Children's Misconceptions: Opinions and Practices of Preschool Teachers

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Abstract: This study investigated preschool teachers' perceptions of common misconceptions among 4- to 6-year-olds and their strategies for addressing these misconceptions. For this purpose, the study adopted phenomenology design. The participants consisted of a total of 122 preschool teachers selected via snowball (n=122) and criterion (n=24) sampling. A total of 122 participants completed the structured survey, and 24 participants participated in the semi-structured interview. Percentage and frequency were used in the analysis of data collected through structured survey. Descriptive and content analysis were used to analyze the data collected with the semi-structured interview form. The findings indicated that the concepts in which children made the most misconceptions were about yesterday-today-tomorrow, right-left, on someone's right-on someone's left, deep-shallow, ellipse, before-now-after, circle, number of rankings, edge, morning-noon-evening, corner, rectangle, glossy-matte, first-middle-last, numbers between 1 and 20, and odd-even. The majority of teachers evaluated children's readiness to detect their misconceptions. Children made misconceptions by mixing similar concepts, making semantic errors, making linguistic problems and making generalizations. The main sources of misconceptions in children were the family, the child (level of cognitive deficit), the nature of the concept, excessive use of digital tools and the educator. The research recommends that preschool teachers receive in-service training to use different methods and techniques to detect and correct misconceptions.

Keywords: Misconception, children, preschool period, preschool teachers, teacher's opinion

Çocuklardaki Kavram Yanılgıları: Okul Öncesi Öğretmenlerinin Görüşleri ve Uygulamaları

Öz: Bu araştırmada okul öncesi öğretmenlerinin 4-6 yaş grubu çocuklarındaki kavram yanılgıları ve öğretmenlerin kavram yanılgılarını gidermek için yaptıkları uygulamalara ilişkin görüşlerinin incelenmesi amaçlanmıştır. Bu amaçla çalışmada fenomenoloji deseni kullanılmıştır. Çalışma grupları kar topu (n=122) ve ölçüt (n=24) örnekleme ile seçilmiş toplam 122 okul öncesi öğretmeninden oluşmaktadır. 122 katılımcı yapılandırılmış anketi tamamlamıştır ve bu katılımcılar arasından ölçüt örnekleme ile seçilen24 katılımcı yarı yapılandırılmış görüşmeye katılmıştır. Yapılandırılmış anket yoluyla toplanan verilerin analizinde yüzde ve frekans kullanılmıştır. Yarı yapılandırılmış görüşme formu ile toplanan verilerin analizinde betimsel ve içerik analizi kullanılmıştır. Bulgular, çocukların en çok kavram yanılgısı yaptıkları kavramların

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dün-bugün-yarın, sağ-sol, birinin sağında-solunda, derin-sığ, elips, önce-şimdi-sonra, daire, sıralama sayısı (birinci, ikinci,...), kenar, sabah-öğle-akşam, köşe, dikdörtgen, parlak-mat, ilk-orta-son, 1 ile 20 arasındaki sayılar ve tek-çift göstermiştir. Öğretmenlerin çoğunluğu çocukların kavram yanılgılarını tespit etmek için öncelikle hazırbulunuşluklarını değerlendirmektedir. Öğretmenlere göre çocuklar benzer kavramları karıştırarak, anlam hataları yaparak, dilsel sorunlar yaparak ve genellemeler yaparak kavram yanılgıları yapmışlardır. Öğretmenlere göre çocuklarda kavram yanılgılarının temel kaynaklarının aile, çocuk (bilişsel eksiklik düzeyi), kavramın niteliği, dijital araçların aşırı kullanımı ve eğitimci olduğu görülmüştür. Araştırma, okul öncesi öğretmenlerinin kavram yanılgılarını tespit etme ve düzeltme konusunda farklı yöntem ve teknikleri kullanabilmeleri için hizmet içi eğitim almalarını önermektedir.

Anahtar kelimeler: Kavram yanılgıları, çocuklar, okul öncesi dönem, okul öncesi öğretmeni, öğretmen görüşleri.

Introduction

Concepts are considered cognitive tools that enable children to think, understand the world they live in, and communicate by interacting (Tepetaş & Haktanır, 2013). From birth, children encounter their environment and begin to experience concepts through people, places, objects, and events (Yoleri, 2010). Piaget states that children's cognitive development occurs through the assimilation of old and new knowledge via intrinsic intuition, following a fixed sequence. While social interaction is not entirely dismissed, Tudge and Rogoff (1989) argue that children before the formal operational stage are egocentric, making excessive interaction less influential in cognitive development. In this context, Piaget asserts that children's misconceptions arise from their experiences and observations of the world (Watson, 1997). In their research on children's misunderstandings of astronomical concepts, Vosniadou and Brewer (1992) found that children believed the Earth was flat rather than round, supporting Piaget's viewpoint. Levin et al. (1990) conducted a study on the speed of two moving objects with children and adults, finding that both groups made the same incorrect inference that the rotation speed of two coins placed at different distances from the center of a rotating mechanism would be equal. This finding suggests an inconsistency with real-world experiences, as children running in a circular formation would require those on the outer edge to run faster to maintain synchronization. This result supports Vygotsky's view that social interaction influences cognitive development from infancy (Watson, 1997), as he argues that misconceptions are shaped by social and cultural interactions. Social transmission indicates that while children acquire extensive experience with speed concepts, they may not fully grasp them unless explicitly taught that linear speed remains constant, but circular speed may vary. Similarly, Vosniadou and Brewer (1992) described the Earth as "round" instead of "spherical," leading children to model it as a flat, circular shape when asked.

Children form misconceptions either through intrinsic intuition or as a result of social interaction. Carey (1985) states that children may ignore the correct use of a concept if they hold a misconception. However, when faced with sufficiently anomalous situations, they may revise their false beliefs (Watson, 1997). In some cases, if children do not encounter enough anomalous situations, they may persist in their incorrect beliefs. Watson (1997) defines this phenomenon as weak restructuring. Piaget refers to belief changes regarding misconceptions as global restructuring, suggesting that changes occur across all areas of thought. However, subsequent research demonstrating that conceptual development depends on acquiring sufficient knowledge in specific domains has led to the rejection of Piaget's global restructuring hypothesis, replacing it with the concept of radical restructuring (Carey, 1985).

Concept development in children progresses from simple to complex and from concrete to abstract (Aktaş Arnas, 2009). Therefore, children attempt to understand abstract concepts by concretizing them (Ünal, 2013). During this process, they may develop misconceptions. Several studies (Abell & Lederman, 2007; Smolleck & Hershberger, 2011; Watson, 1997) indicate that children acquire misconceptions due to their experiences or the non-scientific usage of concepts in social contexts. For example, children may develop incorrect beliefs such as "The Earth is round" (Worth, 2000). Misconceptions strongly influence children's future learning, creating difficulties in understanding scientific concepts, leading to serious obstacles in education, lowering academic achievement, and diminishing learning motivation (Akman, 1995; Schneider et al., 2009; Yılmaz & Yenilmez, 2007). Furthermore, these misconceptions negatively affect children's critical thinking and problem-solving skills.

Given the critical role of misconceptions in education, the importance of early childhood education—the first step in formal education—becomes even more apparent. At this stage, preschool teachers play a key role (Whitebook, 2003) because they are responsible for identifying, explaining, and correcting children's misconceptions (Barke et al., 2008). If there is a disconnect between the knowledge children acquire informally and the knowledge provided in formal education settings, it may lead to challenges in the instructional process (Sarama & Clements, 2009). Therefore, teachers must carefully identify children's readiness levels and misconceptions. Otherwise, misconceptions may deepen (Aydın & Özkara, 2011; Philips, 1991; Watson, 1997), making conceptual change more difficult (Tytler, 1998). The primary element in identifying children's misconceptions is assessment (Izzati & Rochmah, 2020) because it is impossible to obtain sufficient information about a child without evaluation. Determining the nature and causes of misconceptions is crucial for ensuring effective and meaningful learning and for correcting or eliminating these misconceptions (Pekel, 2019). Kambouri et al. (2011) found that when preschool teachers were aware of children's misconceptions, they could plan more effective learning processes and successfully address these misconceptions.

Teachers must be knowledgeable about various methods and techniques for identifying and addressing children's misconceptions. For example, they can use concept cartoons (Atasoy & Zoroğlu, 2014), concept maps (Wehry et al., 2008), observations, interviews (Treagust & Duit, 2008), question-and-answer sessions, and brainstorming to detect and correct misconceptions. Additionally, model-based reasoning (Jonassen et al., 2005), argumentation-based digital storytelling learning (Köseoğlu et al., 2024), and learning model based on cognitive conflict may help address misconceptions (Mufit et al, 2018). In a study investigating the effectiveness of a guidance and explanation-based approach in eliminating children's misconceptions, Venkadasalam (2022) found that this approach successfully addressed conceptual misunderstandings. Other research suggests that peer interaction (de la Hera et al., 2019) and evidence-based argumentation (Weisskirch & Pérez-Granados, 2011) are effective in reducing misconceptions. Since children do not fundamentally change their thinking through a single learning experience (Watson, 1997), teachers must provide multiple learning experiences to address misconceptions.

Preschool teachers must also have adequate knowledge of how to teach concepts correctly. Kallery and Psillos (2001) investigated preschool teachers' understanding of physical phenomena and found that they struggled to explain complex natural events scientifically. Andersson and Gulberg (2014) noted that preschool teachers often use traditional approaches when teaching science concepts, potentially leading to misconceptions among children. Correcting misconceptions can be more challenging than teaching a new concept (Bitlisli, 2014).

In the literature, studies on preschool children's misconceptions include mathematical misconceptions (Lee & Ginsburg, 2009; Şahin & Korkmaz, 2019), geometric shapes (Lüle Mert, 2019), the environment (Taşkın & Şahin, 2008), cloud formation (Tekerci et al., 2023), living and non-living entities (Öztürk & Tulum, 2021), and astronomy concepts (İzgi Onbaşılı & Kabadayı, 2019). These studies primarily focus on specific concepts rather than a broad range of misconceptions. This study aims to determine which misconceptions children have when starting preschool education and the methods used by preschool teachers to identify and address these misconceptions, based on teacher perspectives. Accordingly, this research seeks to identify the common misconceptions among children, assess preschool teachers' competencies in determining children's readiness levels and misconceptions, and evaluate their effectiveness in addressing these misconceptions. By identifying common misconceptions in advance, this study aims to help teachers plan appropriate interventions and contribute to the design of in-service training programs, seminars, and online courses for preschool teachers. In line with this purpose, the study addresses the following questions:

1.   What do preschool teachers think about the concepts that preschool children have misconceptions about?

2.   What methods and techniques do preschool teachers use to assess children's readiness levels regarding concepts?

3.   What methods and techniques do preschool teachers use to detect misconceptions in children?

4.   What do preschool teachers think about how misconceptions in children emerge?

5.   What do preschool teachers do to eliminate misconceptions in children?

Method

The method of the research is presented under the following subheadings: permissions, research design, participants, data collection tools, data collection techniques and process, and data analysis. This research was approved by Sivas Cumhuriyet University Educational Sciences Research Proposal Ethics Evaluation Board on 30/04/2023 (Protocol Number: E-50704946-100-290369).

Research Design

This study used the phenomenology design, in line with the opinions of preschool teachers, to determine the concepts in which children made the most mistakes, the possible causes of children's mistakes, and the strategies applied to correct their mistakes. Phenomenological design aims to reveal the target audience's personal experiences with a phenomenon or concepts and the personal meanings they construct with these experiences (Creswell, 2007; Johnson & Christensen, 2012). This research dealt with children's misconceptions as a phenomenon within the framework of teachers' professional experiences.

Participants

The researchers collected data from a total of 122 preschool teachers using data triangulation. Snowball sampling (n = 122) and criterion sampling (n = 24) were used in the selection of the participants of the research. 122 of the parcipants particapted in the structured survey phase, and 24 of them participated in the semi-structured interview process. Snowball

sampling is a sampling method that enables the researcher to reach other people who may have information about the subject, starting from a person who can obtain information about the subject and with the guidance of this person (Strydom, 2005). In this regard, the mean age of the teachers formed by snowball sampling was determined as 27.2 and the mean experience was 7.9. Then, the researchers interviewed 24 preschool teachers using criterion sampling. Criterion sampling allows setting a set of predetermined criteria to select individuals to be included in the study group (Palinkas et al., 2015). The criteria were "participating in the survey phase and having at least 5 years of experience". Teachers who were teaching before the pandemic and who had more face-to-face experience were selected. Demographic information of the teachers who participated in the interviews is included in Table 1.

Table 1

The Demographic Characteristics of the Participants (n=24)

Demographic Information	f	%
Age		
25-30	10	41,7
31-35	13	54,2
35-40	1	4,1
Seniority		
5	21	87,5
6-10	3	12,5
Age Group Teachers Worked With		
4-5	5	20,8
5-6	13	79,2
School Type		
Kindergarten	16	66,7
Nursery Class	8	33,3
Place of Work		
City	9	37,5
District	12	50
Village	3	12,5
Total	24	100

Research Instruments and Procedures

The data of the study was collected in May-Sep 2023. To determine the opinions of teachers regarding the misconceptions of preschool children, the "Structured Survey on Misconceptions of Preschool Children between the Ages of 4 and 6" was developed by the researchers using all the concepts specified in the Ministry of National Education 2013 Preschool Education Program.

Later, the researchers developed "Semi-Structured Interview Form on Misconceptions of Preschool Children". Initially, the researchers developed an item pool of ten questions and sent them to three field experts. Following the feedback of field experts, four questions were removed from the form because they were of the opinion that they were repetitions of other questions. The form included the following six questions:

1. Do you implement any practices to determine children's readiness levels?
2. Which methods and techniques do you use to assess children's readiness levels?
3. Which methods and techniques do you use to identify misconceptions in children?
4. What could be the sources of misconceptions in children?
5. What are the types of misconceptions in children?
6. What practices do you implement to address misconceptions in children?

The researchers conducted a pilot study with a preschool teacher to ensure the understandability of the questions in the prepared form. The pilot study indicated that the questions were clear and understandable, and the form was given its final form. Application of the interview form took approximately 20 minutes.

The researchers collected data using data triangulation (Creswell, 2012). Accordingly, the data collection process was carried out in two stages. In the first stage, the "Structured Survey on Misconceptions of Preschool Children" prepared by the researchers was converted into Google Form and delivered to 122 preschool teachers using the snowball sampling. The researchers collected the phone numbers of teachers who wished to participate in the second phase, and 37 teachers volunteered for it. Among 37 teachers, 24 met the criteria. Then, data was collected from these 24 preschool teachers selected by criterion sampling, using the semi-structured interview form. The researchers preferred interview as it provides in-depth data. While conducting interviews, the interviewer should ask all participants the same questions in the same order, ensuring that the questions are clear and understandable (Corbetta, 2003). The interviewer should also select individuals who are competent in the subject investigated (Royce et al., 2012). The participants approved the informed consent forms. Before the interviews were held, the researchers talked to the teachers and planned a suitable date and time for them, and the interviews were held face-to-face taking notes in an environment where they felt comfortable. The researchers conducted interviews with participants who could not attend in person through online meeting platforms. During the interview, teachers were asked to answer by taking into account not only their current classroom but also their entire professional experience. Each of the interviews lasted approximately 20 minutes. The notes taken during the interviews were transferred to the computer environment by giving codes as "T1, T2, T3, …T24" on the basis of confidentiality.

Data Analysis

The study used two different data collection tools: a structured survey, and a semi-structured interview form. With the survey, teachers' opinions about which concepts the children made mistakes were expressed in terms of percentage and frequency. In the semi-structured interview form analysis, descriptive and content analysis, which are qualitative data analysis techniques, were used. The content analysis technique provides the opportunity to understand human behavior in indirect ways. Content analysis is a systematic and repeatable technique in which the text is summarized with codes and categories based on certain rules, in order to determine the existence and relationships of words or concepts in a text (Büyüköztürk et al., 2012. The main purpose of content analysis is to reach concepts and relationships that can explain the data (Yıldırım

& Şimşek, 2011). 20% of the interviews were sent to another field expert and he was asked to create codes, categories and themes. The results indicated that the codes, categories and themes made by the expert matched exactly with the codes, categories and themes created by the researchers. While reporting the qualitative findings, the researchers used concept maps using NVivo 10.

Results

The findings of the data collected using structured survey and semi-structured interview questions are presented using tables and figures.

Table 2

Structured Survey Data

CONCEPTS	Misconceived Concept		CONCEPTS	Misconceived Concept	
	f	%		f	%
Yesterday-Today-Tomorrow	85	66.3	Reverse-Straight	7	5,4
Right-Left	54	42.1	Fresh-Stale	7	5,4
On Someone's Right- On Someone's Left	48	37.4	Half-Full	6	4.6
Deep-Shallow	46	35.8	Long-Short	6	4,6
Ellipse	42	32.7	In Front-Behind	5	3.9
Before-Now-Later	41	31.9	Large-Medium-Small	5	3.9
Circle	41	31.9	Inside-Outside	4	3,1
Number of Rankings (first, second…)	37	28.8	Interior-Exterior	4	3,1
Edge	34	26.5	Hairy-Hairless	4	3,1
Morning-Noon-Evening	33	25.7	Night-Day	4	3,1
Corner	31	24.1	Beautiful-Ugly	3	2,3
Rectangle	30	23.4	Front-Back	3	2,3
Glossy-Matte	28	21.8	Hot-Cold-Warm	3	2,3
First-Middle-Last	28	21.8	Wet-Dry	3	2,3
Numbers between 1 and 20	27	21	Salty	3	2,3
Odd-Even	27	21	Scared	3	2,3
Money	24	18.7	Easy-Hard	3	2,3
Wide-Narrow	23	17.9	Shocked	3	2,3
Sharp-Blunt	22	17.1	Triangle	2	1,5

Previous-Next	21	16.3	Hard-Soft	2	1,5
Circle	21	16.3	Moving-Still	2	1,5
Same-Different-Similar	17	13.2	Sweet	2	1,5
Square	17	13.2	Dark-Light	2	1,5
Light-Dark	16	12.4	Sour	2	1,5
Slippery-Rough	16	12.4	Old-Young	2	1,5
Equal	15	11.7	Heavy-Light	1	0.7
Crowded-Secluded	15	11.7	Next to something	1	0.7
Thin-Thick	14	10.9	Above-Below	1	0.7
Color	13	10,1	Inside-Outside	1	0.7
Start-Finish	12	9	Far-Near	1	0.7
Part-Whole	12	9	Fragrant-Odorless	1	0.7
Zero	11	8.5	Sad	1	0.7
Living-Inanimate	9	7	Open-Close	1	0.7
Straight-Curved	8	6.2	Fat-Skinny	1	0.7
Forth-Back	8	6,2	Aesthetic	1	0.7
Under-Middle-Above	8	6,2	Sadness	1	0.7
Low-High	8	6,2	Pentagon	1	0.7
Between	7	5.4	Hexagon	1	0.7
Lower-Upper-Middle	7	5,4	School-Classroom	1	0,7

Table 2 indicated that the concepts in which children made the most misconceptions were yesterday-today-tomorrow, right-left, on someone's right-on someone's left, deep-shallow, ellipse, before-now-after, circle, number of rankings (first, second, ...), edge, morning-noon-evening, corner, rectangle, glossy-matte, first-middle-last, numbers between 1 and 20, and odd-even. Table 2 further highlighted that the concepts in which children made the least misconceptions were heavy-light, next to something, above-below, inside-outside, far-near, fragrant-dorless, sad, open-close, fat-skinny, aesthetic, sadness, pentagon, hexagon, and school-class.

Figure 1

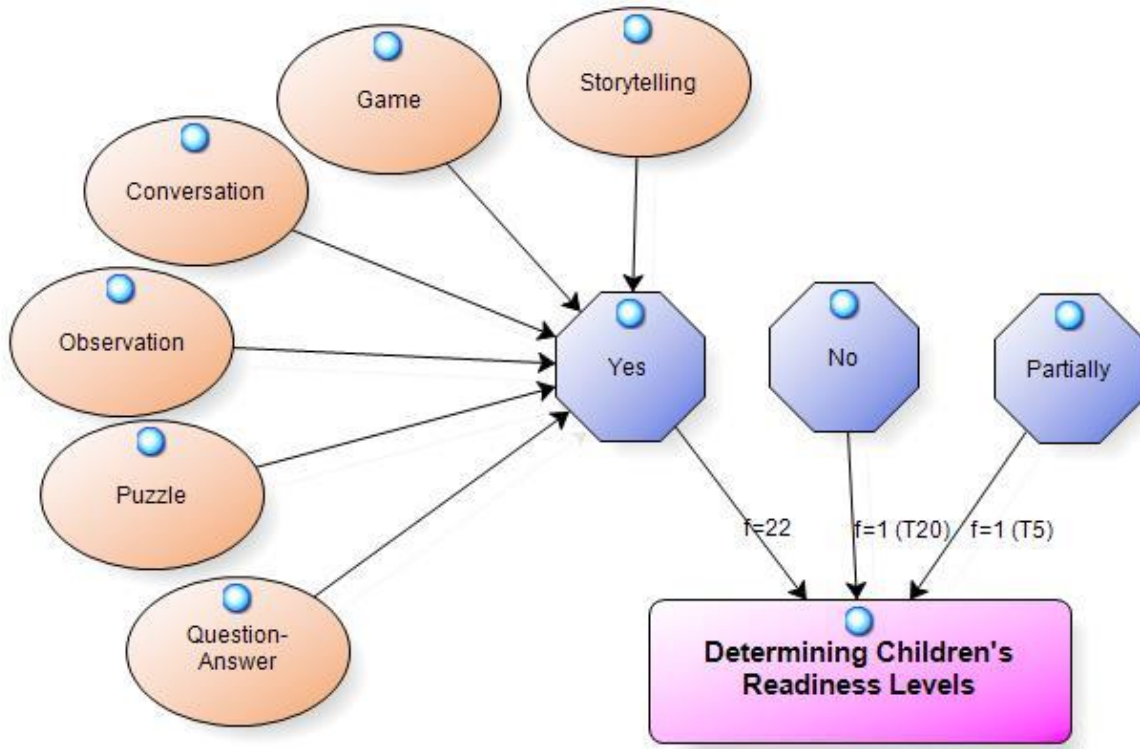*Methods Used by Teachers to Determine Children's Readiness Levels*

Figure 1 indicated that teachers used puzzle, question-answer, observation, conversation, storytelling and game methods when determining children's readiness levels. In addition, the frequency values indicated that there were teachers who answered no (f = 1) and partially (f = 5) regarding determining children's readiness levels.

Yes

"Of course, I determine their readiness levels. I pay attention to their interests and needs. I consider how much they already know and plan accordingly." T.6

"Initially, I ask questions, give examples, and observe whether they understand or not. Since the neighborhood where my school is located does not consist of highly involved families, children's readiness levels are generally low." T.8

"Of course, I teach that concept by considering children's prior knowledge." T.13

"I always determine their readiness levels." T.14

"I ask questions to understand what they already know about the concepts. Once I assess their level of knowledge through questioning, it becomes easier for me to explain things to them." T.15

"Even though there is a center, we cannot implement pre-designed plans for the children. First, we check their prior knowledge—what they know and what they do not know. In fact, I should mention that when children come to us, most of them do not know the language. So, we start by teaching the language first." T.21

No

"To be honest, I do not determine children's readiness levels. I can say that things develop spontaneously. Also, it largely depends on the level of the children. The city I live in makes it easier for me to predict whether they know Turkish or not." T.5

Partially

"I would say partially because, in a crowded classroom, we do not always have the opportunity to do this. However, I do pay attention to children's readiness levels to some extent." T.20

Figure 2

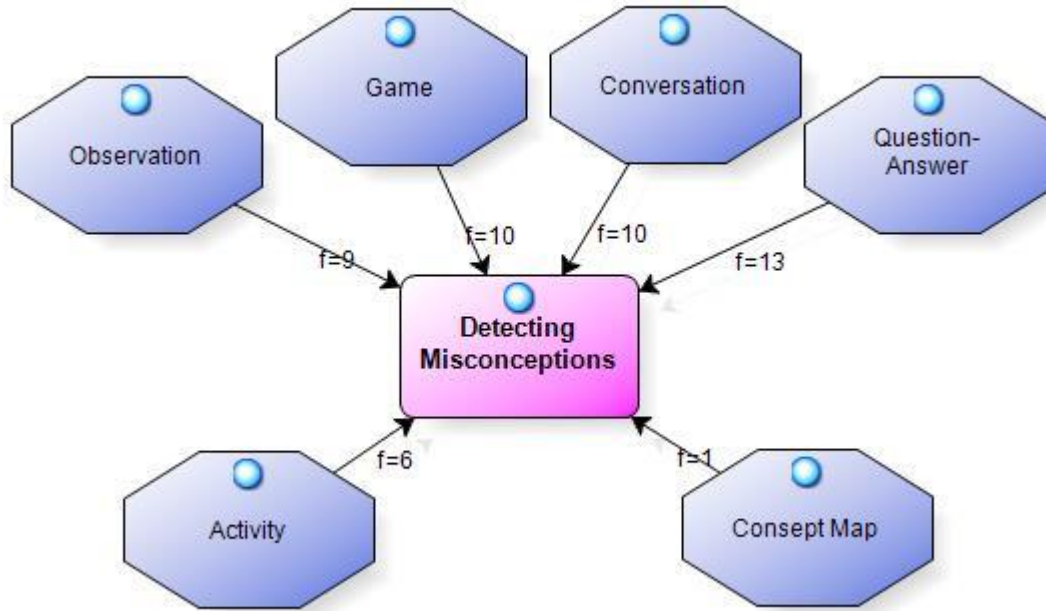*Methods Used by Teachers to Detect Children's Misconceptions*

Figure 2 shows the teachers' use question-answer (f=13), game (f=10), conversation (f=10), observation (f=9), activity (f=6) and concept map (f=1) methods when detecting misconceptions.

Conversation: "You can understand it even from the child's speech. For example, if the child says, 'Teacher, we went on a picnic tomorrow.', you immediately realize that the child has not actually learned that concept." T.14

Observation: "Since I use the observation technique, I take more notes. This way, I can revisit any concept where the child makes errors." T.12

Concept Map: "We use concept maps. While preparing them, children express their ideas, and for example, we can identify which of their ideas are incorrect." T.18
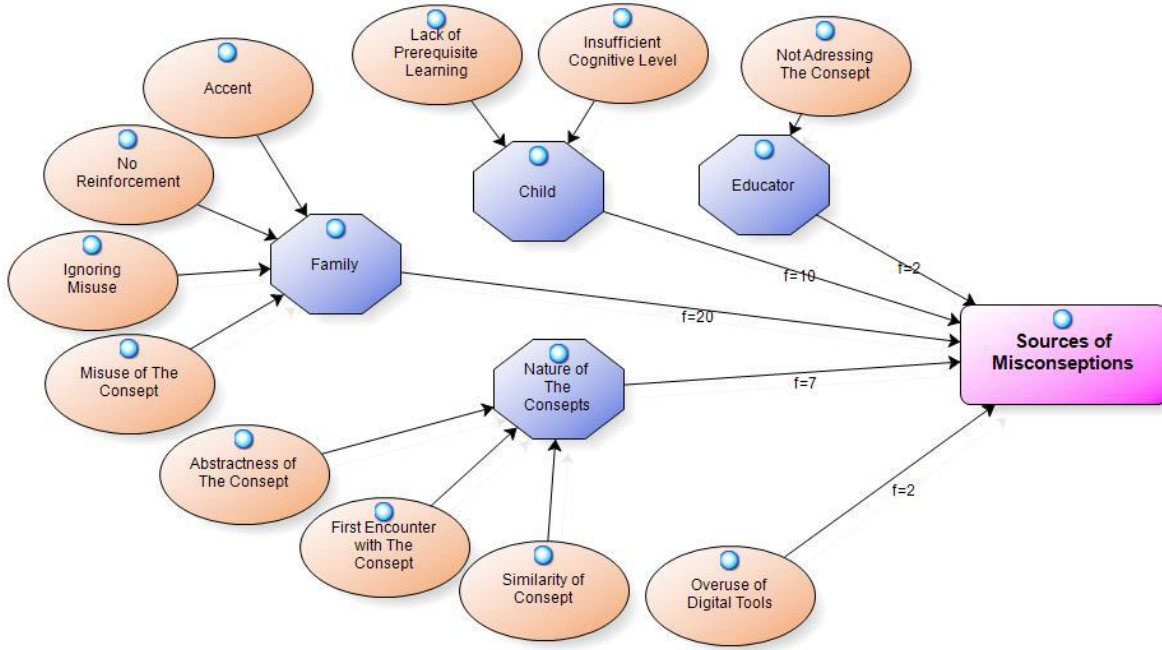
Figure 3

Sources of Children's Misconceptions

Figure 3 illustrated that the participants stated the sources of children's misconceptions as family (f = 20), child (f = 10), nature of the concept (f = 7), educator (f = 2), and use of digital tools (f = 2). Reasons such as parents' misuse of the concept, accent, disregard for misuse, and failure to reinforce the correct use of the concept were the sources of misconceptions in children among the sources of misconceptions caused by the family. Among the misconceptions originating from the child, insufficient cognitive level and prerequisite learning deficiencies were the sources of misconceptions. Among the misconceptions arising from the nature of the concept, the abstractness of the concept, encountering the concept for the first time and the similarity of the concept appear were the sources of misconceptions. The instructor's failure to address the concept was one of the sources of misconceptions.

Family

"If the family establishes incorrect relationships between concepts or uses one concept instead of another, the child observes this at home and repeats the same mistake at school." T.3

"The main sources of the misconception in children regarding the family arise from children who have not been given much attention or who come from families with many children." T.6

"Maybe because they don't hear it much in their families, they don't use it, so maybe their families use it incorrectly." T.7

Child

"First of all, I would attribute it to the child's lack of attention and failure to listen." T.8

"It is due to the child's stage of development." T.10

"I think it happens because the children are not yet ready, and their readiness level is not appropriate." T.12

Instructor

"The instructor may not realize the need to introduce certain concepts at the right time. For example, they may conduct an art activity but neglect to teach the difference between sharp and blunt because they do not prioritize it. Instructors can make such mistakes." T.12

Nature of the Concept

"I think some concepts are beyond children's current level of understanding. They remain very abstract." T.8

"I believe it stems from the complexity of the concept itself." T.11

"Concepts are abstract." T.12

Excessive Use of Digital Tools

"Children who I know spend more time with mobile devices are more likely to develop misconceptions." T.15

"It results from the wrong use of technology." T.16

Figure 4

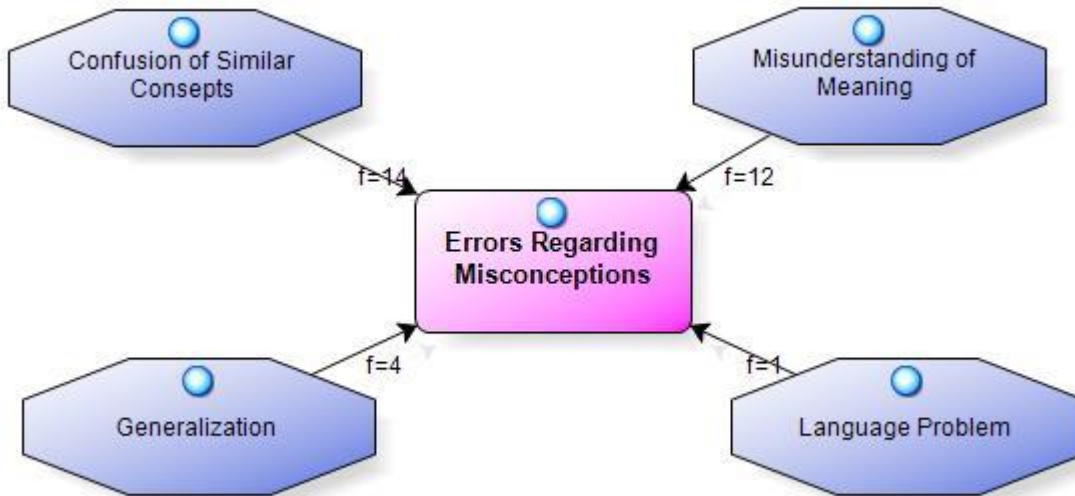*The Reason for Misconceptions Made by Children*

Figure 4 indicated that the participants stated that children's errors regarding concepts occurred in various ways. The frequency values indicated that the errors related to concepts in children were in the forms of confusion of similar concepts (f = 14), misunderstanding of meaning (f = 12), generalization (f = 4) and language problem (f = 1).

Confusion of Similar Concepts

"They confuse what I taught the day before and the day after. For example, they might mix up what I taught them today with what I taught yesterday or even a week ago." T.8

"Sometimes they confuse similar numbers such as 6 and 9 or 5 and 2." T.20

"They especially struggle with distinguishing between the concepts of corner and edge." T.21

Generalization

"Let me give an example through the concept of shape. You know, they tend to call everything that is round a circle." T.24

Misunderstanding of Meaning

"It seems to me that they misuse the meaning, particularly when using it in a sentence. For example, with the concepts of big and small, they understand the difference, but they use them incorrectly in sentences." T.18

Language Problem

"We sometimes face difficulties with language. It's something that can be overcome over time. While it may be a challenge at first, it can improve late." T.5

Figure 5

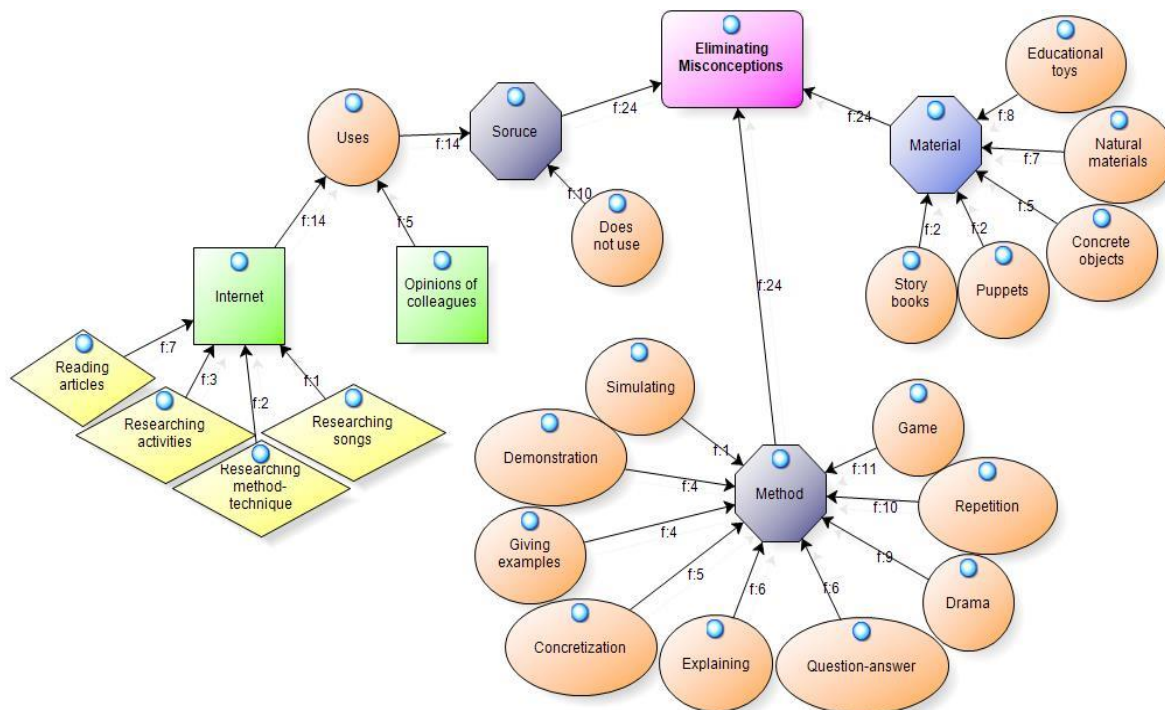*Activities Done by Teachers to Eliminate Children's Misconceptions*

Figure 5 shows the materials, methods, and whether or not teachers use resources to eliminate children's misconceptions. Figure 5 illustrates that teachers use educational toys (f=8),

natural materials (f=7), concrete objects (f=5), puppets (f=2) and story cards (f=2) as materials. It further illustrates that methods used by teachers are game (f=11), repetition (f=10), drama (f=9), narrative (f=6), question-answer (f=6), concretization (f=5), sampling (f). =4), demonstration (f=4) and simulation (f=1). Teachers use the internet (f = 14) and colleagues' opinions (f = 5) as sources to eliminate children's misconceptions. Teachers conduct reading articles on the internet (f=7), activity research (f=3), method-technical research (f=2) and song research (f=1) in order to eliminate misconceptions. There are teachers (f = 10) who do not use resources to eliminate children's misconceptions.

"Frankly, I do not do reseach." T.9

"So, I generally do not use any resources." T.11

"So, to be honest, I do not conduct research right now." T.12

"No, I do not conduct research." T.15

"So, to be frank, I have not done much research." T.17

"I cannot say I have ever done it." T.18

"I do not do any research. There is no source I read." T.19

"I have not really done research yet. Since I have observed that the biggest issue is that they do not know Turkish, I believe that no matter what I do, they will only overcome this problem once they learn the language." T.22

Discussion and Conclusion

Preschool teachers stated that the concepts in which children made the most misconceptions were yesterday-today-tomorrow, right-left, on someone's right-on someone's left, deep-shallow, ellipse, before-now-after, circle, number of rankings, edge, morning-noon-evening, corner, rectangle, glossy-matte, first-middle-last, numbers between 1 and 20, and odd-even. Hacıibrahimoğlu (2014) stated that children before the age of six most often confuse the concepts of yesterday-today-tomorrow among time concepts. Şahin and Korkmaz (2019) concluded that children most often confused the concepts of yesterday-today-tomorrow and morning-noon-evening, respectively, among time concepts. Among the results of the same study, children also experienced misconceptions in the concepts of right-left, on someone's right-on someone's left, deep-shallow, circle and edge. Clements and Sarama (2000), Gunčaga et al. (2017) and Kesicioğlu et al. (2011) concluded that children had misconceptions regarding the concept of triangle. Similarly, the participants of the current study stated that children had misconceptions about the concept of triangle, although the frequency was low. Philips and Pexman (2015) stated that although 4-5-year-old children knew opposite concepts, they could not fully understand their meanings. Mert (2019) found that children confused circles with circular and spherical objects (e.g., basketball hoop, ring, ball). Gunčaga et al. (2017) found that while children had no problems naming the circle, some children confused it with the sphere shape when choosing the circle from the given pictures. They further determined that children did not make any misconceptions regarding the concept of rectangle. However, this result does not coincide with the current research findings. Aubrey (1993) found that children made misconceptions in the numbers between 1 and 20. Similarly, Eleftheriadi et al. (2023) concluded that children had misconceptions about numbers. Children's misconceptions about these concepts may arise due to their abstract and relative nature,

lack of experience, linguistic and conceptual confusion, cognitive development process, cultural aspects, and errors in teaching methods. For example, time-related concepts such as yesterday-today-tomorrow, morning-noon-evening, and before-now-after are abstract. The relativity of time may cause misconceptions in children, as they tend to learn through concrete experiences. Similarly, concepts like odd-even and first-middle-last are also abstract. Spatial concepts such as right-left or on someone's right-on someone's left vary based on perspective. If children receive instruction without considering these perspective shifts, and their ability to perceive perspective has not yet developed, they may form misconceptions. Likewise, concepts like deep-shallow and bright-dull are relative, and children may lack sufficient experience to understand them properly. Shapes such as circle, ellipse, rectangle, corner, and edge share similarities, making it difficult for children to distinguish between them. Additionally, if the child's environment consistently refers to all objects as "round," they may fail to notice specific features. Numbers from 1 to 20, ordinal numbers, and odd-even distinctions are mathematical expressions that may remain abstract for children. Moreover, if children are not corrected when they count numbers randomly, they may develop misconceptions. A lack of exposure to structured experiences may further contribute to the formation of these misconceptions in children.

The second phase of the research examined the opinions of preschool teachers regarding the activities they conducted on concepts in which children had misconceptions. In this regard, the study concluded that the majority of preschool teachers determined the readiness levels of children regarding misconceptions using games, observations, puzzles, question-answers, conversations and storytelling activities before teaching concepts. However, one of the teachers stated that he did not do such activities with children. Teachers generally recognize the importance of determining children's readiness levels. However, they could utilize more data collection methods to assess readiness more specifically. For example, they can use concept cartoons, concept maps, checklists, or rubrics developed by teachers based on children's developmental characteristics outlined in curricula to conduct these evaluations. Various studies have shown that a qualified education process cannot be carried out without determining children's readiness levels and which concepts they make misconceptions in, and that children's misconceptions may deepen further (Aydın & Özkara, 2011; Philips, 1991; Watson, 1997; Tytler, 1998).

The participants determined children's misconceptions using question-answer, conversation, game, observation, activity and concept maps methods. The study found that the participants did not know sufficient methods and techniques for detecting misconceptions. Chavan and Patankar (2016) recommend strategies such as concept maps, word association, concept cartoons, children's drawings, card sorting, clinical interviews, mind / thinking maps, role playing and model / scientific device for detecting misconceptions. Apart from these, teachers can also use methods such as metaphor to determine children's misconceptions and how they perceive concepts.

Among the mistakes children made regarding misconceptions, the participants stated that children confused similar concepts, made misunderstandings in meaning, made generalization errors, and made regional mistakes due to language problems. The participants stated the sources of children's conceptual errors as family, child, nature of the concept, educator and excessive use of digital tools. The conceptual errors and sources stated by the teachers are in line with the literature (e.g., Şahin & Korkmaz, 2019). Misconceptions may occur in children as a result of social interaction and their own experiences. In this context, teachers need to pay particular attention to the meaning and usage of words, on the grounds that they are the main authority that children will take as role models (Watson, 1997). Another factor that teachers should know as the source of

children's misconceptions is that the books they use can also cause misconceptions. Kazantzidou and Kotsis (2023) found that the fairy tales they examined caused children to learn the concepts incorrectly. For example, although the concept of weight is a concept in physics, they stated that children may mislearn the scientific meaning of the concept as a result of its homonymous use. Therefore, teachers need to review the books they use in detail. Additionally, teachers have overlooked the possibility that conceptual misconceptions may stem from the incomplete development of children's cognitive skills (e.g., abstract concepts, inability to perceive perspective) and cultural factors. Otherwise, they may cause new misconceptions to emerge in children.

The study found that teachers used games, repetition, drama, question-answer, narration, concretization, sampling, demonstration and simulation methods, and educational toys, natural materials, concrete objects, puppets and story books as materials to eliminate children's misconceptions. However, Ünal (2013) determined that teachers carried out the teaching process of concepts with the traditional method, did not make the necessary arrangements in the educational environment, were inadequate in presenting alternative ideas in material preparation, and could not choose tools and examples that would attract the attention of children. Teachers should also use methods such as making explanations to resolve children's misconceptions (Chinn & Malhotra, 2002), using peer support effectively (de la Hera et al., 2019), ensuring peer cooperation by planning small activities (Asterhan & Schwarz, 2009), and preparing a conflict environment (Limón, 2001). Additionally, teachers should compare children's misconceptions with a sufficient number of anomalies (Watson, 1997). Teachers resort to the online environment and peer opinions while doing research to eliminate conceptual errors, but a significant portion of them prefer to eliminate conceptual errors with the methods they know without doing any research. However, qualified teachers need to renew themselves. In this regard, they should closely follow the developments in the field. The teacher's task is to find the most appropriate methods that will facilitate children's learning (Shuell, 1987). Teachers can also use the methods suggested by Chavan and Patankar (2016) for detecting misconceptions to correct misconceptions in children. In order to eliminate children's misconceptions, teachers can use strategies such as the productive learning model (Cosgrove & Osborne 1985), the conflict of ideas model (Champagne et al., 1985), balancing, conflict and instruction suggested by Rowell and Dawson (1985).

According to preschool teachers, children mostly had problems with concepts related to time, direction/position in space, and geometric shapes. Further, according to teachers, children made misconceptions by mixing similar concepts, making semantic errors, making linguistic problems and making generalizations. The main sources of misconceptions in children were families, the child (level of cognitive deficit), the nature of the concept, excessive use of digital tools and educators. The study further concluded that the participants were aware of children's misconceptions. However, the findings revealed that the participants did not know different methods and techniques to detect and eliminate misconceptions. The study recommends that preschool teachers should receive in-service training on the detection and correction of misconceptions. The content of the Education Information Network (EBA) can be enriched with methods and techniques that can be used for preschool teachers to identify and correct misconceptions. Teachers can plan their instructional processes by considering the frequent conceptual misconceptions identified in the study. The study further recommends that teachers assess themselves and strengthen their weaknesses in providing children with sufficient information and scientific explanations when addressing commonly misunderstood concepts. To identify and eliminate conceptual misconceptions, teachers should be knowledgeable about

methods such as peer education, conceptual change texts, evidence-based argumentation-based learning, explanation-based teaching, and concept cartoons.

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Geniş Özet

Çocuklardaki kavram yanılgılarının eğitim sürecindeki kritik rolü düşünüldüğünde, formal eğitimin ilk basamağı olan okul öncesi eğitimin önemi daha da belirginleşmektedir. Bu eğitim kademesinde anahtar rol, okul öncesi öğretmenlerine düşmektedir (Whitebook, 2003). Çünkü öğretmenler çocukların kavram yanılgılarını belirleme, açıklama ve düzeltme sorumluluğuna sahiptir (Barke et al, 2008). Formal eğitimle birlikte, çocukların informal olarak edindikleri bilgiler ile formal eğitim ortamındaki bilgi ve beceriler arasında bir bağlantı eksikliği, öğretim sürecinde sorunlara yol açmaktadır (Sarama & Clements, 2009). Bu nedenle, öğretmenler çocukların hazırbulunuşluk düzeylerini ve kavram yanılgılarını dikkatlice belirlemelidir. Aksi takdirde, çocuklardaki kavram yanılgıları daha da derinleşmektedir(Aydın & Özkara, 2011; Philips, 1991; Watson, 1997) ve istenen kavramsal değişimin gerçekleşmesini zorlaştırabilir (Tytler, 1998). Çocukların yanlış kavramlarını belirlemede kritik bir rol oynayan temel unsur ise değerlendirmedir (Izzati & Rochmah, 2020). Çünkü değerlendirilmeyen bir çocuk hakkında yeterli bilgiye sahip olmak mümkün değildir. Eğitim sürecinde etkili ve anlamlı öğrenmeyi sağlamak için çocuklardaki kavram yanılgılarını ve nedenlerini belirlemek, bu yanılgıları düzeltmek veya ortadan kaldırmak büyük önem taşımaktadır (Pekel, 2019).

Bu çalışmada, okul öncesi eğitime başlayan çocukların hangi kavramlara ilişkin yanılgılara sahip oluklarının ve okul öncesi öğretmenlerinin bu yanılgıları tespit etmek ve ortadan kaldırmak için uyguladıkları yöntemlerin, öğretmen görüşleri doğrultusunda belirlenmesi amaçlamaktadır. Bu doğrultuda, çocukların genel olarak hangi kavramlarda yanılgı yaptıkları, okul öncesi öğretmenlerinin çocukların hazırbulunuşluğunu belirleme, çocuklardaki kavram yanılgılarını tespit etme ve bu yanılgıları giderme konusundaki yeterlikleri de ortaya çıkarılması hedeflenmiştir. Bu amaçla, çalışma aşağıdaki sorulara yanıt aramıştır:

1. Öğretmenlere göre okul öncesi dönem çocuklarının kavram yanılgısı yaşadığı kavramlar nelerdir?

2. Öğretmenler çocukların hazırbulunuşluklarını değerlendirmek için hangi yöntem ve teknikleri kullanmaktadır?

3. Öğretmenler çocuklardaki kavram yanılgılarını tespit etmek için hangi yöntem ve teknikleri kullanmaktadır?

4. Okul öncesi öğretmenlerine göre, çocuklardaki kavram yanılgısı nasıl ortaya çıkmaktadır? ?

5. Öğretmenler çocuklardaki kavram yanılgılarını gidermek için neler yapmaktadır?

Yöntem

Bu araştırmada okul öncesi öğretmenlerinin görüşleri doğrultusunda çocukların en çok kavram yanılgısı yaptıkları kavramları, çocukların kavram yanılgılarının nedenlerini ve kavram yanılgılarını düzeltmek için uyguladıkları stratejileri belirlemek amacıyla fenomenoloji deseni kullanılmıştır. Araştırmada, veri çeşitlemesi ve yöntem çeşitlemesini kullanarak toplam 122 okul öncesi öğretmeninden veri toplamıştır. Araştırmaya katılanların seçiminde kartopu örnekleme (n=122) ve ölçüt örnekleme (n=24) kullanılmıştır. Araştırmacılar tarafından hazırlanan "Okul Öncesi Dönem Çocuklarının Kavram Yanılgılarına İlişkin Yapılandırılmış Anket" ile "Okul Öncesi Dönemdeki Çocukların Kavram Yanılgılarına İlişkin Yarı Yapılandırılmış Görüşme Formu" kullanılarak görüşme tekniği ile veriler toplanmıştır. Anket ile toplanan veriler yüzde ve frekans ile belirtilmiştir. Yarı yapılandırılmış görüşme formundan elde edilen verilerin analizinde ise nitel veri analiz tekniklerinden olan betimsel ve içerik analizi kullanılmıştır.

Bulgular

Öğretmenlere göre çocukların sırasıyla en çok; dün-bugün-yarın, sağ-sol, sağında-solunda, derin-sığ, elips, önce-şimdi-sonra, çember, sıra sayısı (birinci, ikinci…), kenar, sabah-öğle-akşam, köşe, dikdörtgen, parlak-mat, ilk-orta-son, 1-20 arası sayılar ve tek-çift kavramlarında en az ise ağır-hafif, yanında, yukarıda-aşağıda, içeri-dışarı, uzak-yakın, kokulu-kokusuz, üzgün, açık-kapalı, şişman-zayıf, estetik, hüzün, beşgen, altıgen, okul-sınıf kavramlarında hata yaptıklarını ifade etmişlerdir. Çocuklarda kavramlara ilişkin hataların; benzer kavramları karıştırma (f=14), anlam yanılgısı (f=12), genelleme (f=4) ve dil sorunu(f=1) şeklinde olduğu bulgulanmıştır. Öğretmenler, çocukların kavram yanılgılarının kaynaklarının; aile (f=20), çocuk (f=10), kavramın doğası (f=7), eğitici (f=2) ve dijital araç kullanımı (f=2) kaynaklı olduğunu belirtmişlerdir. Öğretmenlere göre, ailelerin; kavramları yanlış kullanımı, şivesi, yanlış kullanımı önemsememesi ve pekiştirme yapmaması kavram yanılgısına neden olmaktadır. Çocuktan kaynaklanan bilişsel düzeyin yetersizliği ve ön koşul öğrenme eksiklikleri kavram yanılgılarının kaynaklarından olduğu görülmektedir. Kavramın doğasından kaynaklanan; kavramın soyutluğu, kavram ile ilk defa

karşılaşılması ve kavramın benzerliği kavram yanılgılarının kaynaklarından biri olarak ifade edilmektedir. Eğiticinin kavramı ele almaması da kavram yanılgılarının nedenleri arasındadır. Öğretmenler; soru-cevap (f=13), oyun (f=10), sohbet (f=10), gözlem (f=9), etkinlik (f=6) ve kavram haritası (f=1) yöntemlerini çocukların kavram yanılgılarını tespit ederken kullanmaktadır. Öğretmenlerin materyaller olarak eğitici oyuncaklar (f=8), doğal materyaller (f=7), somut nesneler (f=5), kuklalar (f=2) ve hikâye kartları (f=2) kullandıkları belirlenmiştir. Öğretmenler çocukların kavram yanılgılarını gidermek için kaynak olarak; internete (f=14) ve meslektaş görüşlerine (f=5) başvurmaktadırlar. Öğretmenlerin kavram yanılgılarını gidermek için internet kaynağından makale okuma (f=7), etkinlik araştırma (f=3), yöntem teknik araştırma (f=2) ve şarkı araştırma (f=1) çalışmaları yaptıkları görülmektedir. Ayrıca çocukların kavram yanılgılarını gidermek için kaynak kullanmayan (f=10) öğretmenleride bulunmaktadır.

Sonuç ve Tartışma

Okul öncesi öğretmenleri çocukların en çok yanılgı yaşadığı kavramları sırasıyla; dün-bugün-yarın, sağ-sol, sağında solunda, derin-sığ, elips, önce-şimdi-sonra, çember, sıra sayısı, kenar, sabah-öğle-akşam, köşe, dikdörtgen, parlak-mat, ilk-orta-son, 1-20 arasındaki sayılar ve tek-çift olduğunu ifade etmişlerdir. Clements ve Sarama (2000); Gunčaga ve diğ, 2017; Kesicioğlu, Alisinanoğlu ve Tuncer (2011) çocukların üçgen kavramına ilişkin kavram yanılgısı yaşadıkları sonucuna ulaşmışlardır. Benzer şekilde de bu araştırma sonucunda da sıklığı az olmasına rağmen öğretmenler çocukların üçgen kavramına ilişkinde yanılgı yaşadıklarını belirtmişlerdir. Philips ve Pexman (2015) 4-5 yaşındaki çocukların zıt kavramları bilse de tam olarak anlamlarını kavrayamadıklarını belirtmişlerdir. Gunčaga ve arkadaşlarının (2017) yapmış olduğu çalışmada çocukların daireyi isimlendirmede sorun yaşamazken daireyi verilen resimlerden seçerken bazı çocukların küre şekli ile karıştırdıklarını bulgulamıştır. Aynı araştırma sonuçlarında dikdörtgen kavramına ilişkin çocukların hiçbir kavram yanılgısı yapmadığı tespit edilmiştir. Ancak bu sonuç araştırma bulgularımızla örtüşmemektedir. Aubrey (1993) yapmış olduğu araştırmada 1-20 arasındaki sayılarda çocukların kavram yanılgısı yaptıklarını bulgulamıştır.

Öğretmenler çocukların kavram yanılgılarını gidermek için; oyun, tekrar, drama, soru-cevap, anlatım, somutlaştırma, örnekleme, gösterip yaptırma ve benzetim yöntemlerini, materyal olarak eğitici oyuncaklar, doğal materyaller, somut nesneler, kuklalar ve hikâye kitaplarını kullandıkları sonucuna ulaşılmıştır. Ancak Ünal (2013) yapmış olduğu çalışmasında öğretmenlerin, kavramların öğretim sürecinin geleneksel yöntemle gerçekleştirdiği, eğitim ortamında gerekli düzenlemeler yapmadıklarını, materyal hazırlama konularında alternatif fikirlerin ortaya konulmasında yetersiz kaldıklarını, çocukların ilgisini çekecek araç gereç ve örneklerini seçemediğini tespit etmiştir. Öğretmenler çocukların kavram yanılgılarını gidermek için açıklama yapma (Chinn & Malhotra, 2002), akran desteğini etkili bir şekilde kullanma (de la Hera, Sigman & Calero, 2019), küçük etkinlikleri planlayarak akran işbirliğini sağlama (Asterhan & Schwarz, 2009) ve çatışma ortamı hazırlama (Limón, 2001) yöntemleri de kullanmalıdır.

Okul öncesi öğretmenlerine göre çocuklar en çok zaman, uzayda yön/konum ve geometrik şekillerle ilgili kavramlarda sorun yaşamaktadır. Ayrıca öğretmenlere göre çocuklar benzer kavramları karıştırarak, anlam hataları yaparak, dilsel problemler yaparak ve genellemeler yaparak kavram yanılgıları yaşamaktadırlar. Çocuklardaki kavram yanılgılarının temel kaynakları; aileler, çocuk (bilişsel eksiklik düzeyi), kavramın doğası, dijital araçların aşırı kullanımı ve eğitimcilerdir. Okul öncesi öğretmenleri çocukların kavram yanılgısına sahip olabileceğinin farkındadırlar. Ancak

kavram yanılgılarının tespiti ve düzeltilmesine ilişkin sınırlı sayıda yöntem ve teknik bildikleri sonucuna ulaşılmıştır.

Öğretmenler araştırma sonucunda ortaya çıkan çocukların sıklıkla yaptığı kavram yanılgılarına dikkat ederek öğretim süreçlerini planlayabilir. Çocukların sıklıkla kavram yanılgısı yaptıkları kavramların öğretimi noktasında öğretmenlerin çocuklara yeterli bilgileri bilimsel açıklamalar doğrultusunda dönütler verme noktasında kendilerini değerlendirmeleri ve eksik yanlarını güçlendirmeleri önerilmektedirAraştırmada okul öncesi öğretmenlerine kavram yanılgılarının tespiti ve düzeltilmesi konusunda hizmet içi eğitim verilmesi önerilmektedir. Eğitim Bilgi Ağı (EBA) içeriği, okul öncesi öğretmenlerinin kavram yanılgılarını tespit edip düzeltmelerinde kullanılabilecek yöntem ve tekniklerle zenginleştirilebilir.