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Metaphorical Perceptions of Gifted Students Regarding the Concept of 'Space'*

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Abstract

Since prehistoric times, human beings have tried to make sense of space through their imagination. For this, they observed the locations and activities of celestial bodies. They tried to shape their daily lives in the light of the data they obtained from their observations. This study aimed to examine the perceptions of gifted students regarding the concept of "space" through metaphors. Phenomenological design, a qualitative research method, was used in the research. The study group in the research consisted of 94 gifted students studying in two different Science and Art Centers (BİLSEM) in the east of Turkey in the first semester of the 2021-2022 academic year. The participants of the study were determined through the convenience sampling method. 45 of the participants were female and 49 were male. The data in the study were collected by having the participants complete the sentence "Space is like…….. (similar to.....), because……". In the analysis of the data obtained, descriptive and content analysis methods were used. As a result of the analysis of the data, it was determined that the participants produced a total of 52 different metaphors about space. Among these metaphors, the seven most preferred metaphors were void, infinity, garbage, black hole, sea, maze, and pit. In addition, considering the reasons stated by the participants, these 52 metaphors were grouped into seven different categories as "scientificalness", "daily life", "complexity", "fear", "impasse", "mathematics" and "knowledge".

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Introduction

Space has been one of the greatest curiosities of humankind. From prehistoric times to the present, space and astronomy have always piqued people's interest and sparked their curiosity. Humankind has attempted to make sense of space by using their limitless imagination and strong observational skills. Looking back at human history, it is clear that almost every civilization or culture was interested in celestial events and the movements and positions of celestial bodies through observing space. Since ancient times, events such as the movements of the sun and the moon, the positions of the stars, the seasons have become an interesting situation for people (Türk & Kalkan). Humans, from time to time, have resorted to the positions and movements of the celestial bodies to guide their day-to-day lives. The formation of stars, planets, and satellites in space, as well as the processes that control their movement and the question of what causes these events, have been among the most important areas of scientific studies. Indeed, astronomy is the oldest branch of all sciences (Trumper, 2006). Astronomy studies the structure, properties, and movements of celestial bodies (planets, stars, galaxies, etc.) (Yüce, 2009). This field of science is one of the oldest branches of science, with origins dating back to when humans first began to observe the sky (Okulu, 2018). Modern astronomy, which focuses on asteroids, stars, planets, galaxies, etc., in the universe and their connections, observes their movements, and analyzes their properties, continues to provide us with information about the past, present, and future (Yüzgec, 2021).

Due to the fact that astronomy is one of the oldest known sciences (Bailey & Slater, 2003), studies on the subjectbegan centuries ago. As a consequence of the observations made by the earliest civilizations with the bare eye and the systematic observations carried out after the invention of the telescope, attempts have been made to comprehend the place of humanity within the cosmos. Astronomy is an interdisciplinary field of science that covers

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physics, mathematics, chemistry, biology, natural science, and many others. Humans conducted more scientific observations of the positions and movements of celestial bodies using these fields of science and tried to make meaning of life and nature as a result of their observations. This field of science has had a profound impact on humans in understanding themselves and their environment for centuries (Trumper, 2006).

The subject of astronomy is contemporary, as satellites, new stars, space tests, comets, and other related topics are frequently featured in the mass media, and therefore students of various academic backgrounds are motivated to study this subject (Pena & Gil Quilez, 2001). Furthermore, since astronomy is an interesting topic, school activities provide students with an opportunity to learn more about the subject (Demir, 2020). Young children are fascinated and captivated by the concept of space (Kallery, 2010). However, it would be incorrect to claim that only students find astronomy and space fascinating. Subjects related to space and astronomy have piqued the interest of people of all ages. In fact, this topic has attracted the interest and attention of the entire public (Bailey & Slater, 2003). People have had a long-standing interest in the topics of astronomy and space. Although astronomy has a long history in the public's mind, studies on astronomy education are a relatively recent field (Bailey & Slater, 2003).

The new millennium will mark a milestone in understanding our role in the cosmos (National Research Council [NRC], 2001). In an effort to better understand our place in the cosmos, scientists are rapidly advancing their scientific research. Moreover, many developed and developing countries have accelerated their studies on space exploration and space technology. The subject of space is important for the future of humanity. Consequently, many countries have made astronomy education a priority. In addition, subjects related to space are included in the curriculum. In Turkey, astronomy education is practiced at many educational levels, from pre-school to university. One of the specific objectives of the 2018-renewed Science Curriculum is“to provide basic information about astronomy, biology, physics, chemistry, earth and environmental sciences, and applications of science and engineering" (Ministry of National Education [MoNE], 2018). The science curriculum from the 3rd grade of primary school to the 8th grade of secondary school includes astronomy-related topics and units. In the curriculum, the 3rd grade covers the unit "Earth and the Universe," the 4th grade covers "Let's Get to Know Our Planet," the 5th grade covers "The Earth's Crust and the Movements of Our Earth," the 6th grade covers "The Solar System and Eclipses," the 7th grade covers "The Solar System and Beyond," and the 8th grade covers "Seasons and Climate" (MoNE, 2018). Within the scope of these units, there are 35 learning outcomes and 92 lesson hours (MoNE, 2018). Moreover, the elective course of Astronomy and Space Sciences Curriculum is taught in secondary education (MEB, 2010). In light of this, it can be asserted that the Ministry of National Education gives due importance to astronomy/space education.

Given that astronomy/space is a subject that attracts the interest of children of all grade levels and school levels, from pre-school to university, researchers have also concentrated on this issue. There are many studies conducted on astronomy education (Colantonio et al., 2021; Danaia, 2006; Demirci, 2022; Dove, 2002; Ekinci, 2021; Fanetti, 2001; Gali, 2021; Hannust & Kikas, 2007; Kallery, 2010; Kulegel & Topsakal, 2020; Koçak & Oralhan, 2022; Salimpour, 2019; Siouli et al., 2018; Starakis & Halkia, 2010; Trumper, 2006; Yaşar Çetin, 2021; Yavuz Çiv et al., 2022). Some of these studies included the following topics: Teaching basic astronomy concepts to primary and secondary school teacher candidates (Trumper, 2006), investigating post-primary school students' perceptions of astronomy concepts (Cardinot & Fairfield, 2022), identifying gifted students' attitudes towards astronomy (Ceylan & Topsakal, 2021), reporting alternative astronomy concepts in pre-adolescent individuals (Slater et al., 2018), research on studies conducted on the topic of astronomy education (Ayvacı & Sezer, 2018; Bailey & Slater, 2003; Cole et al., 2018; Oğuzman et al., 2021) developing astronomy concepts in preschool students (Demirci, 2022), revealing the perspectives of high school students on space and space exploration (Yolagiden & Bektaş, 2022), secondary school students' attitudes towards astronomy (Yüzgeç, 2021), researching thinking and speaking patterns of

primary and secondary pre-service teachers about astronomical events such as the phases of the moon (Suzuki, 2002), determining the attitudes of pre-service science teachers towards astronomy and their self-efficacy beliefs towards teaching astronomy (Karaçam et al., 2022), preschool teachers' experiences in astronomy education in their classrooms (Ültay & Ültay, 2022), teaching the sphericity of the world and the causes of day and night phenomenon to children aged 4 to 6 (Kallery, 2010), identifying/eliminating misconceptions about astronomy and space subjects (Azizah et al., 2022; Dove, 2002; Ekinci, 2021; Sarrazine, 2005; Yıldız Tezer, 2022) Moreover, there are studies that investigate how students perceive space/astronomy concepts and topics through metaphors (Gürkan & Kıraç, 2019; Karamustafaoğlu & Aktürk, 2016). These studies were conducted with primary school students. Additionally, it has been reported that metaphor studies on different concepts were conducted with gifted students. These studies investigated the perceptions of gifted students towards the following subjects: science concepts and science lessons (Kocabaş, 2022), biology (Özarslan, 2019), technology in 2053 (Keskin & Özkan, 2022), Turkish teacher and Turkish lessons (Oğuz, 2020), the concept of music (Akça et al., 2019), history lesson (Su et al., 2021), school and BILSEM (Epçaçan et al., 2020), social studies course (Bolat, 2020), the concept of principal (Doğan, 2021) and psychological counselor (Duruğa & Doğan, 2021).

Purpose of the study

The purpose of this study is to investigate the perceptions of gifted students studying at Science and Art Centers (BILSEM) towards the concept of "space" through metaphors. In this context, answers were sought for the following subproblems:

1. What metaphors have gifted students created for the concept of "space"?
2. Which conceptual categories do the "space" metaphors generated by gifted students fall under?

Method

Study design

The study employed phenomenological design, one of the qualitative research approaches, to determine the perspectives of gifted students towards a phenomenon. Phenomenology is used to shed light on phenomena that we are already familiar with but lack an in-depth understanding of (Yıldırım & Şimşek, 2013). Moreover, phenomenology offers a suitable basis for the investigation of phenomena that are not entirely foreign to us but whose meaning we are unable to fully comprehend (Yıldırım & Şimşek, 2013). This study examined the perspectives of gifted students on the concept of "space."

Study group

The study group consists of 94 gifted students enrolled at two Science and Art Centers (BILSEM) located in a city center in the Eastern Anatolia Region of Turkey during the first semester of the 2021-2022 academic year. The study participants were determined through the convenience sampling method. This strategy allows the researcher to expedite and optimize the study process by selecting a situation that is nearby and easily accessible to them (Yıldırım & Şimşek, 2013). Twenty-eight of the participants are in the support groups (3rd and 4th grades), while sixty-six of them are in the BYF (Being Aware of Individual Talents) (5th and 6th grades) groups. Forty-five of the participants are female, and forty-nine are male. Students diagnosed with special talents attend public and private schools apart from the education they receive at BILSEM.

Data collection tool, data collection and ethics

In the study, first of all, a form was created in the light of the opinions of the experts. The study's data were collected during the first semester of the academic year 2021-2022 through forms with the phrase "Space is like..... (similar to), because;....." filled out by support and BYF students attending BILSEM. During the application process, the students were given sufficient time. In order to preserve the confidentiality of the collected data, they were instructed to write only their grade and gender on the paper. Participants in the study were briefed on the purpose of the study and were informed of how and where their information would be utilized (only for scientific purposes) before any data was collected. Consent forms were obtained from

the students, and they were informed that they could withdraw from the study at any time. The study was conducted taking the confidentiality of the participant as a basis, and they were each assigned codes as Student-1, Student-2, ..., Student-94.

Data analysis

Data were analyzed using descriptive and content analysis methods, which are among the qualitative analysis methods. The obtained data were initially transferred to the computer environment. Afterward, analysis was performed utilizing the same procedures employed by Gürkan and Kıraç (2019); coding the data, developing categories, organizing the data in accordance with the codes and categories, ensuring validity and reliability, and interpreting the data The data that were transferred to the computer environment were reviewed, and following the review, codes were generated. After the codes were created, categories were generated by grouping similar codes together. Then, the data were organized according to codes and categories. The metaphors put forward by the participants were examined by two science and physics teachers who served as experts to ensure validity. In addition, in the analysis of the obtained data, two independent researchers concurrently developed a code list, which was then compared. The reliability of the researchers' coding was determined using Miles and Huberman's (1994) reliability calculation formula, and as a result, the coders' agreement was 91%. Codes and categories were tabulated and presented as frequency (f) and percentage (%) during data interpretation.

Findings

In this chapter, findings regarding the analysis of data collected through data collection tools are presented. The obtained information on students and teachers is presented sequentially.

Findings regarding the first sub-problem

In this part, the data gathered in response to the research question "What are the metaphors that gifted kids created for the concept of “space?” are presented. Table 1 provides the metaphors created by students for the concept of space, along with their frequency values.

Table 1.
Frequency and percentage values of metaphors developed by students for the concept of "space"

Metaphors	f	%	Metaphors	f	%
Void	18	19.14	Pitch-black	1	1.06
İnfinity	7	7.44	Ink	1	1.06
Garbage	5	5.31	Soup	1	1.06
Black hole	3	3.19	Bulb	1	1.06
Sea	3	3.19	Earth	1	1.06
Maze	3	3.19	Street	1	1.06
Pit	3	3.19	Dustcloud	1	1.06
Painting	2	2.12	Pasta	1	1.06
Complexity	2	2.12	Hourglass	1	1.06
Numbers	2	2.12	Swamp	1	1.06
Future	2	2.12	Fascinating landscape	1	1.06
Room	2	2.12	Equation	1	1.06
Ball	2	2.12	School	1	1.06
Ocean	2	2.12	Glow	1	1.06
Well	1	1.06	Gifted student	1	1.06
Book	1	1.06	Fruit plate	1	1.06
Garden	1	1.06	Darkness	1	1.06
House	1	1.06	Line	1	1.06
A full box	1	1.06	Classroom	1	1.06
Balloon	1	1.06	Star pool	1	1.06
Beach	1	1.06	Inside of a bag	1	1.06
Bucket	1	1.06	Dead	1	1.06

Knowledge	1	1.06	City	1	1.06
Hole	1	1.06	Mud	1	1.06
Puzzle	1	1.06	Whirlpool	1	1.06
A deserted place	1	1.06	Endless	1	1.06

Examining Table 1 reveals that the participants produced 52 different metaphors about space in total. It has been determined that the seven most preferred metaphors were void (18), infinity (7), garbage (5), black hole (3), sea (3), maze (3), and pit (3). Moreover, it was found that the metaphors of painting, complexity, numbers, future, room, ball, and ocean were produced by two students each. It was concluded that the remaining metaphors were created by 1 student each.

Table 2.
Distribution of metaphors produced by students according to categories

Number	Categories	Metaphors
1	Being scientific	Void, İnfinity, Black hole, Endless, Dust cloud, Star pool, Earth
2	Daily life	Garbage, Sea, Picture, Ball, Bulb, City, Bucket, A full box, Classroom, Street, House, Maze, Garden, Well, Hourglass, Room, Balloon, School, Glitter, Gifted student, Fruit plate, Ink, A fascinating view
3	Complexity	Complexity, Ocean, Maze, Soup, Future, Pasta, Riddle, Bag, Swamp
4	Fear	Void, Future, Deserted place, Room, Dark, Hole, Pitch black, Dead
5	Difficult to Get Out of	Pit, Whirlpool, Mud, Beach
6	Mathematics	Numbers, Line, Equation
7	Knowledge	Book, Knowledge

When Table 2 is examined, there are seven (7) metaphors in the form of void, infinity, black hole, endless, dust cloud, star pool and earth in the "being scientific" category; twenty-three (23) in the form of garbage, sea, painting, ball, light bulb, city, bucket, balloon, street, house, a full box, classroom, maze, garden, well, hourglass, room, school, glow, gifted student, fruit plate, ink and fascinating landscape in the category of "daily life"; nine (9) in the form of complexity, ocean, maze, soup, future, pasta, riddle, inside of the purse and swamp in the category of "complexity"; eight (8) in the form of void, future, a deserted place, room, darkness, hole, pitch black and dead in the category of "fear"; four (4) in the form of pit, whirlpool, mud and beach in the category of "hard to get out"; three (3) in the form of numbers, lines and equations in the category of "mathematics"; and two (2) separate metaphors in the form of book and knowledge in the category of "knowledge".

The category of being scientific

Thirty-one of the space metaphors produced by the participants fall into the "being scientific" category. Table 3 provides the frequency and percentage values of the metaphors produced in the being scientific category:

Table 3.
Frequency and percentage values of metaphors in the category of being scientific

Metaphors	f	%
Void	17	18.08
İnfinity	7	7.44
Black holes	3	3.19
Endless	1	1.06
Dust cloud	1	1.06
Star pool	1	1.06
World	1	1.06

Table 3 reveals that 17 students have formed the metaphor of void, seven students have formed the metaphor of infinity, three students have formed the metaphor of black holes, and one student has formed the metaphors of the endless, dust cloud, star pool, and world in the scientific category. The reasons given by some of the students who created these metaphors are given below:

S8: "It is impossible for an end to be present."
S9: "It goes on forever."
S56: "There are countless stars."
S58: "It is endless."
S84: "It is empty except for planets and stars."
S94: "Everything inside floats as if it were a void."

Daily life category

Thirty-one of the metaphors produced by the participants for the concept of space fall under the category of "everyday life." Table 4 provides the frequency and percentage values of the metaphors created in the category of daily life.

Table 4.
Frequency and percentage values of metaphors in the category of being scientific

Metaphors	f	%	Metaphors	f	%
Garbage	5	5.31	Maze	1	1.06
Sea	3	3.19	Garden	1	1.06
Painting	2	2.12	Well	1	1.06
Ball	2	2.12	Sandglass	1	1.06
Light bulb	1	1.06	Room	1	1.06
City	1	1.06	School	1	1.06
Bucket	1	1.06	Glow	1	1.06
Balloon	1	1.06	Gifted students	1	1.06
Streer	1	1.06	Fruit plate	1	1.06
House	1	1.06	İnk	1	1.06
A full box	1	1.06	Fascinating landscape	1	1.06
Classroom	1	1.06			

Table 4 reveals that, in the category of daily life, five students produced garbage metaphors, three students produced sea metaphors, two students produced painting and ball metaphors, and one student produced light bulb, city, bucket, balloon, street, house, a full box, classroom, maze, garden, well, sandglass, room, school, glow, gifted students, fruit plate, ink, and fascinating landscape metaphors. The reasons given by some of the students who created these metaphors are given below:

S14: "Sometimes it is as dark as a charcoal, and sometimes it is as colorful as a colored pencil."
S31: "Space is narrow, long and continuous, like a street."
S35: "Space is like a house. It has a hallway, a room and a living room."
S38: "Space is like garbage. It contains all kinds of black holes, stars, planets and asteroids."
S45: "Space is like the sea. Even if you can't breathe every now and then, you'll feel like you're floating."

Complexity category

Twelve of the metaphors produced by the participants for the concept of space fall under the "complexity" category. Table 5 displays the frequency and percentage values of the metaphors produced in the category of complexity:

Table 5.
Frequency and percentage values of metaphors in the category of complexity

Metaphors	f	%

Complexity	2	2.12
Ocean	2	2.12
Maze	2	2.12
Soup	1	1.06
Future	1	1.06
Pasta	1	1.06
Riddle	1	1.06
Inside the bag	1	1.06
Swamp	1	1.06

Table 5 reveals that, in the category of complexity, two students created complexity metaphors, two students created ocean metaphors, two students created maze metaphors, and one student each created the metaphors of soup, future, pasta, riddle, inside the bag, and swamp. The reasons given by some of the students who created these metaphors are given below:

S22: "You feel confused inside."
S59: "It is complex. It is hard to find your way."
S64: "Because space is complex like pasta."
S88: "Because even though we know bits and pieces about it, we cannot know exactly what it is."
S92: "It's a complex place, like a woman's purse."
S93: "It is like a swamp, because there are things that cannot be discovered when you dive into it."

Fear category

Eight of the metaphors produced by the participants for the concept of space fall under the category of "fear." Table 6 provides the frequency and percentage values of the metaphors created in the category of fear.

Table 6.
Frequency and percentage values of metaphors in the category of fear

Metaphors	f	%
Void	1	1.06
Future	1	1.06
A deserted place	1	1.06
Room	1	1.06
Darkness	1	1.06
Hole	1	1.06
Pitch black	1	1.06
Dead	1	1.06

Table 6 reveals that, in the fear category, one student each created the metaphors of void, future, a deserted place, room, darkness, hole, pitch black, and dead. The reasons given by some of the students who created these metaphors are given below:

S11: "It is a quiet, endless, dark and frightening place."
S28: "It is so deserted that we cannot even breathe."
S33: "Space is a very dark place."
S40: "Everything is pitch black and frightening."
S82: "It is pitch black and deserted."
S83: "Everything is pitch black, and it is dark as a pocket."
S94: "It is a frightening thing like death."

The difficult-to-get out of category

Six of the metaphors produced by the participants for the concept of space fall under the category of "hard to get out of". Table 7 provides the frequency and percentage values of the metaphors produced for the category "difficult to get out."

Table 7.
Frequency and percentage values of metaphors in the category of difficult to get out of

Metaphors	f	%
Pit	3	3.19
Whilpool	1	1.06
Mud	1	1.06
Beach	1	1.06

Table 7 reveals that three students created the metaphors of the pit, and one student each created the metaphors of whirlpool, mud, and beach in the category of difficult to get out of. The reasons given by some of the students who created these metaphors are given below:

S1: "It draws you in more and more."
S7: "When you get in, you can't get out."
S20: "You can't get out once you get in."
S21: "One who get in cannot come back easily."
S32: "If you get in, it will be very difficult for you to get out."
S89: "It can be difficult to get out once we get in it and your body can get hurt."

Mathematics category

Four of the metaphors produced by the participants for the concept of space fall under the "mathematics" category. The frequency and percentage values of the metaphors created in the mathematics category are given in Table 8:

Table 8.
Frequency and percentage values of metaphors in the category of mathematics

Metaphors	f	%
Numbers	2	2.12
Line	1	1.06
Equation	1	1.06

Table 8 reveals that, in the mathematics category, 2 students created the metaphor of the numbers, and 1 student each created the metaphors of line, and equation. The reasons given by some of the students who created these metaphors are given below:

S46: "It goes on forever, like numbers."
S47: "Space goes on forever, like the lines in mathematics."
S74: "The planets always rotate in accordance with a mathematical equation."

Knowledge category

Two of the metaphors produced by the participants for the concept of space fall under the category of "knowledge". Table 9 provides the frequency and percentage values of the metaphors produced in the knowledge category:

Table 9.
Frequency and percentage values of metaphors in the knowledge category

Metaphors	f	%
Book	1	1.06
Knowledge	1	1.06

Table 9 reveals that, in the knowledge category, 1 student created the book and 1 student created the knowledge. The reasons given by some of the students who created these metaphors are given below:

S3: It contains a vast amount of information and the information it contains is unique."
S17: "It is endless and has a lot to discover."

Discussion and Conclusion

In this study, which investigated the metaphorical perceptions of gifted students towards the concept of space, 94 different participants presented 94 valid metaphors. Participants produced a total of 52 different metaphors for space. It was concluded that the most preferred metaphors were void, infinity, garbage, black hole, sea, maze, and pit. It is thought that previous learning and visual communication tools (TV, books, magazines, internet, brochures, etc.) are effective in producing these metaphors. In their study conducted with 233 students from the 3rd and 4th grades of primary school, Karamustafaoğlu and Aktürk (2016) concluded that the students mostly produced the metaphors of "Planets Realm," "Sphere" and "Darkness" related to space. The study by Gürkan and Kıraç (2019), which was conducted with 90 students from the 3rd and 4th grades of primary school, concluded that the metaphors most produced by the students for the concept of space were "space" and "infinity," respectively. On the other hand, in our study, we concluded that the metaphors most frequently produced by the students were "infinity" and "void," respectively. Meanwhile, the findings of the study by Ayvacı, Bülbül, Özbek, and Ünal (2018), conducted with 113 students attending various levels of primary school, show that students have different mental models regarding the concept of space. Fifty-two different metaphors produced by gifted students for the concept of "space" were brought together under conceptual categories.

The relationship between the metaphors and the similarities in the reasons for the metaphors were utilized in categorizing the metaphors produced by the students. Accordingly, the categories of "being scientific," "daily life," "complexity", "fear," "difficult to get out of," "mathematics" and "knowledge" were created. Karamustafaoğlu and Aktürk (2016), Gürkan and Kıraç (2019), and Benek (2022) also brought together the metaphors produced by the participants under certain categories in their studies. The metaphors produced by students were brought together as follows: the metaphors of space, eternity, black hole, endless, dust cloud, star pool, and earth fall under the category of "being scientific"; metaphors of garbage, sea, painting, ball, light bulb, city, bucket, balloon, street, house, a full box, classroom, maze, garden, well, hourglass, room, school, glow, gifted student, fruit plate, ink, and fascinating landscape fall under the category of "everyday life"; metaphors of complexity, ocean, maze, soup, future, pasta, riddle, inside a purse and swamp fall under the category of "complexity"; metaphors of the void, future, a deserted place, room, darkness, hole, pitch black and dead fall under the category of "fear"; metaphors of the pit, whirlpool, mud, and beach fall under the category of "difficult to get out of"; the metaphors of numbers, lines, and equations fall under the category of "mathematics"; metaphors of books and knowledge fall under the category of "knowledge." It has been concluded that 31 of the metaphors produced by the participants regarding the concept of space were in the category of "being scientific," with 31 in "daily life," 12 in "complexity" 8 in "fear," 6 in "difficult to get out of," 4 in "mathematics" and 2 in the category of "knowledge." Students produced 23 different metaphors in the "everyday life" category. From this point of view, it is thought that students' daily life experiences are effective in producing metaphors. When the participants' opinions on the reasons behind the metaphors were examined, it was concluded that they had a high interest in space/astronomy, had an interest in space/astronomy, and had different ideas about space/astronomy. In their study conducted with secondary school students, Yolagiden and Bektaş (2022) concluded that students were curious about space, desire to go to space, and desire to conduct space-related research. Considering that astronomy is the oldest branch of science, it is natural that it is the first subject that piques people's interest (Yerlikaya, 2021). In their study, Onbaşılı and Kabadayı (2019) reported that all participants enjoyed observing the sky.

Limitations and Recommendations

In this study, it was concluded that the most preferred metaphors were void ve infinity. It will be useful for researchers and practitioners to conduct studies on these two concepts. In this

study, the perceptions of gifted students towards the concept of space were examined through metaphors. This study was limited to 94 students attending support and BYF groups in two different BILSEM. In future studies, the number of schools, the number of groups, and the number of participants can be increased. The present study investigated the metaphors produced by gifted students toward the concept of space. In future studies, the metaphorical perceptions of gifted students about different concepts and subjects can be investigated. In this study, only the metaphorical perceptions of the students who were diagnosed with special talents towards the concept of space were investigated. In future studies, the perceptions of students from all educational levels, from preschool to university, towards the concept of space can be investigated.

References

Akça, O., Şen, Ç., & Kurtaslan, Z. (2019). Determination of science and art centers music field's students perception of music concept: a study of methapor analysis. *Journal of Academic Music Research*, *5*(10), 123-145.

Ayvacı, H. Ş., & Sezer, K. (2018). Descriptive content analysis for studies related to astronomy. *International E-Journal of Educational Studies*, *3*(5), 47-57. https://doi.org/10.31458/iejes.480799

Ayvacı, H. Ş., Bülbül, S., Özbek, D., & Suat, Ü. (2018). A study on the development of mental models: space concept. *YYU Journal of Education Faculty*, *15*(1), 1355-1391.

Azizah, S. N., Akhsan, H., Muslim, M., & Ariska, M. (2022). Analysis of college students misconceptions in astronomy using four-tier test. *İn journal of physics: conference series* (Vol. 2165, No. 1, P. 012004). Iop Publishing.

Bailey, J. M., & Slater, T. F. (2003). A review of astronomy education research. *Astronomy Education Review*, *2*(2), 20-45.

Bolat, H. (2020). The metaphorical perceptions of the gifted and talented students towards social studies lesson in the Science and Art Centre and in their school. *Journal of Social Sciences of Mus Alparslan University*, *8*(4), 1135-1144. https://doi.org/10.18506/anemon.647705

Cardinot, A., & Fairfield, J. A. (2022). Game-based learning to engage students with physics and astronomy using a board game. *In Research Anthology on Developments in Gamification and Game-Based Learning* (Pp. 785-801). Igi Global.

Ceylan, Ö., & Topsakal, Ü. U. (2021). Gifted secondary school students' astronomy attitudes. *Education & Youth Research*, *1*(2), 49-61.

Colantonio, A., Marzoli, I., Puddu, E., Bardelli, S., Fulco, M. T., Galano, S., ... & Testa, I. (2021). Describing astronomy identity of upper primary and middle school students through structural equation modeling. *Physical Review Physics Education Research*, *17*(1). https://doi.org/10.1103/PhysRevPhysEducRes.17.010139

Cole, M., Cohen, C., Wilhelm, J., & Lindell, R. (2018). Spatial thinking in astronomy education research. *Physical Review Physics Education Research*, *14*(1), 010139. https://doi.org/10.1103/PhysRevPhysEducRes.14.010139

Danaia, L., J. (2006). *Students' experiences, perceptions and performance in junior secondary school science: an intervention study involving astronomy and a remote telescope* (Unpublished doctoral thesis). Charles Sturt University.

Demir, N. (2020). *Effects of 5E learning model in teaching astronomy topics on academic successes and attitudes of seventh class students* (Unpublished doctoral thesis). Erciyes University.

Demirci, V. (2022). *The effect of game-based activities on the development of astronomy concepts in children in early childhood* (Unpublished master's thesis). Kastamonu University.

Doğan, Ü. (2021). Special talented students attending Science and Art Centers metaphorical perceptions of the concept of director. *Dicle University Journal of Ziya Gökalp Faculty of Education*. (39), 104-116. http://dx.doi.org/10.14582/DUZGEF.2021.169

Dove, J. (2002). Does the man in the moon ever sleep? An analysis of student answers about simple astronomical events: a case study. *International Journal of Science Education*, *24*(8), 823-834. https://doi.org/10.1080/09500690110066935

Duruğa, M., & Doğan, Ü. (2021). Analysis of specially talented students' perceptions about psychological counseling. *Dicle University Journal of Ziya Gökalp Faculty of Education*. (39), 92-103. http://dx.doi.org/10.14582/DUZGEF.2021.168

Ekinci, E. (2021). *Preservice science and physics teachers' misconceptions about motions of the moon* (Master's thesis). Hacettepe Univesity, Ankara.

Epçaçan, U., Pesen, A., & Üzüm B. (2020). Özel yetenekli öğrencilerin algıları üzerinden Okul ve Bilim ve Sanat Merkezi. *Ankara University Faculty of Educational Sciences Journal of Special Education, 21*(2), 273-297. https://doi.org/10.21565/ozelegitimdergisi.577545

Fanetti, T. M. (2001). *The relationships of scale concepts on college age students' misconceptions about the cause of lunar phases* (Unpublished master's thesis). Iowa State University.

Gali, F. (2021). Secondary school children's understanding of basic astronomy concepts. *Journal of Studies in Social Sciences and Humanities*, *7*(3), 328-342.

Gürkan, G. & Kıraç, Ş. (2019). Investigation of perceptions of elementary school students on space and satellite concepts through metaphors. *The Journal of Academic Social Science*, *7*(89), 445-456. http://dx.doi.org/10.16992/ASOS.14764

Hannust, T., & Kikas, E. (2007). Children's knowledge of astronomy and its change in the course of learning. *Early Childhood Research Quarterly, 22*(1), 89-104. https://Doi.Org/10.1016/J.Ecresq.2006.11.001

Kallery, M. (2010). Astronomical concepts and events awareness for young children. *International Journal of Science Education, 33*(3), 341–369. https://doi.org/10.1080/09500690903469082

Karaçam, S., Yener, D., Canbazoğlu Bilici, S., Şahin Çakir, Ç., & Yürük, N. (2022). Investigation of pre-service science teachers'attitudes toward astronomy and self-efficacy beliefs in astronomy teaching: online astronomy education. *Educational Academic Research, 46*, 71-84. https://doi.org/10.5152/AUJKKEF.2022.992620

Karamustafaoğlu, S., & Aktürk, M. (2016). Primary school students' metaphors about space concept. *Turkish Studies*, *11*(3), 1387-1406. http://dx.doi.org/10.7827/TurkishStudies.9424

Keskin, M., & Özkan, M. (2022). Investigation of perceptions towards future technology through metaphors in the context of the year 2053 goals: a study on gifted children. *International Journal of Social Sciences, 6*(1), 291-315. http://dx.doi.org/10.30830/tobider.sayi.10.14

Kocabaş, G. (2022). *Gifted students' metaphorical perceptions of basic science concepts and studying science: Alanya BİLSEM example* (Master's thesis). Alaaddin Keykubat University.

Koçak, S., & Oralhan, İ. A. (2022). Astronomi eğitiminde bazı doğru bilinen yanlışlar. *Turkish Journal of Astronomy and Astrophysics*, *3*(3), 72-80. https://doi.org/10.55064/tjaa.1038802

Kulegel, S., & Topsakal, U. U. (2020). Secondary school students' perceptions about space camp: space camp Turkey. *Journal of Education and Learning*, *9*(3), 154-162.

Ministry of National Education [MoNE]. (2010). Astronomy and space sciences curriculum. Retrieved from file:///C:/Users/ibrahim/Downloads/20199301430541 13Astronomi%20ve%20Uzay%20Bilimleri%20Program%C4%B1%20PDF%20(1).pdf

Ministry of National Education [MoNE]. (2018). Science course curriculum (3th, 4th, 5th, 6th, 7th and 8th grades). Retrieved from file:///C:/Users/İbrahim/Downloads/201812312311937Fen%20b%C4%B0l%C4%B0mler%C4%B0%20%C3%96%C4%9eret%C4%B0m%20programı2018.Pdf

National Research Council (2001). *Astronomy and astrophysics in the new millennium.* Washington Dc: National Academy Press.

Oğuz, B. (2020). Metaphoric perception of gifted students for Turkish lessons and Turkish teachers. *International Journal of Science and Education, 3*(2), 80-91. https://doi.org/10.47477/ubed.777973

Oğuzman, T., Metin, M., & Kaya, H., (2021). Analysis of astronomy education researches in turkey: a descriptive content analysis. *Maarif Mektepleri International Journal of Educational Sciences, 5*(1), 43- 65.

Okulu, H. Z. (2018). *The effect of developed astronomy activities on the knowledge and attitude levels of preservice science teachers towards astronomy (Mugla sample)* (Master's thesis). Muğla Sıtkı Koçman University.

Onbaşılı, Ü. İ., & Kabadayı, G. S. (2019). Investigation of preschool children's knowledge on basic concepts of astronomy. *Turkish Journal of Primary Education, 4*(2), 85-97.

Özarslan, M. (2019). The comparison of gifted and talented students and non gifted students' perception of biology: metaphoric study. *PAU Journal of Education, 45*(45), 310-334. https://doi.org/10.9779/PUJE.2018.235

Pena, B. M., & Gil Quilez, M. J. (2001). The importance of images in astronomy education. *International Journal of Science Education, 23*(11), 1125-1135. https://doi.org/10.1080/09500690110038611

Salimpour, S. (2019). Capturing the cosmos: teaching astronomy (and more) through astrophotography in middle school. *Rtsre*

Proceedings, 2(1). https://doi.org/10.32374/rtsre.2019. 010

Sarrazine, A. R. (2005). *Addressing astronomy misconceptions and achieving national science standards utilizing aspects of multiple intelligences theory in the classroom and the planetarium* (Unpublished doctoral thesis). Indiana University.

Siouli, S., Dratsiou, I., Antoniou, P. E., & Bamidis, P. D. (2018). Primary school STEM education through co-creative methodologies. *In Cc-Tel/Tackle@ Ec-Tel.* Retrieved from https://ceur-ws.org/Vol-2190/CC-TEL_2018_paper_6.pdf

Slater, E. V., Morris, J. E., & Mckinnon, D. (2018). Astronomy alternative conceptions in pre-adolescent students in Western Australia. *International Journal of Science Education, 40*(17), 2158-2180. https://doi.org/10.1080/09500693.2018.1522014

Starakis, J., & Halkia, K. (2010). Primary school students' ideas concerning the apparent movement of the moon. *Astronomy Education Review, 9*(1), https://doi.org/10.3847/Aer2010007

Su, Ş., Sağlam, A., Su, R., & Kaynar, O. (2021). Analysis of history perception levels of the gifted students through metaphors. *Turkish Scientific Researches Journal, 6*(2), 400-414.

Suzuki, M. (2003). *Conversations about the moon with prospective teachers in Japan. Science Education, 87(6), 892–910.* https://doi.org/10.1002/sce.10082

Türk, C & Kalkan, H. (2017). An Experimental Comparison of Two Different Methods in Astronomy Teaching. *Journal of the Human and Social Sciences Researches*, 6(2), 1015-1036.

Trumper, R. (2006). Teaching future teachers basic astronomy concepts-seasonal changes-at a time of reform in science education. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 43*(9), 879-906. https://doi.org/10.1002/tea.20138

Ültay, E. & Ültay, N. (2022). Pre-school teachers' experiences in astronomy education. *Inonu University Journal of the Faculty of Education, 23*(2), 892-909. https://doi.org/10.17679/inuefd.1085678

Yaşar Çetin, B. (2021). Images of 5th grade students about the basic concepts of astronomy. *Journal of Research in Informal Environments, 6*(1), 1-23

Yavuz Çiv, Y., Saka, Y., & Koray, Ö. (2022). The astronomy education in Türkiye with the evaluations of Prof. Dr. Zeki Aslan. *Cumhuriyet International Journal of Education, 11*(3), 500-511. https://doi.org/10.30703/cije.1026092

Yerlikaya, A. (2021). A descriptive profile about wonders of astronomy concepts. *Turkish Scientific Researches Journal, 6*(1), 1-11.

Yıldırım, A., & Şimşek, H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences].* Seçkin Yayıncılık.

Yıldız Tezer, A. (2022). *Middle school students'misconceptions about astronomy concepts and their attitudes towards astronomy* (Master's thesis). Middle East Technical University.

Yolagiden, C., & Bektaş, O. (2022). Middle school students' thoughts on space and space research. *Journal of Bayburt Education Faculty (BAYEF), 17*(35), 844-869. https://doi.org/10.35675/befdergi.877329

Yüce, K. (2009). Why astronomy? Retrieved from https://Services.Tubitak.Gov.Tr/Edergi/Yazi.Pdf;Jsessionid=Wodtc1mw4adsrdavwsx3jpl?Dergikodu=4&Cilt=42&Sayi=636&Sayfa=99&Yaziid=27996.

Yüzgec, S. (2021). *The impact of teaching astronomy with STEM-based activities on attitude towards astronomy* (Master's thesis). Inonu University.