorunlara çözüm odaklı yaklaşması ve bu bilimsel süreç becerilerini kullanarak kendini geliştirmesi için ilk adımı ebeveynler atmalıdır. Çalışma, erken çocukluk döneminde fen eğitimi üzerine daha fazla araştırma yapılmasını teşvik ederek, yaklaşımlardaki çeşitliliği desteklemekte ve bu kritik alandaki anlayışı genişletmektedir.