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A Qualitative Study Inquiring Children's Views on Microbes During the Pandemics

Pandemi Sürecinde Çocukların Mikroplar Hakkındaki Görüşlerine Yönelik Nitel Bir Çalışma

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ÖZ

Araştırma, beş-yedi yaşlarındaki çocukların pandemi sürecinde mikroplarla ilgili görüşlerinin incelenmesi amacıyla fenomenolojik (olgubilim) desende gerçekleştirilmiştir. Araştırmanın çalışma grubunu beş-yedi yaşlarındaki çocuklar ve anneleri oluşturmuştur. Verilerin toplanmasında, Genel Bilgi Formu ve Çocuk Görüşme Formu ile çocukların çizdikleri resimler kullanılmıştır. Veriler, COVID-19 salgını nedeniyle telefon görüşmeleri yoluyla toplanmıştır. Araştırmadan elde edilen veriler, betimsel ve içerik analizi yöntemleri ile incelenmiştir. Araştırmada çocukların çoğunluğunun; mikropları küçük/minik şeyler olarak nitelendirdiği, mikropları mikroskop/büyüteç yardımıyla görebileceğini ifade ettiği, mikropların zararlı olduğunu, hastalık yaptığını, mikropların en çok dışarıda bulunduğunu ve yakın temas aracılığıyla bulaştığını söylediği, mikropları medya aracılığıyla öğrendiği, mikroplardan hijyen kurallarına uyarak korunabileceğini belirttiği ve koronavirüsü hasta yapan bir virüs olarak gördüğü bulunmuştur. Mikroplarla ilgili resim çizen çocukların; "mikrobun ne olduğu", "mikrobun zararları", "mikropların bulaş yolları" ve "mikroplardan korunma yolları"na ilişkin resimler çizdikleri görülmüştür.

Anahtar kelimeler
Erken çocukluk, koronavirüs, mikrop, pandemi, resim

ABSTRACT

The study was carried out employing a phenomenological design to examine the views of children aged five to seven years about microbes during the pandemic. The sample of the study consisted of children aged five-seven and their mothers. The participating mothers and their children were selected through purposeful sampling method. The "General Information Form," "Child Interview Form," and the pictures drawn by the children were used as data collection tools. The data were collected via phone calls due to the COVID-19 pandemic. The data obtained in the research were analyzed with descriptive and content analysis methods. As a result of the relevant analyses, it was found that the majority of children described microbes as small/tiny things. According to them, microbes can only be seen with the help of a microscope/magnifier; microbes are harmful and the harm is to cause disease; mostly found outside and transmit through close contact; they have learned about microbes through the media; they can be protected from microbes by following hygiene rules; and the coronavirus is a virus that makes one sick. The participating children were found to draw pictures about "what the microbe is", "harms of microbes", "modes of transmission", "ways of protection from microbes".

Keywords
Early childhood, coronavirus, microbe, pandemic, picture

INTRODUCTION

Early childhood is a period between the ages of zero and eight of life, and this period is one of the critical periods in development. This period lays the foundation for a child's learning experiences, well-being and productivity later in life. During this period, children grow and develop faster than at any other time in their lives. Early interventions in this period will have a lasting effect on individuals' cognitive capacities, personalities and social behaviors (Bellamy, 2003; Bredekamp, 2015). Also, early childhood is a period when children's interests, such as observing, inquiring, and exploring the environment, gain importance. For this reason, science in early childhood is considered as a part of children's development and learning (Ceylan et al., 2015). One of the opportunities that will introduce science to children is to include science activities in early childhood education. Science education is rather advantageous in early childhood since it supports children's curiosity, provides opportunities for research and inquiry on nature, and enables children to ask questions about and get to know their environment (Unal & Akman, 2006). Microbe, one of the basic concepts in science education, is a general name given to beings that are too small to be seen with the naked eye and is an expression of many life forms with very different sizes and characteristics (Ural Keles, 2019). Views on microorganisms have been conceptualized since the 1950s, but still limited and negative views dominate (Simard, 2021). The concept of microbe can be interpreted in different ways by different age groups. In his study conducted with children with an average age of 12, Milandri (2004) found that 60% of the children focused on the harmfulness of microorganisms and that 25% expressed positive opinions about them. Byrne (2011) investigated the microorganism knowledge and understanding of seven, 11, and 14-year-old children and stated that some seven-year-old children could understand some complex events about microorganisms, so some issues related to microorganisms could be adapted to lower grades. However, the invisibility of microbes and three-six-year-old children's being in the "pre-operational stage" make it difficult for children to form a cognitive structure of microbes (Bayhan & Artan, 2007; Karadon & Sahin, 2010; Kurt, 2013). For this reason, it is critical developing curricula for children taking into account their ages and developmental levels. Accordingly, children are informed about microbes within the scope of self-care skills in early childhood curricula (MEB, 2013). Giordan (2015) found that 92% of children and 76% of adults describe microorganisms as dangerous, bad, deadly and harmful. Gray et al. (2020) emphasized the importance of reinforcing good hygiene practices and making it a habit, revealing the necessity of a video/cartoon-based entertainment-educational intervention for children.

Microbes are found in many places in daily life. Children unconsciously touch and step on the dirty places around them with their hands and feet/shoes while walking; thus, they infect their bodies and hair with dust and microbes. Moreover, they can unconsciously bring their dirty hands to their mouths and cause microbes to enter their bodies (Gul & Ozay Kose, 2020). It is essential to raise children's awareness by informing them about microbes to prevent infectious diseases in early childhood and to gain them cleaning habits. Cleaning is the primary rule in protecting the health and preventing diseases (Ceker & Toman, 2019). In early childhood, children are at much higher risk against infection and infectious diseases due to many reasons, such as touching almost everything, putting their hands to their mouths, being in close contact with other children, not having a fully developed immune system and a complete vaccination

(Akcay, 2016). The COVID-19 pandemic, spreading to almost anywhere in the world since March 2020, has caused dramatic changes in the lives of both adults and children and brought up issues related to pandemic and measures to be taken (Kurt Demirbas & Sevgili Kocak, 2020). Therefore, children should have accurate information about protection from microbes and diseases (Kaya et al., 2006; Turken & Kose, 2020). Drawing a picture is a method that relaxes children emotionally and can be more effective than verbal expressions in conveying their feelings, thoughts, fears and wishes (Şen Beytut et al., 2009). In a study, children showed distance, cleanliness, mask, curfew, not being able to go to school, using a computer at home in their pictures (Foster et al., 2020). Duban and Sen (2021), in their study to determine the perspectives of primary school first grade students (half-past six-seven years old) about the Coronavirus and its effects, it awareness has been reached.

When the literature is analyzed, although there are many studies on Coronavirus and COVID-19 in medicine, researches in educational sciences and social sciences are almost nonexistent. To fill this gap in the literature and to reveal the effects of the process, searches should be done in all branches of science. The group that needs to be provided with psychological support and increased psychological resilience primarily in the COVID-19 process is children (Caykuş & Mutlu Caykuş, 2020). It is difficult for preschool children to perceive and make sense of microbes, which are microscopic creatures that cannot be seen with the naked eye, because children in this period cannot make sense of abstract concepts in their cognitive development process. Learning the information that children have acquired about microbes and determining their perceptions about microbes during the pandemic days when children are exposed to news and conversations about microbes, they are in social isolation with the COVID-19 epidemic and their lives have changed, it is a light for both parents and experts to communicate with children about microbes. is thought to hold. When the relevant literature is examined, researches on the concept of microbe have been reached. It was observed that these studies were conducted with primary, secondary and high school children and adolescents, and there were no studies examining the views of preschool children about microbes. For this reason, determining the opinions of children between the ages of five and seven about microbes will guide families, experts, researchers and educators in increasing the knowledge level of children. The limitedness of the relevant literature and the fact that no study has been found in the literature to investigate the cognitive structures of children aged between five and seven years regarding the concept of microbe makes the results of this study important. In light of such a background, this study aimed to examine the views and pictures of children between five-seven years about microbes. It is thought that uncovering their views on microbes will be useful in increasing their knowledge and awareness and will also guide professionals working with children.

METHOD

This section presents the information about the research design, sample, limitation of the research, data collection tools, data collection process, ethical consideration of the research, and data analysis.

Research Design

The present study, which was conducted to examine the views of children between five-seven years on microbes and their pictures about microbes, was designed as a phenomenological

study. The qualitative research method is a method that uses an inductive approach where the researcher is allowed to get out of the data of the analysis categories as the study progresses and starts with specific observations (Mertens, 2019). The most common methods of data collection are document study, (non-) participant observations, semi-structured interviews and focus groups. For data analysis, field-notes and audio-recordings are transcribed into protocols and transcripts, and coded using qualitative data management software. Criteria such as checklists, reflexivity, sampling strategies, piloting, co-coding, member-checking and stakeholder involvement can be used to enhance and assess the quality of the research conducted. Using qualitative in addition to quantitative designs will equip us with better tools to address a greater range of research problems, and to fill in blind spots in current neurological research and practice. Qualitative research can be defined as the study of the nature of phenomena and is especially appropriate for answering questions of why something is (not) observed, assessing complex multi-component interventions, and focussing on intervention improvement (Busetto el al., 2020). Phenomenology seeks answers to the question "What is truth?" by drawing attention to situations that one is aware of but does not have in-depth knowledge. In phenomenology, researchers are concerned with the participants' personal experiences and examine the individuals' perceptions and the meanings they attribute to the events (Akturan & Esen, 2008). The phenomenon discussed in this study can be uttered as "the views of children between five-seven years on microbes."

Sample

The sample of the study consisted of 37 children aged five to seven years and their mothers, who were selected with the snowball sampling method. It was found that 51.4% of the participating children were five years, 62.2% were females, 40.5% had been attending pre-school education for two years, and 43.2% had a sibling. The majority of the mothers in the study were also discovered to be university graduates, to be employed, and to have a nuclear family. It was determined that not all working mothers (n = 27) stopped going to work, but only fathers (n = 13) continued to work during the social isolation process.

Limitation of the Research

The research is limited to children between the ages of five and seven and their mothers, the answers given by the mothers to the "General Information Form" and the children to the "Child Interview Form", the pictures drawn by the children and the dates of May-July 2020.

Data Collection Tools

The "General Information Form," "Child Interview Form," and the pictures drawn by the children were used as data collection tools.

The General Information Form consists of questions related to the sociodemographic characteristics of the child and the mother. The Child Interview Form is a semi-structured form that was finalized in line with expert (microbiologist, child development specialist, pre-school teacher) opinions. This form contains questions about "what the microbe is, their benefits and harms, modes of transmission, the ways of protection, the source of learning about microbes, and what the coronavirus is." In addition, the pictures drawn by the children about microbes were evaluated.

Data Collection Procedure

The sample of the study consisted of 37 mothers and their children selected through snowball sampling method. Snowball sampling method is a method used to identify individuals or situations that can be a rich source of information about the problem. In this method, the process is "Who can have the most knowledge on this subject? Who or whom would you like me to talk to about this matter?" It starts with questions. As the process progresses, the names or situations obtained continue to grow like a snowball (Yildirim & Simsek, 2008). For this reason, snowball sampling method was also used in this study. The data of the study were collected via phone calls (audio or video) due to the COVID-19 outbreak and social isolation. The mothers were informed about the purpose and data collection procedure of the study, and they were enabled to sign the "Informed Consent Form," which was sent online by the researchers. Volunteer mothers were interviewed via phone calls. Also, the mothers took part in telephone calls with the children as facilitators. The interviews were recorded, and the participants' responses were also noted down. After the interviews, the researchers gave the instruction, "Can you draw me a picture of a microbe?" to the children who were willing to draw pictures. Then the mothers were asked to provide relevant drawing materials. The children who drew the microbe pictures were asked to explain what they drew, and their explanations were noted down. The children were asked to describe what they drew in their pictures in the presence of their mothers. There was the knowledge and approval of the mothers in the children's picture narrations. Moreover, the mothers were asked to send pictures of their children via a mobile application. The data collection process took approximately 30-50 minutes for each participant.

Ethical Considerations

Relevant ethical approvals were obtained from the Health Sciences Ethics Sub-Committee of Ankara University (12.05.2020/116) and the Ministry of Health to conduct the study. Consent was obtained from the mothers for the children to participate in the study. The children were also asked if they would like to draw pictures. Children who wanted to draw voluntarily were included in the study. The voices of participating mothers and their children were recorded during the interviews.

Data Analysis

The data of the study were subjected to descriptive and content analyses. In the content analysis, the data can be examined in line with previously emerged themes, as well as by considering the questions or dimensions that arise during the research. Descriptive analysis or content analysis is commonly used in the analysis of data collected in qualitative research. Content analysis is the careful, detailed and systematic examination and interpretation of data with the aim of identifying patterns, themes, biases and meanings related to the core of the research. The purpose of content analysis is to reach concepts and relationships that can explain the data obtained through the views of the participants and the file and document review. The data summarized and interpreted by descriptive analysis are processed in-depth by content analysis and new concepts or relationships between concepts are discovered. In content analysis, it is essential to bring together similar data within the framework of certain concepts and themes and organize them in a way that the reader can understand (Baltaci, 2017; Guba & Lincoln, 1994; Maxwell, 2008; Pope et al., 2006). Content analysis requires a more

detailed examination of the collected data and reaching the concepts, categories and themes that explain this data. Content analysis focuses on collected data; Codes are extracted from the events and facts that are frequently repeated in the data set or that the participant emphasizes heavily. From the codes to the categories and from the categories to the themes. In short, data (codes) that are found to be similar and related to each other are interpreted by bringing them together within the framework of certain concepts (categories) and themes. In content analysis, the content of the participants' views is systematically separated (Bengtsson, 2016; Crabtree & Miller, 1999; Merriam & Grenier, 2019). After the interviews with the participants, while the mothers were given the codes "M1...M37," the children were coded as "C1…C37". Then, themes and sub-themes were generated related to the questions asked in the interviews. Since the study was carried out during the Covid-19 pandemic period, coding was done by three experts through video calls during the evaluation and analysis of the data. As such, these experts held meetings via online video interviews and as a result of the collected data, they negotiated the themes, sub-themes and frequencies and determined them in line with the agreed decision. This evaluation was carried out with the consensus of three experts. Accordingly, themes were identified as "what the microbe is," "their benefits and harms," "where they can be found," "modes of transmission and ways of protection," "the source of learning about microbes," and "what the coronavirus is." In the sub-themes created upon the themes, the responses given by the children were quoted and explained. In addition, the contents of the children's pictures were grouped into themes, with examples of pictures and explanations of the children.

RESULTS

The findings were evaluated in two parts: interviews with the children between and their pictures and comments.

Findings of the Interviews with the Children

This section presents the findings obtained as a result of interviews with the children.

Table 1. *Distribution of children's responses to what microbes are*

Theme	Sub-theme	n	%
What do microbes look like?	Small/tiny being	10	**27**
	Round	6	16,2
	Monster	6	16,2
	Virus	4	10,8
	Thorn	3	8,1
	Colored	3	8,1
	Insect	3	8,1
	Microbe	2	5,4
What comes to your mind when you think of microbes?	Disease	18	**48,7**
	Pollution	5	13,5
	Virus/coronavirus	4	10,8
	Small	2	5,4
	Hide	1	2,7
	Enemy	1	2,7
	Alive	1	2,7
	Mouth	1	2,7
	Destroy	1	2,7
	Drug	1	2,7
	Monster	1	2,7
	China	1	2,7

The participating children were asked, "What the microbes look like?" The most frequently given response was determined to be "small/tiny being" (n = 10), followed by "round" and "monster" (n = 6) (Table 1). Below are some examples of children's responses.

C4: They look like a clock. They are *round*, and there is something on it.

C1: Microbes look like *monsters* that make one sick.

C33*:* They are *small, tiny* beings. They make our lungs sick and shoot us.

"Disease" (n = 18), "pollution" (n = 5), and "virus/coronavirus" (n = 4) were the most frequent responses given to the question "What comes to your mind when you think of microbes?"

C31: Not *sterilizing* the floor

C36: *Disease* comes to my mind when you say microbe because I don't like being sick at all.

C26: *Coronavirus* comes to mind when I think of microbes.

Table 2. *Distribution of children's responses regarding the visibility of microbes*

Theme	Sub-theme	n	%
Have you ever seen microbes? Where did you see?	With the help of a microscope/magnifier	4	**10,8**
	In the tooth	1	2,7
	In the game	1	2,7
Why can't we see microbes?	Small	31	**83,8**

The majority of the children (n = 31) stated that microbes could not be seen, while six said that microbes could be seen. In the latter group, children said that they could be seen "with the help of a microscope/magnifier" (n = 4), "in the tooth" (n = 1), and "in the game" (n = 1). Children gave the response "small" as the reason for the invisibility of microbes (Table 2).

C6: Yes. We can see them with a magnifier and a telescope. I haven't seen any microbes. I heard about them when I grew up.

C12: I saw them. They rotted my teeth.

C17: Some microbes are invisible, so we can't see them. They are tiny; their colors don't appear sometimes. All have a different color. For example, we see white dust; they are insects. When they come together, they become dirt.

Table 3. *Distribution of children's responses to the benefits and harms of microbes*

Theme	Sub-theme	n	%
Beneficial	Good	4	**10,8**
	Immune enhancer	2	5,4
	Protective	2	5,4
	Didn't know their benefits	1	2,7
Harmful	Causing diseases	28	**75,6**
	Not being able to go to school	3	8,1
	Fatal	3	8,1
	Contagious	2	5,4
	Scary	2	5,4

In the question, regarding the benefits and harms of microbes, to which children gave more than one response, it was found that nine children said that microbes were beneficial, four of them described them as "good," and two children each gave appropriate responses to the "immune enhancer" and "protective" sub-themes. One child stated that microbes were beneficial, but he did not know their benefits. Twenty-eight of the children, who stated that microbes were harmful, indicated their harm as "causing diseases", and other frequently given responses were "not being able to go to school," "fatal," "contagious," and "scary" (Table 3).

C10: We cannot go to school because we infect others with diseases. We get bored at home.

C25: They enhance our immunity, our strength.

C30: I watched they were useful in the cartoon. There were good bacteria there too.

C35: Coronavirus is more harmful, something fatal.

Table 4. *Distribution of the answers given by the children regarding the places where the germs are found*

Theme	Sub-theme	n	%
Places	Outside	11	**28**
	In toilets	8	21,6
	In dirty places	6	16,2
	In dirty food and beverages	5	13,5
	Everywhere	5	13,5
	In parks	3	8,1
	In our body	3	8,1
	In China	3	8,1
	In the meat market	2	5,4

In Table 4, 11 children stated that "microbes are mostly found outside." This response was followed by "Microbes are found in toilets" (n = 8), and “Microbes are found in dirty places” (n = 6). Children gave more than one response to the question.

C14: They are found in playgrounds or parks and outdoors. We have to pay attention; I mean we shouldn't go out on windy days. Or else, we may be infected with the coronavirus.

C24: In China, Turkey, money, and toilets. In schools, parks, shopping malls, and markets. On the remote controls, phones, everything.

Table 5. *Distribution of children’s responses to the transmission routes of microbes*

Theme	Sub-theme	n	%
Transmission modes	Close contact	25	**67,5**
	Coughing	8	21,6
	Not following the hygiene rules	7	18,9
	Sneezing	5	13,5
	Breathing	2	5,4

The children gave more than one response to the question about the transmission modes of microbes. When these responses were examined, children mostly expressed that microbes transmitted mostly through "close contact" (n = 25). Other children stated that they transmitted through "coughing" (n = 8), "not following the hygiene rules" (n = 7), "sneezing" (n = 5), and "breathing" (n = 2) (Table 5).

C1: They can infect me if a sick person sneezes next to me. You can get infected if you don't wash your hands after the toilet or if you don't wash what you eat.

C12: If microbes spread over the air when anyone coughs, someone else may be infected.

C22: They infect us when we get close to each other, of course. So, they spread over the air, then viruses from somebody else infect us.

Table 6. *Distribution of the answers given by children regarding the resources from which they learn about microbes*

Theme	Sub-theme	n	%
Information source	Media	17	**45,9**
	School/teacher	9	24,3
	Mother	8	21,6
	Myself	7	18,9
	Mother/father	6	16,2
	Family elders/relatives	2	5,4

The sources that the children learned about microbes were found as "media" (n = 17), "school/teacher" (n = 9), and "mother" (n = 8). The children gave more than one response to the related question (Table 6).

C3: You, I mean teachers, taught them to me. Also, I heard a microbe song in a cartoon.

C14: I saw them on the news, and I learned all about them before the outbreak. A small bacterium can do a lot of harm to our bodies. You feel nauseous and have a fever and abdominal pain. It makes you sick, starting with a little shivering.

C17: My teacher taught me, and I had already known about them.

Table 7. *Distribution of the answers given by children regarding the ways to protect against microbes*

Theme	Sub-theme	n	%
Ways of protection	Following the hygiene rules	19	**51,3**
	Social isolation	10	27
	Healthy nutrition	9	24,3
	Wearing a mask	8	21,6
	Using drugs	2	5,4

Table 7 shows that the children gave more than one response to the question about ways of protection from microbes, which can be listed as "following the hygiene rules" (n = 19), "social isolation" (n = 10), and "healthy nutrition" (n = 9). Below are some examples of children's responses.

C2: We must be clean. We need to wash our hands a lot. We must eat well. We should drink kefir.

C7: My father, mother, I, and my brother need to wear a mask to protect against coronavirus. We need to wash and dry our hands. Nobody should go out without a mask. Bless my family, my loved ones, and my brother in heaven.

C21: We should drink plenty of water, eat fruit, be healthy. We drink our milk and eat chocolate.

Table 8. *Distribution of children's responses to coronavirus*

Theme	Sub-theme	n	%
Coronavirus	Something making sick	15	**40,5**
	Something fatal	8	21,6
	Something bad	5	13,5
	Something that does not take out	2	5,4
	Something in Wuhan	2	5,4
	Something enemy	2	5,4
	Something cartoon	1	2,7

When the responses of the children to the question "coronavirus" were examined, it was determined they mostly defined it as "something making sick" (n = 15). The number of children who defined coronavirus as "something fatal" is eight, and the number of children who defined it as "something bad" is five (Table 8).

C10: It is the virus that causes disease and infects us from anywhere. It is the virus that is the enemy of our grandparents.

C17: It is a very harmful virus. Everybody goes out with each other and use public transportation. That virus is a very bad virus, like many microbes. It makes us sick and may lead us to be hospitalized.

C29: The coronavirus causes a pandemic; it is contagious. It spreads from one place to another. I will equip everywhere with lanterns and wash everything with hot water.

Table 9. *Distribution of children's knowledge on microbes*

Feature		n	%
Does the Child Know About Microbes?	Yes	32	**86,5**
	Partially	5	13,5
Mother Informing the Child about Microbes in the Isolation Process	Yes	35	**94,6**
	Partially	2	5,4
Those Giving Information to the Child about the Microbe in the Isolation Process	Mother	36	**97,3**
	Sibling	5	13,5
	Relative/neighbor	11	29,7
	Cartoon	24	64,9
	News	22	59,5
	Books	7	18,9
	Internet	14	37,8
	Social media	7	18,9
	School/teachers	18	48,6
What is a Microbe for the Child?	Disease	33	**89,2**
	Stay at home	15	40,5
	Boring	9	24,3
	Separation from school and friends	8	21,6
	Other	7	18,9

Table 9 summarizes the participating mother's views. Accordingly, it was understood from the table that most of their children were informed about microbes (n = 32), most mothers informed their children about microbes during the isolation process (n = 35), most children

were informed by their mothers during the isolation process (n = 36), and microbes meant diseases for almost all children. The vast majority of the mothers expressed that their children were knowledgeable about microbes and were informed about microbes during the pandemic. According to the mothers, microbes meant disease for their children.

Below are some examples of how the mothers informed their children about microbes, especially coronavirus, during the pandemic.

M5: I explained him/her that a disease that we have not seen before is spreading in the world; it appears like flu and makes people cough badly; there is no medicine for this disease yet; we try to take measures; s/he will not go to school for a while; and we need to be careful.

M19: We have been living in a village house since March 18. All of us are here including my parents and far from the incidents. That's why s/he knows it's "coronavirus," but doesn't know the details. It is enough for him/her to know what s/he needs to know. S/he only knows that it's a disease, that's all. We are isolated anyway. We do not wear masks or anything. We are already in nature. We have told very little of what s/he should know. We haven't even told about such measures that s/he needs to do 20 seconds of handwashing. We are safe here, not like families in the city.

M27: I have told her/him: There's a virus called "coronavirus." It comes to wander the world and is now in Turkey ... But we can be protected from it. When we wash our hands for 20 seconds, as I taught, it cannot transmit to us. Our hands should always be under our waist in this process if we are outside. When we come home, we wash our hands, and our hands become free. If it infects us, we are much stronger than it. We can easily kill it inside of us by eating healthy. We cannot go to school, and someone cannot visit us because it infects very fast. We are strong, but we may infect weak people. We don't want to harm anyone, so we are home.

M37: I told him/her that we could get sick if we went out, and it would affect his/her sibling too. I told him that if s/he was sick, s/he would infect us. We keep social distance when his/her father comes home. I told him/her that this was a temporary period, that s/he would go to school, we would go on vacation when it was over. I said we would be patient for a few more months. S/he knows that the coronavirus is transmitted from bats in China but doesn't know people are infected when they eat bats. I said that it was transmitted while doing an experiment. Regarding protection, we constantly wash our hands for 20 seconds, and we try not to go out. We even wash our hands when we go out on the balcony. When we come home from outside, s/he always changes his/her clothes and washes them. S/he pays a lot of attention to such measures. Even today, looking at one of his/her clothes, s/he asked, “Mom, is this my cloth with coronavirus? I wouldn't wear this." We follow the social distancing rules, and we do not leave the house.

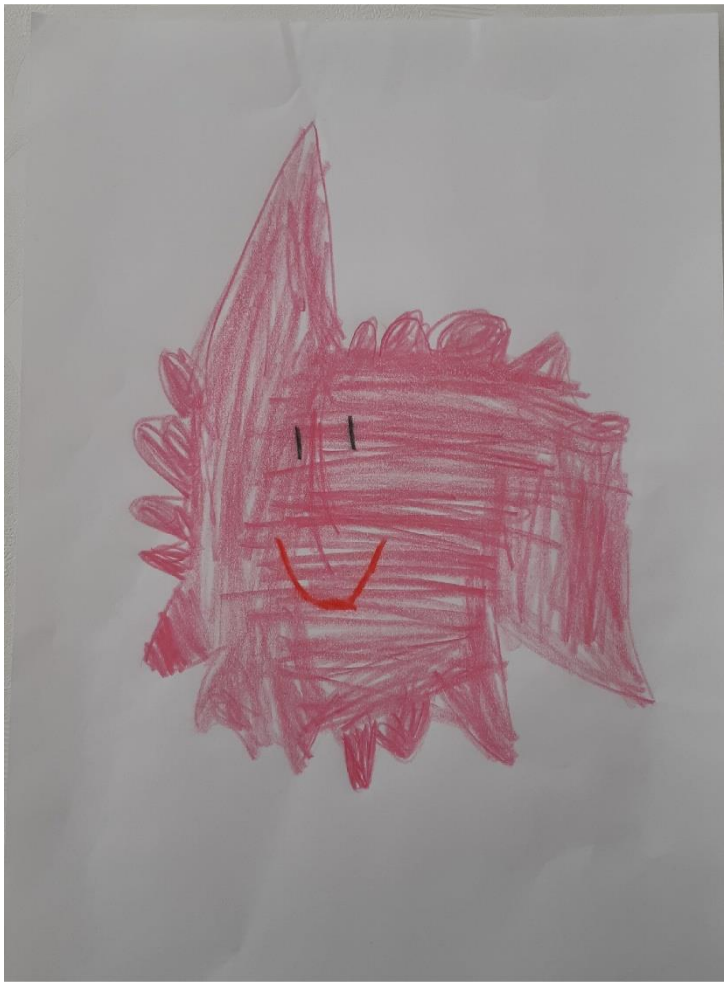
The Findings of the Children's Pictures About Microbes

This section covers some pictures and comments of 30 children. It was found that the children drew pictures about "what the microbe is," "harms of microbes," "modes of transmission," and "ways of protection from microbes."

The children's pictures about what the microbe is

All children were asked, "Can you draw me a picture of a microbe?" and 13 children drew a picture of what the microbe is. Below are a sample picture and the child's comments.

Figure 1.



C30: I drew a smiling "love virus" in my picture. It even has eyes. I drew it pink because it is a "love virus." Its eyes were a little awkward, but that's okay. My virus is not harmful but a useful one. It infects people with love, not a disease. But if you are infected, please don't go to the doctor (**Figure 1**).

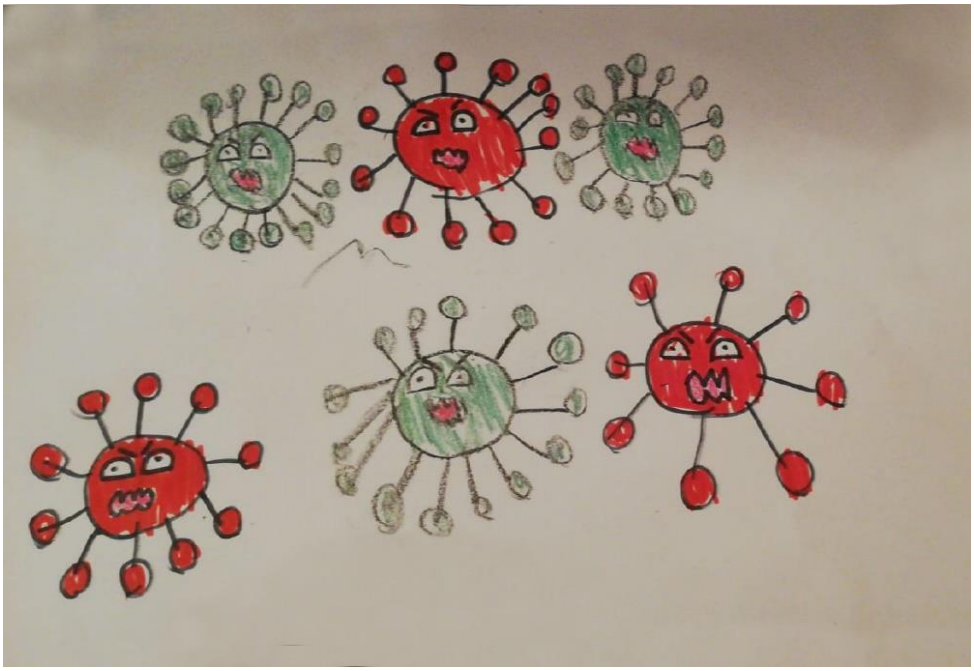
The children's pictures about harms of microbes

Twelve of the participating children drew pictures about "harms of microbes."

Figure 2

C14: Well, ummm, there is a lot of wind. The coronavirus spreads faster in the wind and approaching two people. It is very happy because it will hurt people. When people suffer, it becomes happier. Then, these two people get sick (**Figure 2**).

Figure 3



C26: I drew microbes. They are trying to make people sick, but I didn't draw people here; it's a hand. These microbes are visible through a microscope. They also called their relatives, the red ones, and would hurt teeth. Well, I have a friend, but I don't remember much. I was in kindergarten; I forgot his/her name. He was a little dirty, so they would hurt his/her teeth, and

his/her teeth became rotten. Green ones are ordinary microbes making someone sick (**Figure 3**).

The children's pictures about modes of transmission

Six participating children were discovered to drew pictures about "transmission modes of microbes."

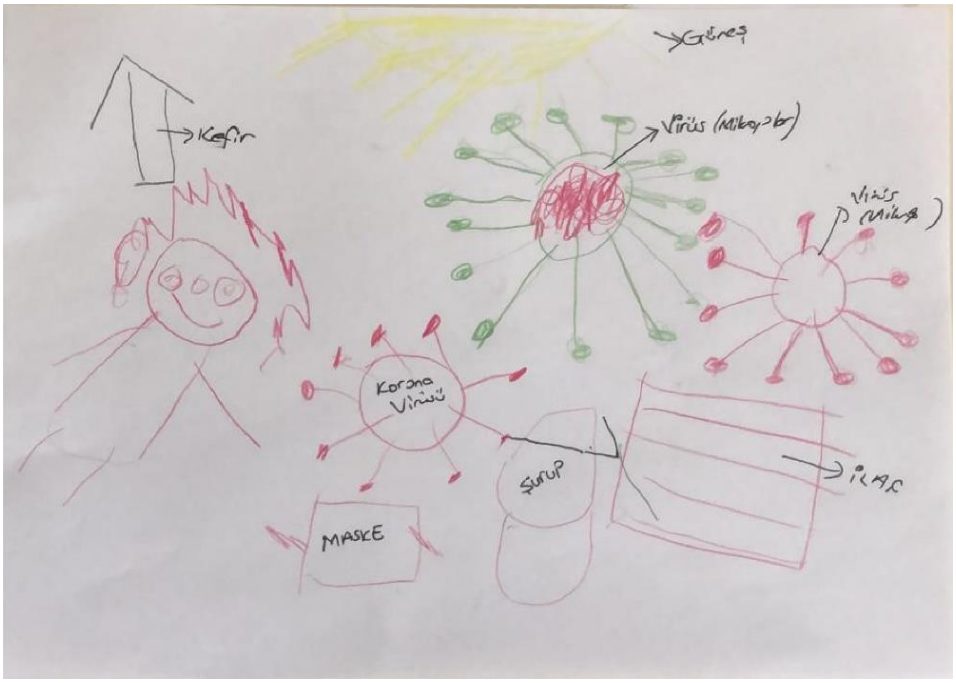
Figure 4

C25: I drew infecting viruses. Viruses are wandering around. That girl is on the run from the virus. They spread to infect people (**Figure 4**).

The children's pictures about ways of protection from microbes

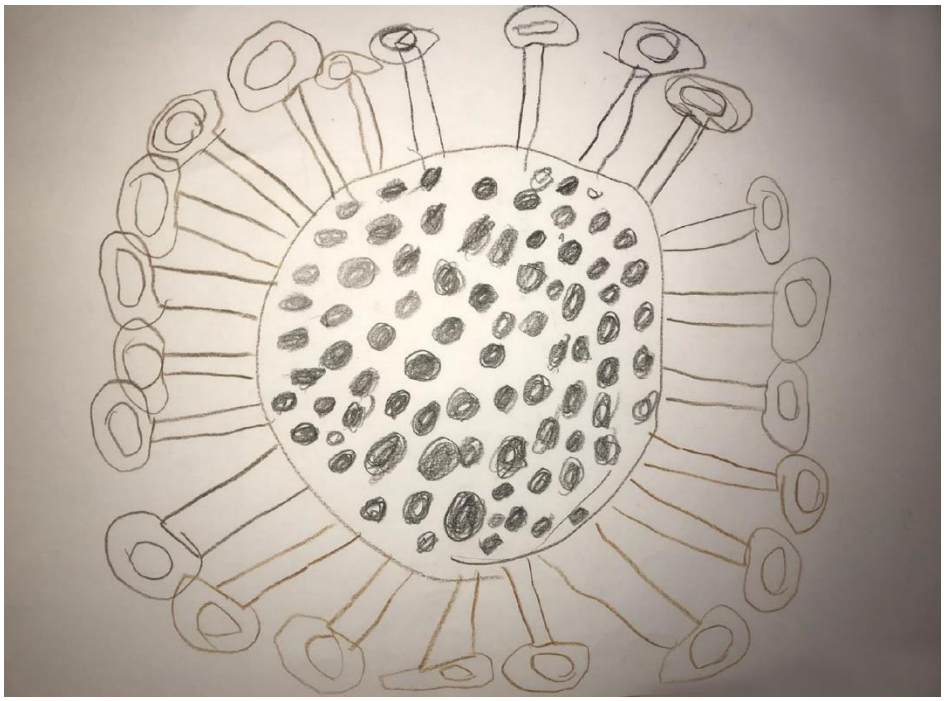
Six participating children were found to draw pictures about "ways of protection from microbes." Below are the samples of such pictures.

Figure 5



C2: We can only see half of the sun now. We can get rid of the coronavirus if we drink syrup or take drugs. Kefir is also very healthy. We must wear a mask (**Figure 5**).

Figure 6



C23: There is coronavirus outside. There are children and people still going out; please don't go out, or you could get sick and die. I drew a coronavirus. It makes people sick and killed, as I just said (**Figure 6**).

DISCUSSION

In this study conducted to examine the views of children between five-seven years on microbes, it was found that the children mostly compared microbes to "small/tiny" things, some described microbes as "round" and "monsters," and most of them thought of disease when it came to microbes. In Tukey, the concept of microorganisms is taught to children starting from the pre-school period. In the pre-school curriculum, the concept is explained to children, especially within the scope of the learning outcomes related to self-care skills, and microbes and microorganisms are included in the subjects of various lessons in primary school (MEB, 2013; MEB, 2018). However, the concept of “microbe” is a concept that children have difficulty in forming an appropriate cognitive structure (Karadon & Sahin, 2010; Kurt, 2013). The COVID-19 outbreak, which has become the focal point of the agenda in Turkey and the world, is an issue that children can have difficulty in understanding due to lack of abstract thinking (Yuksek Usta & Gokcan, 2020). The most important reason for this situation is that the age of three-six is called the "pre-operational stage" by Piaget, and children are "egocentric, unable to make sense of thoughts other than their own, and it is difficult for them to understand abstract concepts" (Bayhan & Artan, 2007). Research in the field of children's conceptual understanding of biological science phenomena has gained relative popularity over the last two decades. Children begin to develop early concepts (also called prejudices, misconceptions, alternative concepts, or personal theories) about biological science phenomena before formal teaching and start school with individual explanations and understandings about science concepts to be taught in the school. In the literature, a limited number of studies have reported that children from different grades have erroneous thoughts

about microorganisms (Williams & Gillen, 1991; Jones & Rua, 2006). Bandiera (2007) investigated the views of children attending primary school on microorganisms and found that the students had many popular misconceptions. Karadon and Sahin (2010) explored the basic knowledge and views of 7th-graders on microorganisms and discovered that 53% defined microorganisms with the expressions "dirt, pollution, disease, and harmful." Yuksek Usta and Gokcan (2020) stated that most of the children felt negative emotions when describing the virus and were most affected by social isolation.

Almost all of the children stated that microbes could not be seen, but could only be seen with the help of a "microscope/magnifier." Other responses given by the children were "in the tooth" and "in the game." Thirty-one children pointed out that they could not be seen because they were “small.” Byrne (2011) investigated the knowledge and understanding of seven, 11, and 14-year-old children on microorganisms and stated that some of the seven-year-old children could understand some complex phenomena about microorganisms, so some topics related to microorganisms could be adapted to the curricula of lower grades. However, it is difficult for children to understand abstract phenomena since they are in the pre-operational stage. To eliminate such difficulty, it is necessary to teach abstract phenomena to children by concretizing them and to use strategies in which children are active (Sahin, 2016). It is stated that the concepts are shaped in the human mind as a result of experiences related to events and objects. Therefore, the more the experience about that object or event a person has, the more comprehensive and appropriate ideas or images will be formed in its mind (Ural Keles, 2019). Concepts' being abstract or invisible adversely affects the formation of cognitive structures of that concept (Knippels et al., 2005; Quinn et al., 2009). Children, who have been introduced to microscopes before and who have been told that small beings, such as microbes, cannot be seen with the naked eye, can explain that microbes cannot be seen because they have had the opportunity to observe or make sense abstract concepts concretely. Considering the results of this study, the reason why almost all children stated that microbes could not be seen may be that they might not know microscope, they might not be taught about this issue, and ultimately, they might not have the opportunity to observe and make sense of abstract concepts concretely.

Most of the participating children stated that microbes were harmful and expressed their harm was to "cause disease." Other responses given were "not being able to go to school, "fatal," "contagious," and "scary". It was determined that most of the children drew pictures about "harms of microbes." Milandri (2004) found that 60% of the children focused on the harmfulness of bacteria, and 25% expressed positive opinions about bacteria. In the study conducted by Karadon and Sahin (2010), children defined the microorganism as dirt, pollutant, and harmful, 37.4% of them could not give examples to microorganisms, they reported to feel bad when they heard the word microbe, and they thought that the risks of microorganisms were more than their benefits. Giordan (2015) found that 92% of children and 76% of adults describe microorganisms as dangerous, bad, deadly and harmful. Yuksek Usta and Gokcan (2020) found that children had negative feelings about the coronavirus, were most affected by social isolation, they received information mostly from the media as well as their mothers and were aware of the terminology about the pandemic. All kinds of events at the national or local level affect children directly or indirectly (ACEV, 2016). It is quite normal for the developmental levels of children in early childhood to have different interpretations and

to perceive what happened more dramatically than adults (Kocakurt & Guven, 2005; Yavuzer, 2016). Children who have been introduced to the concept of illness in childhood and are frequently exposed to words, such as microbe and disease, may not have difficulty in interpreting and defining such abstract concepts. Children, who realize microbes make them sick and acquire various information about microbes from their parents, teachers, and other adults around them, may associate and match the concept of the microbe with some concepts although they may have difficulty in perceiving abstract concepts. The reason why most of the children expressed that microbes were harmful may be that they are frequently exposed to the COVID-19-related news in the media, they cannot go out and must spend their days at home, they are exposed to some COVID-19 discourses in their immediate environment, and they develop concerns and fear due to such experiences.

Some of the participating children stated that microbes were mostly found outside. There were also children stating that microbes were found in the toilet and in dirty places. If children, who are knowledgeable about microbes, have an idea about where microbes can live, and if such information is accurate, they are more likely to be conscious individuals in the future about diseases and prevention methods. The relationship that children establish with science begins with the very first moment they contact with the natural environment and continues throughout their lives. Children in early childhood are in need of understanding scientific knowledge, processes, and values. Therefore, science is the means children discover the world (Gozun Kahraman et al., 2015). It is very important to meet science at an early age, to support its current development and to contribute to all areas of development (Eshach & Fried, 2005; Sackes et al., 2011). Children, who have been introduced to science and learned about microbes and diseases, may also know how to protect themselves from diseases. Children, who know where the microbes live, how they are transmitted, and how they protect themselves, can take comprehensive measures against microbes and develop higher-level awareness. During the COVID-19 pandemic, it is essential for children to obtain information about the methods of protection from microbes through the appropriate sources and to gain fundamental hygiene habits.

The children stated that microbes were mostly transmitted through "close contact." They also indicated not obeying hygiene rules, coughing, and sneezing as the other modes of transmission. It was discovered that some of the children, who drew microbe pictures, used the themes of modes of transmission. Infectious disease is a social health problem caused by the direct or indirect transmission of a specific malignant agent or its toxic products from a source to a sensitive person. There are two modes of transmission: direct and indirect. Indirect transmission refers to transmission by means, vectors, and air. Direct transmission is the transmission of the agent from source to source without any intermediate means of contamination. For example, droplets that are sprayed with a cough or sneeze are larger than 5 microns, can reach 30-60 cm away, and be placed on mucous membranes at this distance, or they can fall to the ground and pose a risk of direct transmission (Aksoy & Bulut Arikan, 2016). Today, COVID-19, which has affected the world and led a pandemic, is transmitted from person to person mainly by droplets and at a distance of about two meters. In addition, people are infected after contact with the droplets sprayed by sick individuals through coughing and sneezing and touching mouth, nose, or eye mucosa with contaminated hands. Asymptomatic people can also be infectious since the virus can be detected in their respiratory tract secretion

(Turken & Kose, 2020). The reason why children stated that microbes were transmitted by means of close contact and respiratory tract may be related to the pandemic and discourse in COVID-19 news.

In the research, it was determined that the children learned about microbes mostly through the media. Other resources that children learned about microbes were found to be school/teacher and their mothers. Media tools, such as television, appear to be an effective means for a child's recognition and interpretation of the outside world (Bekar & Arikan, 2017). The rapid spread of microbial diseases and concerns arising from the close attention of the media raise questions about how best to educate the public to enable it to make smarter decisions about health, sanitation, and family safety (Karadon & Sahin, 2010). Learning through media can also adversely affect children's emotional development (Uzun, 2014). The inability of children to be critical enough to filter incoming messages makes it difficult to protect themselves from disinformation (Aslan et al., 2019). Environmental factors that occur around the child (war, death, the birth of siblings, neglect, illness, natural disaster, etc.), the reactions of families to these factors, and the quality of parent-child communications within the child's micro space also have considerable effects on the child. Children and families are intensively experiencing the pandemic and the social changes it brings. Children may be more distressed than adults due to the factors such as, the reactions of family members to the isolation measures and current disease news frequently featured in the media (Yuksek Usta & Gokcan, 2020). The media, which children are frequently exposed to, emerges as a teaching and learning tool. Many news and information in the media, which may not be suitable for the age of children, can pose a risk for the development of children. The COVID-19 pandemic might lead children to be exposed to media much more than the regular times, which is a risk for their development. In the study, some mothers stated that their children were adversely affected by the deaths and incidents reported on the news. In their study, Yuksek Usta and Gokcan (2020) expressed that the children received information from the media, but they preferred their parents to learn what they were curious about. Accordingly, it is critical that parents should provide their children with accurate and sufficient information and skills about microbes, diseases, and protection methods.

Most of the children stated that they could be protected from microbes by following the hygiene rules. There were also children who stated that they could be protected from microbes with social isolation, eating healthy, and using drugs. Six of the children drew ways of protection from microbes. Yuksek Usta and Gokcan (2020) stated that almost all the participating children had a good command of the measures they need to take to protect from the coronavirus. It will be advantageous to gain cleaning habits in early childhood to prevent infectious diseases. In early childhood, children touch everything, and they are at greater risk especially against infectious diseases due to several reasons, such as that they frequently put their hands to their mouths, they are in close contact with other children, their immune systems have not fully developed, and their vaccination is incomplete (Akcay, 2016). This situation makes it necessary for children to acquire relevant knowledge about protection from microbes and diseases in the early period. Using various methods and techniques to teach about microbes at an early age can provide more effective learning with children. The better the education process is planned during these periods, the more permanent and easier it will be for children to learn. It is difficult for children to understand abstract information due to

being in the pre-operational stage. In addition, teaching through teacher-centered methods makes it more difficult for children to understand such information. To eliminate this difficulty, it is necessary to teach abstract information to children by concretizing it and to use strategies in which children are active. For example, the analogy is one of the useful strategies that can be used for this purpose. In this context, while explaining how our bodies resist microbes, white blood cells can be compared to soldiers and microbes to enemies because the concepts of enemy and soldier are known to the majority of children. The common relationship between microbe and enemy is that both of them harm what they target (human body and lands), while the common relationship between white blood cells and soldiers is that they both protect the places where they live (human body and country territories). When these relationships are established and explained to children, they can better understand the body's defense system (Gunay Bilaloglu, 2005; Sahin, 2016).

While most of the children described the coronavirus as "something making sick," others defined it as "fatal" and "bad." Epidemics have been a problem for humanity throughout history because they affect not only infected individuals but the whole society in many ways. Because microorganisms benefit from modern transport facilities, like humans, epidemics spread much faster and pose a greater risk than before. The epidemic is defined as the spread of infectious diseases caused by the direct or indirect transmission of a disease-causing infectious agent to a susceptible organism. The cause of outbreaks has mostly been the reactions of microorganisms to major upheavals in nature. COVID-19 is also among these epidemics in the world and has become a pandemic in a short time (Parildar, 2020). COVID-19 epidemic, which has occurred in China's Wuhan in December 2019 and has been declared as a pandemic by the World Health Organization in March 2020, is a hot topic of Turkey's agenda as well. This process also includes a period in which schools have been suspended, and people have been restricted from going out unless necessary, as precautions by state authorities. In this period, it is also a matter of curiosity about how an abstract concept, such as a virus, has an effect on children in the pre-operational stage. Children who are not given correct information or who are not adequately informed about social issues may be more prone to worry. In such crises, e.g. a pandemic, an earthquake, a loss in the family, an illness, divorce, or even the birth of a new sibling, it will be helpful that parents and teachers to have frequent conversations with children that allow them to express their feelings and concerns. It should be kept in mind that children need parents more and cannot understand the events as adults in such periods (Yuksek Usta & Gokcan, 2020). According to the findings, it is thought that children may have been exposed to news about COVID-19 more during the social isolation period. The reasons why they frequently gave responses that "coronavirus is a virus that makes one sick" and "it kills" may be due to the fact that the children learned microbes through the media, parents and other adults around the children gave inappropriate information for this age group about the COVID-19.

It was found out that most of the children had a negative perception of microbes and made negative comments about their pictures. The pictures were mostly about "what the microbe is," “harms of microbes," "modes of transmission," and "ways of protection from microbes." In studies conducted with children of different age groups, microbes are often likened to cartoon characters and drawn with face and hands (Kurt, 2013; Choi & Hong, 2014; Eser et al., 2015). On the other hand, it is often stated that anthropomorphism, which is defined as the attribution

of human characteristics to other living beings or inanimate objects, is frequently seen in young children. Although these ideas tend to decrease with age, some are reported to be resistant to change (Kallery & Psillos, 2004; Byrne et al., 2009; Byrne, 2011). Byrne and Sharp (2006) noticed that children drew microbes likening to animal and human figures and found that the animal figures were mostly drawn by children aged seven. Ural Keles (2019) also examined the microbe-oriented cognitive structures of 3rd-grade children with the drawing-writing technique and determined that the robust cognitive structure of the children obtained from their drawings was related to types or shapes of microbes and that they often included anthropomorphism in their drawings. Considering that children express their thoughts and wish mostly through games and drawings in the early childhood period, this study focused on the children's pictures, and it was found that most of the children drew harms of microbes. This may be due to the fact that children have prior knowledge about microbes and, in line with the findings obtained, children learned further about them through media during the COVID-19 pandemic.

Anticipating that children will be more affected by the pandemic, it is important to provide them with accurate information and to make concrete explanations about both the pandemic and microbes. The information conveyed to children in early childhood with verbal and non-verbal methods by parents, educators, and experts about microbes, diseases, and prevention methods will be essential for them to achieve permanent learning.

In conclusion, this study, it was found that the majority of children described microbes as small/tiny things. According to them, microbes can only be seen with the help of a microscope/magnifier; microbes are harmful and the harm is to cause disease; microbes are mostly found outside and transmit through close contact; they have learned about microbes through the media; they can be protected from microbes by following hygiene rules; and the coronavirus is a virus that makes one sick. The participating children were found to draw pictures about "what the microbe is," " harms of microbes," "modes of transmission," and "ways of protection from microbes."

In light of the findings:

- It has been determined that children get information about microbes and microorganisms through the media. In this direction, content such as videos, public announcements and cartoons about microbes and microorganisms can be produced in the media.
- It was observed that the children included in the study mostly had knowledge about germs and transmission routes and protection from germs. Based on this finding, activities related to microbes can be included in early childhood education programs for children.
- In early childhood, children may be taught about the forms of microbes, their benefits and harms, and the modes of transmission in a way that children can understand and experience.
- Parents and educators can concretize the subject related to microbes to children and provide them with relevant experiences by using different methods-techniques and tools, such as games, books, dramas, experiments, and analogies.
- Considering that the media has strengths in learning in today's technology age, children may be ensured to watch programs compatible with their ages.
- Projective methods, such as drawing, can be used to uncover the emotions, thoughts, and opinions of children in early childhood.

- This research can also be conducted with children and adolescents in the advancing age group.

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