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Misconceptions in 5-6 Year Old Children: Formation of a Cloud

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ABSTRACT

Many phenomena and events in which children are included are suitable to be researched and discovered by children within the scope of science education. Children ask many questions while researching the scientific facts and phenomena they are curious about and learn new concepts. In this process, it is essential to teach the concepts children will learn and the new education to be formed. Therefore, this study aimed to examine the concept of cloud, which mainly attracts children's attention, and the current conceptual knowledge and misconceptions about cloud formation. For this purpose, the phenomenology pattern was used in the research. The study group consisted of 5-6 year-old children studying in an independent kindergarten affiliated with the Ministry of National Education in Antalya. A total of 12 children and one teacher were included in the study. The research used the 'Personal Information Form', 'Children's Scientific Concepts Evaluation Form' and 'Teacher Interview Form for Science Education' as data collection tools for children and their teachers. The data were analyzed by the descriptive analysis method. Findings obtained from children were presented in the form of themes by coding. As a result of the research, it was determined that children had concept deficiencies and misconceptions about the formation of the cloud and that there were errors in the formation of meaning. In addition, suggestions were made to teachers for practices to assess and change children's misconceptions.

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INTRODUCTION

Preschool is a period in which the foundations of human life and development are based. This period includes a process in which brain development and synaptic connection speed are highest, and children experience extreme cognitive, social-emotional, language, and motor development changes. Furthermore, while children grow and mature rapidly in the first years of life, the brain is highly open to external stimuli during this period (Nicolic, 2010). For this reason, teachers and families need to form a planned and qualified environment to support children's mental development most effectively. For this, first of all, supporting the competencies of teachers and families and, accordingly, environmental planning organized with a multi-sensory and scientific understanding in the early years should be given priority.

Recent developments in learning suggest that children need science to develop new understandings in the early years (Guo et al., 2015; Lind, 1998). However, past research conducted within the scope of science education shows that many educators do not pay much attention to the ability of early childhood children to learn the concepts of science (Ayers, 1999; Tanık-Önal & Sönmez-Eryaşar, 2022). This idea is wrong in terms of children's development and learning. Because teachers with this idea often fail to "… take advantage of children's innate interest and enthusiasm for science" (Watters et al., 2001, p. 2). Concept-oriented studies have replaced these thoughts, a prerequisite for scientific thinking (Fleer, 2009; Saçkes et al., 2010). The important names that form the basis of this idea in his works are undoubtedly Vygotsky and Piaget. Vygotsky and Piaget, who focused on the development of language and thought in children during their early studies, increased the interest in children's mental structures and concept learning required for scientific thinking (Bodrova & Leong, 2017; Hedegaard & Chaiklin, 2005; Sözbilir, 2003). Especially in Vygotsky's explanations on conceptual development, there has been a great interest in his views on the differences between everyday and scientific concepts due to everyday and scientific thinking (Bodrova & Leong, 2017). Vygotsky (1987) argued that these everyday concepts form the basis of learning scientific concepts. In this context, he stated that forming everyday concepts and forming scientific concepts are strongly linked. Therefore, everyday concepts based on the daily life experiences of children and adults form the potential for developing scientific concepts in the context of school experiences (Fleer, 2009). Concerning this, Hedegaard and Chaiklin (2005) explained that the most powerful learning contexts are that teachers take the contexts of 'everyday concepts' and 'scientific concepts' into consideration when planning to learn.

Concepts are mental tools that enable the individual to think by classifying what is learned and organizing information (Senemoğlu, 2001). However, much research has revealed that children acquire inaccurate information and the right ones from their environment before starting school and that they form a unique world of meaning with what they see in their environment. Accordingly, they point out that children come to school with concepts that are generally inconsistent with the concepts, skills, and phenomena they have in the early years (Abell & Lederman, 2007; Smolleck & Hershberger, 2011). This inconsistent information that children have is called misconception (Akbaş, 2002).

The misconception describes "a situation in which children's ideas about a concept differ from those of scientists" (Blosser, 1987 as cited in Smolleck & Hershberger, 2011). Accordingly, the concepts and misconceptions of young children are based on their daily experiences. Logical but scientific misconceptions often guide children's ways of characterizing and explaining the world. In many cases, children develop partially correct ideas that can be used as a basis for further learning (Committee on Undergraduate Science Education, 1997). Children also make inferences and build basic concepts while constructing these ideas (Civelek & Özyılmaz-Akamca, 2018). However, studies have revealed that these ideas are mainly contrary to scientific explanations (Dove, 1998; Vosniadou & Brewer, 1992).

In the related literature, it is stated that children's misconceptions are caused by their daily observations and experiences, learning, religious or cultural teachings acquired before starting school, and science practices that do not adequately question children's misconceptions (Abell & Lederman, 2007; Alawiyah et al., 2018; Chavan & Patankar, 2016; Committee on Undergraduate Science Education, 1997; Thompson, 2006). There are many contexts in children's lives where they encounter information that encourages misconceptions. Therefore, it is possible for children to draw more than one conclusion for a particular phenomenon, depending on the context they are in (Smolleck & Hershberger, 2011). As children draw conclusions in the learning process, they build their new learning by combining it with their previous learning. Therefore, it is seen that they continue their misconceptions as a result of an error/mistake or inadequate inferences in their previous learning (Kirbulut & Geban, 2014; Rowell et al., 1990). However, the inability to pay attention, excessive attention, incorrect learning, and some physical inadequacies can also lead to misconceptions (Newton, 2000).

On the other hand, Piaget stated that misconceptions are a structure and are added on top of each other. He also revealed that teaching activities without evaluating the learners' prior knowledge and misconceptions would increase the children's misconceptions (Aydın & Özkara, 2011). At the same time, studies have revealed that eliminating misconceptions is not easy and is an essential obstacle to meaningful learning. It has been stated in many studies that children have difficulty in changing the wrong ideas they have acquired and tend to stick to these ideas (Büyükkasap et al., 2001; Duncan, 1999).

When the formation of misconceptions is examined, it is stated that it starts as a gap of lack of knowledge. This gap is explained as the random filling of children with their existing knowledge and experiences due to the lack of unqualified or concept-oriented education. Although the information obtained by the child through random gap-filling is somewhat successful, this situation emerges as a misconception at some point. These misconceptions are seen as developers in terms of teaching, provided that they are corrected over time (Rowell et al., 1990). However, although many teachers think of children as a primary mental writing board and assume the role of filling it, the main problem is that the boards are not empty but contain some preliminary knowledge and intuition. Teaching activities to be carried out without identifying children's prior knowledge and intuition and determining to what extent they are consistent in scientific thinking will cause difficulties in achieving the desired conceptual change (Tytler, 1998).

Teachers are responsible for identifying, explaining, and correcting misconceptions (Barke et al., 2008; Izzati & Rochmah, 2020). Children's misconceptions are only possible with the knowledge of how their cognitive structures work and develop. Therefore, evaluation is critical in determining children's misconceptions. Furthermore, evaluations that will make children's existing concepts and understandings visible are crucial in accurately representing their misconceptions based on the misinformation they produce (Izzati & Rochmah, 2020). Strategies such as concept maps, word association, concept cartoons, student drawings, card sorting, clinical interviews, mind/thinking maps, role-playing, and model/scientific apparatus are proposed for the detection and correction of misconceptions (Chavan & Patankar, 2016). In this regard, Ünal and Akman (2006) drew attention to the importance of the teaching techniques used by teachers to establish a solid scientific basis in children because teachers' competence in doing effective science with children may vary depending on their scientific concept knowledge, attitudes toward science, and scientific understanding.

Effective science education studies to be presented to children should be organized in a motivating way against scientific phenomena and events that children can experience with all their senses, encouraging their effective participation (Macpherson, 2011). Because the concrete experiences gained during this period support brain development in children and provide permanent information (Oktay, 2007). However, children's dispositions towards scientific phenomena and events are known to be highly influential on their learning (Perkins et al., 1993). Because children develop an understanding of the world as they research and discover in line with their dispositions. These understandings and concepts developed in the early years form the basis for future periods and deeper understandings. Therefore, early learning can prevent or support future learning (Smolleck & Hershberger, 2011). For this reason, it is vital for teachers to develop their competencies for effective science practices and to build the concepts children need to correctly make sense of the world through scientific facts and events.

When the studies described above and the related literature were examined, although there are many studies on the misconceptions of children in the preschool years in foreign literature, few studies investigate the scientific misconceptions of children and the effectiveness of the developed educational program in Turkey. Therefore, this study aims to examine the current misconceptions and changes in the cloud concept and its formation that attract children's attention. For this purpose, the conceptual knowledge of children aged 5-6 years about the formation of clouds and clouds was evaluated in the study. Furthermore, with the training program prepared by the researchers about cloud and the formation of cloud, the extent to which the concept knowledge and misconceptions have changed was examined. Therefore, this study is necessary to be an example and guide for future studies with the educational program applied to determining the misconceptions of preschool children and correcting these misconceptions.

Aim of the Study

The main purpose of this study was to examine the concept of cloud, which attracted the most attention of aged 5-6 year children in the study group in line with the results obtained from the preliminary interview, and their current conceptual knowledge and misconceptions about cloud formation.

In line with this purpose, answers to the following questions were sought:

1.What kind of concept knowledge do the children in the study group have about the cloud and the formation of the cloud?

2.What are the misconceptions of the children in the study group about the cloud and the formation of the cloud?

3.Is the education program applied to the children in the study group influential in children's concept development?

METHOD

Research Design

The research was planned as a phenomenology pattern. Phenomenological studies focus on the common characteristics of several people in their experiences associated with a phenomenon or concept. Phenomenological studies usually emphasize a concept or idea (Creswell, 2013). The phenomenon accepted within the scope of this study is the misconceptions of preschool children about clouds and the formation of clouds. Revealing children's misconceptions constitutes the scope of the research.

Study Group

The study group of this research consists of 5-6 years old children attending an independent kindergarten affiliated with the Ministry of National Education (MoNE) in the central district of Antalya in the 2022-2023 academic year. The convenience sample method was used to recruit 12 preschool children and their teacher for this study. No personal information explaining the identity of the children involved in the study was included. The study group consisted of 12 children aged 5-6 years, with more girls (n=8) than boys (n=4) and the teacher was female and had a degree in preschool education with 20 years of experience.

Data Collection Tools

In the study, the "Personal Information Form," "Children's Scientific Concepts Evaluation Form," and "Teacher Interview Form for Science Education" prepared by the researchers were used as data collection tools. Information on data collection tools is presented below.

Personal Information Form

It was prepared by the researchers to determine the characteristics of children, such as age, gender, and developmental status.

Children's Scientific Concepts Evaluation Form

The children's Scientific Concepts Evaluation Form was developed by the researchers to determine the current concept knowledge and misconceptions. Considering the developmental periods of the children, it was given importance to formulate the questions in the form of clear and straightforward language. Accordingly, questions that can reveal children's thoughts about scientific facts or events have been determined. 'Children's Scientific Concepts Evaluation Form' consists of three questions. The questions in the form were studied in two stages with the children.

Teacher Interview Form for Science Education

It was prepared by the researchers to determine the teachers' opinions of the children included in the study about science education in the preschool years. There are a total of six questions in the form. These questions were prepared to obtain the teacher's personal information, the scope of science education, the methods, and techniques used in science education, the frequency of doing science activities, and the information about the materials preferred within the scope of science education.

Educational Program

In the development of the educational program developed by the researchers, the relevant literature was first reviewed. In light of views of the relevant theorists (Vygotsky, Piaget, Chomsky, Lenneberg), approaches (socio-cultural, constructivist) and the categories of scientific concepts described by the National Research Council [NRC] (1996), while forming the framework of the educational program, the idea of the need to support the concepts and development processes that children will need in their scientific thinking processes effectively has been the focus of our program. In this context, various scientific fields in the literature of preschool science education, physical sciences, life sciences, Earth and space sciences, and scientific concepts related to these fields were examined (CUSE, 1997; MoNE, 2013; NRC, 1996). Afterward, children were interviewed to clarify the scientific phenomenon/event to be determined within the scope of the research. Before the concept of cloud formation was defined, the children were asked about the things they were most curious about during the interviews. Accordingly, it was noted that children focused on themes such as rain, cloud, lightning, etc. Therefore, the program's theme is determined as the cloud and the formation of the cloud. In this context, the children's teachers were asked about their studies. In the next stage, the educational program's content, methods, duration, and materials were determined, and the program was finalized. The program was designed to be implemented three times a week for 2 weeks as activities lasting 30-40 minutes. Information about the program is presented during the implementation phase.

Data Collection Process

Necessary permissions were obtained from the institution where the application will be made before starting the study. The teacher of the children to be studied in the institution was informed about the purpose, content, duration of the study, and the data collection tools to be used. data were collected using a semi-structured interview technique. Afterward, preliminary interviews were held with the children to determine the children's concept knowledge and misconceptions about the cloud and the formation of the cloud. The data obtained from the interviews with the children were transferred as raw data. In order to change the existing misconceptions, an educational program developed by the researchers and expert opinion was applied to the children. After the implementation phase, a final interview was held with the children to evaluate how much they had changed their existing misconceptions and the scientific concepts they had just learned. After the last interview, an individual interview was held with the teacher. The study was conducted between February and March 2023.

Implementation Phase

Pre-interview stage; before the implementation of the education program, individual interviews lasting about 10 minutes were held with every child to identify the children's misconceptions and concept knowledge about the cloud and its formation. In the individual interviews, the researcher first introduced himself to each child and explained the purpose of the study. A short conversation was held so the child could feel comfortable and express his/her feelings and thoughts comfortably. In the next stage, the child was asked to examine the sky and clouds by showing an image. The researcher pointed to the clouds and asked, “What do you think these might be?" If the child does not have any conceptual knowledge about "cloud", the child points to the visual and explains that it is a cloud. Then “What do you know about the cloud?” question is asked. To the answer given by the child, "So where did you learn this/these?" question is asked, and data are collected about the children's information source. Then the child is asked, "How do clouds” form? In line with the answers given by the children, the "So where did you learn this/these?" question is asked again, all answers are recorded, and the interview is finished.

Implementation of the educational program; After the children's existing conceptual knowledge and misconceptions about clouds and cloud formation were identified, an educational program was implemented to expand their conceptual knowledge and change their existing misconceptions. The program includes methods and techniques such as science education, drama, brainstorming, concept maps, experimentation, analogy, and drawing.

The final interview phase; After the implementation of the educational program, individual interviews were conducted with the children to determine to what extent the children's misconceptions about the cloud and its formation have changed. The image used in the pre-interview and expressing the sky is shown to the children again. The clouds are pointed out, and questions are repeated. After the children's responses are recorded, the interview is finished.

Interview stage with the teacher; An individual interview was conducted with the teacher in order to find out what kind of activities the teacher included within the scope of science activities, how he/she decided on the theme selection, what kind of materials he/she used within the scope of science education, and how often he/she did science work. Answers were recorded after the interview, which lasted about 20 minutes.

Data Analysis

In this study, Furthermore, the descriptive analysis technique was used to analyze the data obtained from the interview. In the descriptive analysis technique, the data can be formed by considering both the themes revealed by the research questions and the questions in the interview.

Validity and Reliability

In order to increase the validity of the research, the opinion of two field experts, one in the field of preschool education and one in the field of curriculum development, was consulted during the development of the interview forms. In addition, raw data are described with direct quotations and detailed descriptions. The researchers conducted preliminary interviews with three children to test the comprehensibility of the questions. After the interview, some changes were made to the questions, and the form was ready for implementation. In order to evaluate the validity of the program within the scope of the educational program, three field experts, one preschool education researcher, one program development researcher, and one preschool teacher, were consulted. With the feedback from the field experts, the educational program was finalized and made ready for implementation.

Some measures have been taken to ensure the reliability of the research. It is vital to collect data from different sources to collect data in research. Within the scope of this study, data were collected from preschool children and their teachers. The themes formed after the analysis was subjected to expert opinion and verified also called peer inquiry (Türnüklü, 2000). Accordingly, the researchers consulted the themes formed by other researchers who have experience and knowledge about the research subject. Therefore, children were coded as C1, C2, C3….

Ethic

The ethics committee approval of the study was obtained by Burdur Mehmet Akif Ersoy University Ethics Commitee (Approval Nr. GO 2023/84) in 01 February 2023.

FINDINGS

This section presents the findings obtained in line with the research data below.

Table 3. *Children's views about the concept of cloud*

N	Pre-interview		Final Interview	
	Explanations	Theme	Explanations	Theme
C1	"It consists of water. It consists of vapors coming out of the water. It rains from the sky".	Water, steam, weather events	"The cloud is a vapor. Water is made up of droplets."	Steam, water droplets
C2	"The cloud was actually a water droplet, and because the water droplets came together, they turned into a cloud."	Water droplet	"They evaporate from the sea, the droplets accumulate, the cloud cannot carry them, and it rains on certain days."	Water droplets
C3	"I am forgetting. There is a cartoon of Maysa, his brother."	Other	"I have forgotten."	Other
C4	"I see the ones going slowly. Sometimes I see them turn into animals. Sometimes they are straight. And then I see these little clouds."	Other	"I see people going like a straight train. If the clouds go up, we cannot reach them; they are far away."	Other
C5	"Rain, wind, storm, hurricane."	Weather events	"Water is made up of droplets."	Water droplets
C6	"I see it in the air. I see it in the distance. The cloud has grown; it has grown big. I see it above."	Other	"It is raining, and a rainbow appears. Lightning cloud. I learned about rain."	Weather events
C7	"The rain. I don't know anything else, that is all."	Weather events	"The clouds formed the rain."	Weather events
C8	"I know that the clouds are above; they are high, so high."	Other	"First, the water droplets evaporated from the sea, and then the water droplets turned into clouds."	Water droplets
C9	"They can make lightning; I do not know anything else."	Weather events	"The water droplets formed a cloud."	Water droplets
C10	"White is blue because of the color of the air. When the wind blows, they start to turn blue. This is because they are blowing in the wind. When it rains in the clouds, we open the umbrella when we go to school."	Weather events	"When the water droplets rise, they turn into clouds."	Water droplets
C11	"Earth. The disappearance of clouds. That the clouds came out in the morning and disappeared at night."	Other	"Steam, water droplets."	Steam, water droplets
C12	"The rain. I don't know anymore."	Weather events	"The rain. Water"	Weather events

When Table 3 is examined, it was seen that there was a difference between the pre-interview and the last interview in the answers given to the question "What do you know about the cloud?" and the answers of all the children (n=12) differed in the last interview.

When Table 3 is examined, it is seen that there is a difference between the pre-interview and post-interview in the answers given by the children to the question "What do you know about the cloud?" and that the answers of the most of the children (n=10) differed in the post-interview. It was determined that 10 children's knowledge about the cloud changed within the scope of the purpose of the study, while two children did not have any change in their existing knowledge.

Table 4. *Expressions of children about the formation of the cloud*

N	Pre-interview		Final Interview	
	Explanations	Theme	Explanations	Theme
C1	"Clouds are formed by coming vapors from the sea and going to the sky."	Steam	"The sun was warming the sea, evaporating, and the water droplets were rising and turning into clouds."	Water loop
C2	"They evaporate from the sea, and then the droplets accumulate."	Steam, droplets	"The sun warms the sea, and the water evaporates into the sky. Water droplets were becoming clouds in the sky."	Water loop
C3	"From the rain"	Weather events	"The sun heated the sea, and then the droplets went up and merged to form a cloud."	Water loop
C4	"I don't know"	Other	"The sun was heating the pool. After that, steam comes out of the sea into the air. After that, we can see them together."	Water loop
C5	"They go when it is dark and not when it is sunny. God leads them from this side to that side."	Other	"Water droplets. The sun warmed the sea. The steam went up. The water droplets made the cloud."	Water loop
C6	"It is in mother's belly, and it is me."	Other	"The sea was vaporizing; little droplets were going up and merging."	Water loop
C7	"From the rain"	Weather events	"The sun evaporates the water; then the droplets go up and turn into clouds."	Water loop
C8	"Form cotton"	Other	"The sun was warming the sea. It was evaporating. Then the water droplets went up, and the cloud formed."	Water loop
C9	"I don't know"	Other	"The sun was shining towards the sea, and then the sea was warming. The water droplets were meeting above and making clouds."	Water loop
C10	"The clouds come together, and then the sky thunders."	Weather events	"The sun was warming the sea. The sea was evaporating. Then the water rose and turned to clouds."	Water loop
C11	"With smoke"	Other	"The sun warmed the sea, and then steam came out of the sea. When the water droplets went up, there was a cloud."	Water loop
C12	"The clouds go into the sea, evaporating from there and becoming rain."	Weather events	"The sun was warming the sea. The water droplets are going up. Then there are wind and cold, and clouds."	Water loop

When Table 4 is examined, it is seen that there is a difference between the pre-interview and the final interview in the answers given by the children to the question "How does a cloud form?" and in the last interview, it was observed that the answers of all children (n=12) differed. At the end of the study, it was determined that all children made sense of the water cycle for the formation of clouds, used scientific concepts and created meaning.

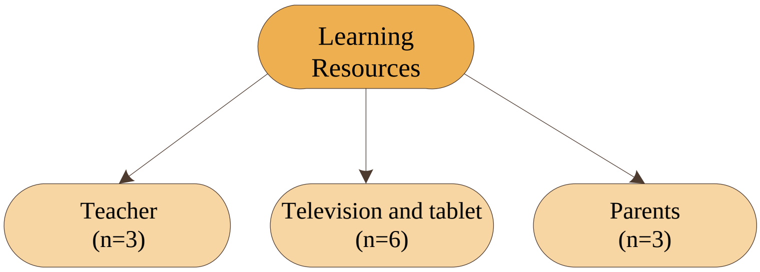

Figure 1. *Children's responses to learning resources about the concept of cloud*

When Figure 2 is examined, the majority of children's responses to the sources of learning the concept of cloud are that they learned it from television and tablets. In the last stage of the study, children were asked to draw a picture to evaluate their thoughts about the formation of the cloud. According to examples from the children's answers; C1 stated "*I learned while watching cartoons*..", C7 stated "*My teacher told me..*".

Examples of children's drawings are presented below.

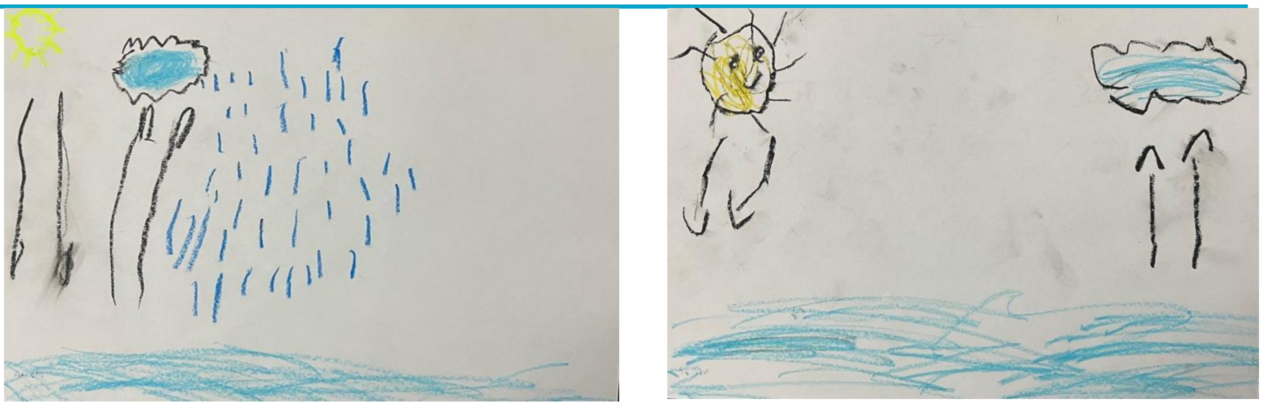

Figure 2. *Examples of children's drawings*

Tablo 6. *Opinions of primary school teachers on science education*

Interview Questions	Teacher's Statements
What kind of activities do you plan within the scope of science activities?	Observation, Trip Activities, Experiments, Experiment Days with Family Participation, Examination of Scientists Contributing to the Experiment
How do you decide on theme selection in science events?	According to Acquisition and Indicators
What kind of materials do you use in science education?	Easily Accessible Materials and Ingredients in Nature
How often do you study science?	Two Days a Week, Sometimes Three Days

When Table 6 is examined, it is seen that the teacher said, "*We definitely organize observation and scientific excursion activities. We are not only dependent on the classroom. Experiments are already a must for us. For example, each child planned an experiment with his/her family and we had experiment days*." In addition, in the scientific theme choices, she answered, "*I plan according to the monthly achievements and indicators, not according to the subject...*". Regarding the materials, she used, she stated, *"...We usually try to use easily accessible materials that everyone can have or have in their hands... Natural materials in nature such as tree branches, stones, shells, soil, etc...*".

DISCUSSION, CONCLUSION, RECOMMENDATIONS

This study aimed to examine the effect of the educational program applied to the conceptual knowledge and misconceptions of children about the concept of cloud and cloud formation in early childhood. Because from the moment they are born, children face many events and phenomena related to the research subject and try to make sense of them. In the research findings, children's explanations about clouds and their formation give an idea of their current perceptions or interpretations. It also shows how these ideas can be influenced by effective science teaching. The effects of these findings on concept teaching are discussed in this study.

When the findings obtained from the preliminary interview with the children for the first question of the study were examined in terms of themes, it was seen that in the answers to the question "What do you know about clouds?" (Table 3.), half of the children answered (n=6) in the ‘other’ category, some (n=4) answered in the ‘weather events’ category, and two children answered in the ‘steam/water droplets’ category. In the research findings, it was seen that there were no misconceptions, only in the prior knowledge of C2 about the cloud, but there was a lack of scientific knowledge. Other children included in the study (n=11) were found to have various misconceptions about clouds in general. For example, it was seen that C3 answered the question "What do you know about the clouds?" as "I forget, there is a cartoon Maysa, her brother" to the question, "I forget, there is a cartoon in Maysa", C4 answered "I see that they turn into animals, they become flat sometimes", C7 answered "Rain. I do not know anything else, that is all". The statements of C1, "It consists of water..." and "It makes it rain," indicate a lack of scientific knowledge and misconceptions about the cloud. As a result of the research, it was seen that the children's preliminary knowledge of the cloud includes information such as rain, the name of a living thing, disappearing at night, being above, and having different shapes.

It is noteworthy that, especially in international studies, children's views and misconceptions about natural cycles (water cycle, states of matter, etc.) have been investigated since a long time ago (Piaget, 1972; Stavy, 1990; Osborne & Cosgrove, 1983). Children are very familiar with water, rain, ice, and steam because these phenomena have been a part of their lives since the first years of their lives (Osborne & Cosgrove, 1983). However, it is seen in the research results that children may have misconceptions about these phenomena in their daily life experiences. These misconceptions will likely affect the scientific concepts, skills, and phenomena children will develop in the future (Smolleck & Hershberger, 2011). Therefore, by investigating and understanding children's concepts and misconceptions, teachers can better shape their education, thus providing opportunities for children to correct their misunderstandings and develop a deeper scientific understanding.

It was determined in the examination of the answers of the children to the question “What do you know about clouds?” in the last interview after the implementation of the educational program (Table 3.) that there was a positive change in the existing concept knowledge and misconceptions of all children except C3, C4, and C12. It was noted that C2 increased his/her scientific knowledge. For example, it was seen that C1's statement 'It consists of water. It consists of vapors from water. It makes it rain from the sky” changed to "Cloud is vapor. It consists of water droplets." It was seen that C6's statements about the cloud during the pre-interview, "I see it in the air, I see it far, I see it above...", his/her prior learning changed and expanded by using expressions about rain and lightning after the program. When the preliminary information and the last information of C3, C4, and C12 were compared, it was noted that there was no change in their conceptual knowledge and understanding.

In previous studies on the subject of the research, it was reported by Henriques (2000) that children had misconceptions such as "clouds are mostly smoke, they are made of cotton or wool". According to Henriques (2000), the idea that clouds are made of cotton or other materials may be a prior knowledge formed by how we define clouds or by the fact that clouds are made of cotton in art activities. Similarly, Platten (1995) stated in his study that children expressed that clouds resemble cotton, cotton candy, and soft feathers. Piaget's (1972) book 'The Child's Conception of the World' revealed that many questions children ask spontaneously relate to natural events. For example, they stated that children ask questions like ‘Why is it raining? Where does it come from? What is fog? Who made it? and in their explanations about this, children perceive clouds as the source and cause of rain and a sign that it will rain soon (Miner, 1992; Piaget, 1972). In this study we conducted, it has been determined that children make references to their belief that clouds are made or moved by a force or someone (for example, 'God.../It is formed in the womb of the mother...). Piaget associated this situation with children's religious explanations of their thinking characteristics, namely egocentrism (Erdener, 2009). These findings and the literature show similar characteristics to our research findings. When the second question of the research, "How does a cloud form?", is examined within the scope of the themes consisting of the answers given by the children in the preliminary interview (Table 4.), it was observed that half of the children (n=6) are in the 'other' category, some of the children (n=4) are in the 'weather events' category, and two children are in the 'steam'/droplets' category. The research findings noted that ten children lacked scientific knowledge about the formation of the cloud, misconceptions, and mistakes in forming meaning. However, in the last interview made after the implementation of the educational program, it was seen that all children's answers (n=12) were gathered under the 'water cycle' category. In the research findings, it has been noted that the use of scientific concepts has increased, there has been a change in misconceptions, and there has been an improvement in the interpretation they have formed about the formation of the cloud. For example, it was seen that C4's statement "I do not know" in the pre-interview was changed to "The sun was heating the pool. After that, steam was coming out of the sea into the air. After that, we can see them together"' after the application. In the pre-interview, it was determined that C8's statement "from cotton" was changed to "The sun was warming the sea. It was evaporating. Then the water droplets were going up, and a cloud was forming." As a result of the research, it was determined that the children's views on the formation of the cloud were explained incompletely and incorrectly in the first application, mostly with daily concepts related to their life experiences. However, after the program, they made explanations combining prior experiences and scientific concepts. Since misconceptions point to wrong or incomplete ideas of children (Kambouri, 2011), concerning this, Fleer (2009), in a study examining children's daily concepts and scientific concept use in early childhood centers, concluded that a well-programmed and scientific context to be presented to children significantly increases their use of scientific concepts. Because misconceptions point to wrong or incomplete ideas of children (Kambouri, 2011). Fleer (2009), in a study examining children's daily concepts and scientific concept use in early childhood centers, concluded that a well-programmed and scientific context to be presented to children significantly increases their use of scientific concepts. In such a case, children will decide which information to keep by engaging in reasonable discussions with themselves and their environment (Rowell, Dawson, & Harry, 1990). Considering the findings obtained from the research and the literature, the teachers need to carry out the practices to be carried out systematically and continuously in order to form a complete understanding of certain concepts in the minds of the children in terms of the correct and permanent acquisition of the concepts.

As a result of the interview with the teacher of the study group in the research, it was seen that the teacher included science activities at least two and at most three times a week, considering the activities he/she applied, the materials he/she used and the frequency of science activities. In addition, it has been determined that the methods and techniques used in science practice are limited to travel and observation, experiments, and family participation studies. Also, although the materials provided for the activities in the classroom are insufficient, it has been determined that he/she prefers natural and easily accessible materials.

There are many possible sources for the development of misconceptions. Some of these are parents, materials, media, and teachers. The main issue is that the above sources are considered 'reliable' and that children readily accept what is taught due to their developmental limitations (Thompson & Logue, 2006). For this reason, teachers' knowledge of children's concept learning and their competence in concept teaching, which is the focal point of science education, is very important. In their study, Kıldan and Pektaş (2008) found that the teaching methods and techniques most used by teachers regarding science and nature teaching are trips, observations, and examinations. Regarding the inclusion of science in the curriculum, some teachers are willing to take steps to include science more in their educational programs. However, these teachers explained that they were unsure of what to do (Conezio & French, 2002). Kambouri (2011) emphasized in his study with children that teachers often do not accept the existence of these misconceptions and that this situation may prevent children from learning.

Children develop scientific concepts due to their interaction with adults, materials in the environment, or their experiences when faced with a new activity or event (Charlesworth & Lind, 2013; Fleer, 2009). As Vygotsky (1987) put forward, while underlining that actual concept formation and daily and scientific concepts should be taught with entertaining events, he primarily focused on the "teacher as mediator". However, he argued that the dynamics of concept formation, how it develops, how it begins, and what it looks like in the end are often not studied (Fleer, 2009). In addition, a list that can be further expanded can be mentioned among the characteristics that effective teachers should have in science teaching and learning, such as scientific concepts and process skills, effective teaching methods, evaluation of science activities and children, and preparing scientific environments (Kostelnik et al., 2019; Akanca et al., 2017; Akman et al., 2017; Bredekamp, 2015; Saçkes et al., 2012; Erdiller & McMullen, 2003). For this reason, teachers need to develop themselves in the above competencies to carry out effective science education and concept teaching with children. Because the erroneous and incomplete concept knowledge that teachers and parents have is transferred to children and similarly emerges in the concept constructed in children. In addition, teachers are required to allow sufficient time for children to explore, to offer experiences organized with themes that support their curiosity, and to include scientific knowledge and concepts appropriate for the age and developmental level of children in these learning experiences.

In addition to the research findings, children were asked to draw pictures to make their mental representations of cloud formation visible. When the pictures drawn by the children were examined, it was seen that the children consistently drew the cloud formation cycle in line with their learning process for cloud formation. It is seen in the research results that the use of methods such as analogy, concept map, and drama, which are included in the study, supports children in making sense of and concretizing the formation of the cloud. Using different active teaching methods in the preschool years affects children's conceptual understanding and academic success. Many studies show that experiments, concept maps, and analogy successfully eliminate certain misconceptions about children (Akay et al., 2012; Chiou et al., 2012; Esiobu & Soyibo, 1995; Güven & Gürdal, 2002; Öztuna, 2002).

As a result, when the findings of the research and the literature are evaluated together, it is seen that children's natural curiosity toward the world around them and the questions they ask are generally related to scientific facts and events. In the past, it was thought that children had too concrete thoughts to reason with scientific means and to understand the concepts of science, but in recent years, there have been changes in this understanding towards children. Because children are full of some preliminary information, prejudices, and intuitions (Baldwin et al., 2009). At this point, teachers and families can be aware of children's misconceptions and that it is possible to achieve conceptual change in children with science-based educational programs and development-appropriate planning to eliminate these misconceptions. One of the most critical issues to consider is that the prerequisite for meaningful learning is that children can form a scientifically consistent and logical link between their previous knowledge and their new knowledge. In line with the results obtained from the research, the following recommendations were developed.

- The limited number of studies conducted in Turkey related to the research subject limits our comparison of the results we obtained. For this reason, conducting studies on educational programs that can be developed to detect and eliminate misconceptions in children will be helpful.
- By expanding the working group of the studies to be carried out, studies with working groups with different characteristics can be planned.
- In the study, no data were collected from the parents to evaluate the children's preliminary knowledge as a result of their daily experiences. Therefore, future studies may also be recommended to collect parents' data to evaluate children's prior knowledge.
- This study discussed children's misconceptions about the cloud and its formation. In similar studies, children's misconceptions about different concepts can be addressed.
- Within the scope of preschool education, the scientific content information, the methods they use, and the existing misconceptions can be shared with the teachers to set an example for the applications to be made. In addition, a scientific concept list can be prepared for teachers under scientific themes that children may be interested in.

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