

Middle School Students' Misconceptions about the Concepts of Astronomy

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Received: June 23, 2018

Accepted: July 26, 2018

Online Published: October 22, 2018

doi:10.5539/ies.v11n11p34

URL: <https://doi.org/10.5539/ies.v11n11p34>

Abstract

The purpose of the current study is to conduct developmental comparison of the middle school students' misconceptions about the concepts of astronomy. The sampling of the study is comprised of middle school students attending a private school located in the west of Turkey. A total of 144 students participated in the study. In order to determine the students' perceptions of the concepts of astronomy, a data collection tool consisting of five open-ended questions was developed by the researchers. The data collected through this data collection tool was subjected to content analysis; on the basis of the analysis of the students' responses, codes were determined and on the basis of these codes, themes were constructed. The results are presented as percentages and frequencies. When the findings of the study were generally evaluated, it was concluded that the students have misconceptions about the concepts of astronomy.

Keywords: misconceptions, astronomy concepts, middle school students

1. Introduction

Astronomy, which is one of the subjects that have attracted the interest of people in almost every period in the historical process, is at the same time the oldest science discipline. Before the invention of writing, in the period called the Dark Age, people arranged their lives according to the Sun they saw in the daytime and the Moon and stars they saw in the night time in the sky. Although Galileo's first telescope gave speed to the work done in the field of astronomy, the great transformation took place in 1957 when Sputnik I was launched. Since then nothing has become as in the old days, the USA and Russia have also caused the beginning of the space age with the work they have done in this area. The transformation continued with the establishment of NASA in 1958 by the United States and accelerated by the Russian cosmonaut Yuri Gagarin's first stepping on the Moon by defeating gravity in 1961 (Dogan, 2013). These advances that have taken place in the field of astronomy have made important contributions both to our daily lives and to the development of other sciences. Measurement and use of geographic coordinates, cartography, time determination, studies on the radiation of stars are just a few of them.

Astronomy education in Turkey was given as an independent course up to 1937 and then was taught as integrated into math education until 1974. In recent years, astronomy finding more place in curriculums has been taught to students in the fifth grade Science and Technology curriculum within the themes of the shapes and sizes of the Sun, the World and the Moon, movements of the World and the Moon and the phases of the Moon, occurrence of day and night; in the seventh grade Science and Technology curriculum within the themes of heavenly bodies, the solar system, space research and in the eighth grade Science and Technology curriculum within the themes of formation of the Universe and the World after the 2005 Science and Technology program was put into effect (Head Council of Education and Morality-TTKB, 2004, 2005). After the 2013 Natural Sciences Teaching Program was put into effect, astronomy was taught in the fifth grade curriculum within the theme of the World and the Universe; in the sixth grade curriculum within the themes of our World, The Moon and the Sun, our source of life; in the seventh grade curriculum within the themes of the solar system and beyond and in the eighth grade curriculum within the themes of earthquake and weather events. In the updated 2018 teaching program, astronomy has been taught in the fifth grade curriculum within the unit of the Sun, the World and the Moon; in the sixth curriculum within the unit of the solar system and eclipses; in the seventh curriculum within the unit of the solar system and beyond and in the eighth grade curriculum within the unit of seasons and climate.

Especially in recent years, astronomy and its concepts have been studied by many researchers and important

studies have been carried out to contribute to this field. In the related literature, there are many studies focusing on the basic concepts of astronomy (Bailey, Prather, Johnson, & Slater, 2009; Bolat, Aydogdu, Ulucinar-Sagır, & Degirmenci, 2014; Bostan, 2008; Bruncell & Marcks, 2005; Canales, Camacho, & Cazares, 2013; Colantonio, Galano, Leccia, Puddu, & Testa, 2016; Emrahoglu & Ozturk, 2009; Joolingen, Aukes, Gijlers, & Bollen, 2014; Iyibil, 2010; Kalkan & Kiroglu, 2007; Kurnaz, 2012; Ozturk, 2011; Tascan, 2013; Turk, 2010; Yıldırım, 2016). Bailey et al. (2009) investigated the opinions of the college students about starts within the context of the Introduction to Astronomy course. The students' opinions about starts were elicited through a questionnaire and as a result of the analysis of the collected data; it was found that the college students have many misconceptions about stars. In a thesis study by Bostan (2008), it was attempted to determine the information levels of the students from different levels of education about same basic concepts of astronomy and some related events. Moreover, it was determined that some of the students' misconceptions disappear with increasing age and some of them get stronger with increasing age. Bruncell and Marcks (2005) conducted a study on 142 science teachers and employed an astronomy concepts recognition test as a data collection tool. They revealed that the teachers have some deficiencies in understanding the concepts of astronomy. Canales et al. (2013) conducted a study with the participation of middle school students to determine the students' mental models of the solar system. As a result of the study, it was found that the students designed six different models of the solar system and these models are not related to the grade level. In an experimental study conducted by Colantonio et al. (2016) on 59 high school students, the researchers carried out the application of the instructional module they themselves developed. The data of the study were collected through a measurement tool consisting of 10 multiple-choice questions and it was concluded that the experimented module was effective. Emrahoglu and Ozturk (2009) conducted a study on 57 pre-service science teachers and employed an astronomy concepts test consisting of 13 open-ended questions. This longitudinal study concluded that the pre-service teachers' levels of understanding of the concepts of astronomy vary significantly over the years. Another finding of the study was that the pre-service teachers had brought many misconceptions to their undergraduate education. In a similar manner, the pre-service teachers left their undergraduate education with many misconceptions and these misconceptions are the same misconceptions as the ones possessed by elementary school students. Iyibil (2010) conducted a study on a total of 293 senior pre-service teachers attending the departments of pre-school teacher education, classroom teacher education, science teacher education and physics teacher education and found that the pre-service teacher could not provide enough explanations about the concepts of world, sun, moon, planet and satellite. When the pre-service teachers' levels of understanding the concepts were analyzed, it was found that the science and physics pre-service teachers are more knowledgeable about the concepts than the pre-service pre-school and classroom teachers. Moreover, the pre-service teachers were found to have nine different mental models (ideal, basic, conceptual, rote learning, selective, descriptive, concrete, relational, and in compliant). In a study carried out by Turk (2010), the elementary school seventh grade students' levels of preparedness for the basic concepts of astronomy and the effect of out-of-school learning environments, planetariums and observatories, on the teaching of the basic astronomy concepts were investigated. In the study, the quasi-experimental method was employed and a total of 240 students participated in it. The data were collected by using a scale comprised of 14 questions. It was also found that the instruction given within the settings of planetariums and observatories is more effective than the traditional instruction given in the classroom environment. The study by Kurnaz (2012) was done to determine the elementary school seventh grade students' mental models of sun, world, moon and sun-world-moon system. The study was conducted by using the special case method and a test consisting of seven open-ended questions was used as a data collection tool. As a result of the study, it was concluded that almost all of the students have the synthesis mental models that are not in enough compliance with scientific knowledge. In a study by Tascan (2013), it was attempted to determine the basic information levels of the science teachers about the basic astronomy concepts and whether their information levels vary significantly depending on gender, graduated faculty, department, length of service, the state of their having astronomy courses during their undergraduate education, the state of having participated in activities related to heaven. In the study, a test having 26 questions and a semi-structured interview form including 10 questions was administered to a total of 100 science teachers. As a result of the study, it was concluded that the teachers have some lack of information about issues such as eclipses, the moon and periods of the moon and formation of seasons and that their interest in astronomy is very low. Moreover, it was found that the teachers' levels of knowledge do not vary significantly depending on the above-mentioned variables. Yıldırım (2016) performed a study on 42 elementary school students and collected the data through the drawing technique. This study was conducted to determine the elementary school students' misconceptions about astronomy and whether these misconceptions vary significantly depending on gender and grade level. As a result of the analysis, it was found that the students produced drawings with the themes of a single world and two worlds. While the drawings converging to the truth were gathered under the theme of single world, the drawings distant from the truth were

gathered under two worlds.

When the research on astronomy is reviewed, it is seen that there is not much developmental research. Therefore, the purpose of the current study was set to be to conduct a developmental comparison of the students' misconceptions about the concepts of astronomy.

2. Method

Developmental research can be conducted in the form of longitudinal, cross-sectional and tendency or prediction studies. The current study was conducted as a cross-sectional study. In cross-sectional studies, it is possible to reach a comprehensive data set in a short time and to save time and money (Cepni, 2010).

2.1 Sampling

The sampling of the current study is comprised of middle school students attending a private school located in the western part of Turkey. A total of 144 students participated in the study. The distribution of the participants across the grade levels is given in Table 1.

Table 1. Distribution of the students across grade levels

Grade level	f	%
Middle school 1 st grade	42	29.16
Middle school 2 nd grade	38	26.38
Middle school 3 rd grade	31	21.52
Middle school 4 th grade	33	22.91
Total	144	100

As can be seen in Table 1, of the participating middle school students, 42 are the first grade students, 38 are the second grade students, 31 are the third grade students and 33 are the fourth grade students. Moreover, of the participating 144 students, 71 are girls and 73 are boys.

2.2 Data Collection Tool and Data Analysis

In order to determine the middle school students' perceptions of the basic concepts of astronomy, a data collection tool was developed by the researchers. This data collection tool has two parts. While in the first part there are questions to elicit the students' grade levels and gender, in the second part there are five open-ended questions. The questions in the second part of the data collection tool are given below;

- 1) What is the universe? Explain briefly.
- 2) What is the solar system? Explain the components of the solar system by drawing.
- 3) What is star? Please, explain.
- 4) What is planet? Please, explain.
- 5) What is constellation? Please, explain.

In order to determine whether the questions serve the purpose of the study and to establish the content validity of the questions, they were submitted to review of 1 science educator and 1 physics educator. The data collected through the data collection tool were subjected to content analysis; as a result of the analysis of the students' responses, codes were determined and on the basis of these codes, themes were constructed. The results are presented with frequencies and percentages.

3. Results

Findings obtained for the 1st question:

The findings obtained from the analysis of the students' responses to the question "What is the universe? Explain briefly." are given in Table 2 below.

Table 2. Students' responses to the 1st question

	1 st grade		2 nd grade		3 rd grade		4 th grade	
	f	%	f	%	f	%	f	%
Eternity	12	28.57	9	23.68	17	54.83	14	42.42
Emptiness	9	21.4	13	34.21	14	45.16	11	33.33
Space covering heavenly bodies	3	7.14	11	28.94	15	48.38	11	33.33
Space	6	14.28	3	7.89	7	22.58	3	9.09
Place where living things live	6	14.28	1	2.63	2	6.45	3	9.09
Place where planets are located	5	11.90	7	18.42	-	-	-	-
World	4	9.52	2	5.26	2	6.45	-	-
Darkness	2	4.76	1	2.63	2	6.45	1	3.03
Existence	-	-	-	-	-	-	4	12.12
Everything	-	-	-	-	-	-	3	9.09
Obscurity	3	7.14	-	-	-	-	-	-
Place where there is no gravity	-	-	2	5.26	-	-	-	-
Place where aliens live	-	-	1	2.63	-	-	-	-

As can be seen in Table 2, the middle school students used the concept of “eternity” the most in their explanations. Of the 144 students, 52 students used this concept and of these 52 students, 12 students are fifth graders, 9 students are sixth graders, 17 students are seventh graders and 14 students are eighth graders. This is followed by the concept of “emptiness” used by 47 students in their explanations. Of these 47 students, 9 students are fifth graders, 13 students are sixth graders, 14 students are seventh graders and 11 students are eighth graders. The concept of “Place covering heavenly bodies” was used by 40 students in their explanations. Of these 40 students, 3 are fifth graders, 11 are sixth graders, 15 are seventh graders and 11 are eighth graders. It is also seen in Table 2 that 19 of the students used the concept “Space” to define the universe, 12 students used the concept “place where living things live” to define the universe and another 12 students used the concept “place where planets are located” to define the universe. Fewer students associated the universe with the concepts of “world”, “darkness”, “existence”, “everything”, “obscurity”, “place where there is no gravity”, “place where aliens live”. When the findings obtained for the 1st question are generally evaluated, it can be argued that the middle school students have misconceptions about the universe. While some of these misconceptions (space, place covering heavenly bodies, place where living things live, darkness) were observed across all the grade levels, some others (place where planets are located) were observed only in 1st and 2nd grades.

Findings obtained for the 2nd question:

The findings obtained from the analysis of the students' responses to the question “What is the solar system? Explain the components of the solar system by drawing.” are given in Table 3.

Table 3. Students' responses to the 2nd question

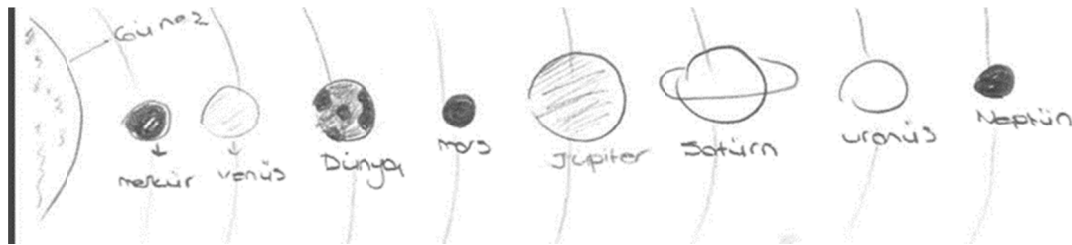
	1 st grade		2 nd grade		3 rd grade		4 th grade	
	f	%	f	%	f	%	f	%
Those with only correct drawings	12	28.57	2	5.26	21	67.74	12	36.36
Those with only correct explanations	10	23.80	7	18.42	1	3.22	12	36.36
Heavenly bodies	13	30.95	20	52.63	3	9.67	-	-
Sun	4	9.52	9	21.42	-	-	5	15.15
System of rings	-	-	-	-	-	-	4	12.12
Illustration of aliens	1	2.38	-	-	-	-	-	-

As can be seen in Table 3, of the 144 students, 47 produced correct drawings of the solar system but did not explain the structure of the solar system. Of the students producing correct drawings of the solar system, 12 are middle school first grade students, 12 are second grade students, 2 are third grade students and 21 are fourth grade students. Some sample drawings in this category are presented below.

S28 (middle school second grade student)



S30 (middle school third grade student)



As can be seen in Table 3, of the 144 students, 30 provided correct explanations about the solar system but did not produce any drawings of the solar system. Of the students making correct explanations about the solar system, 10 are middle school first grade students, 7 are middle school second grade students, 1 is middle school third grade student and 12 are middle school fourth grade students. Some sample explanations in this category are presented below.

S40 (Middle school second grade student)

“Planets moving around the Sun, a star, on certain orbits; the Sun and eight planets.”

S20 (Middle school third grade student)

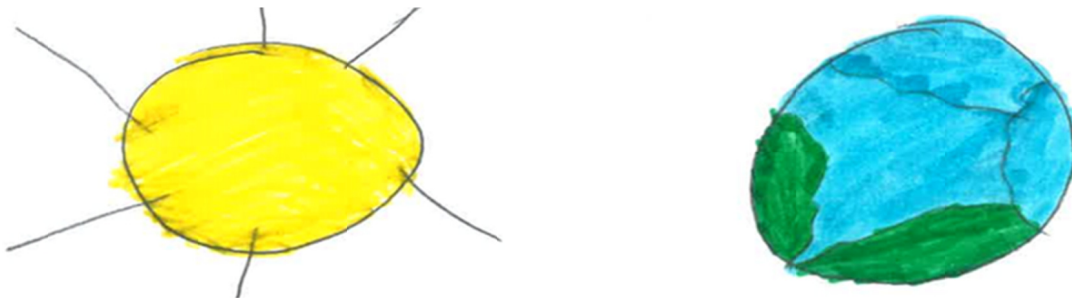
“The solar system is a system encompassing eight planets, meteors, asteroids and the sun. Pluto was declared not to be a planet in 2006.”

As can be seen in Table 3, of the 144 students, 36 depicted heavenly bodies in their drawings. Of the drawings included in this category, 13 were drawn by middle school first grade students, 20 were drawn by middle school second grade students and 3 were drawn by middle school third grade students. In this category, the students depicted sun-world-star, sun-world or sun-planets-stars clusters in their drawings. Some example drawings in this category are given below.

S4 (Middle school first grade student)



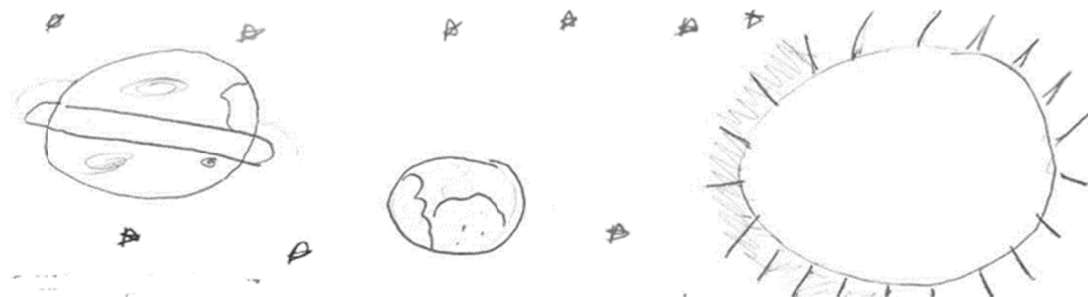
S18 (Middle school second grade student)



S31 (Middle school second grade student)

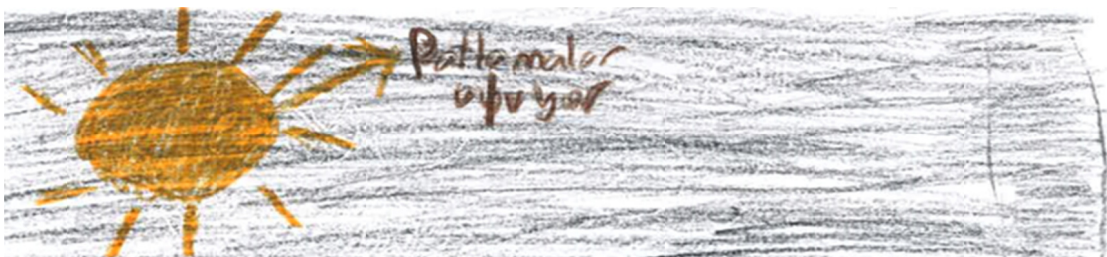


S37 (Middle school second grade student)



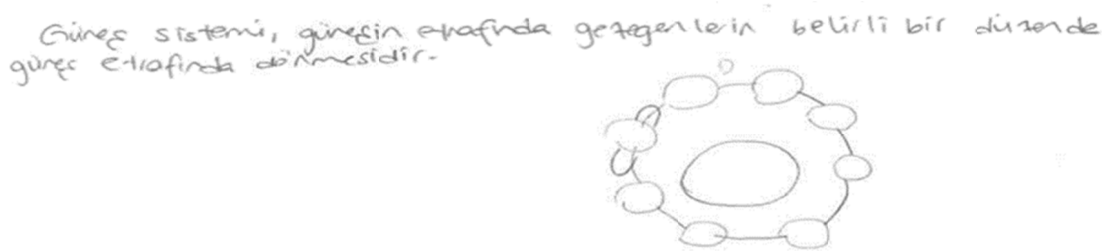
As can be seen in Table 3, of the 144 students, 18 students only included the sun in their drawings. Of the drawings in this category, 4 were drawn by middle school first year students, 9 were drawn by middle school second grade students and 5 were drawn by middle school fourth year students. One sample drawing in this category is presented below.

S4 (Middle school second grade student)



As can be seen in Table 3, of the 144 students, 4 depicted the solar system as a system of rings. All of these students are fourth grade students. One sample drawing in this category is presented below.

S3 (middle school fourth grade student)



When the findings obtained for the 2nd question are generally evaluated, it can be argued that the middle school students have misconceptions about the solar system. While some of these misconceptions (system of rings) are only held by fourth graders or (illustration of aliens) by first graders, there are some misconceptions possessed by students from all the grade levels.

Findings obtained for the 3rd question:

The findings obtained from the analysis of the students' responses to the question "What is star? Please, explain." are given in Table 4.

Table 4. Students' responses to the 3rd question

	1 st grade		2 nd grade		3 rd grade		4 th grade	
	f	%	f	%	f	%	f	%
Source of light	11	26.19	12	31.57	13	41.93	17	51.51
Shiny object	8	19.04	7	18.42	2	6.44	4	12.12
Source of heat	4	9.52	2	5.26	13	41.93	2	6.06
Planet	2	4.76	8	21.05	-	-	3	9.09
Observed at night	4	9.52	2	5.26	3	9.67	1	3.03
Circular in structure	1	2.38	1	2.63	6	19.35		
Pentagonal in structure	7	16.66	-	-	-	-	-	-
Source of energy	-	-	-	-	4	12.90	3	9.09
Sun	-	-	-	-	5	16.12	2	6.06
White colored	2	4.76	2	5.26	1	3.22	-	-
Meteor	3	7.14	1	2.63	-	-	-	-
Guiding light	-	-	-	-	2	6.44	-	-
Parts separated from the sun	1	2.38	1	2.63				
I do not know	7	16.66	6	15.78	-	-	-	-

As can be seen in Table 4, of the 144 students, 53 defined star as a source of light. Of these students, 11 are fifth grade students, 12 are sixth grade students, 13 are seventh grade students and 17 are eighth grade students. As can be seen in Table 4, 21 of the 144 students defined star as a shiny object. Of these students, 8 are fifth grade students, 7 are sixth grade students, 2 are seventh grade students and 4 are eighth grade students. The number of the students explaining star as a source of heat is also 21. Of these 21 students, 4 are fifth grade students, 2 are sixth grade students, 13 are seventh grade students and 2 are eighth grade students. The number of the students associating star with planets is 13. Of these students, 8 are sixth grade students, 3 are eighth grade students and 2 are fifth grade students. As can be seen in Table 4, relatively fewer students used the terms "It is observed at night", "it is pentagonal in structure", "it is circular in structure", "it is a source of energy", "it is sun", "it is white", "it is a meteor" while explaining the concept of star. On the other hand, as can be seen in Table 4, 13 of the students did not make any explanations about the concept of star. When the findings obtained for the 3rd question are generally evaluated, it can be argued that the middle school students have misconceptions about star. Some of these

misconceptions (it is observed at night) were observed across all the grade levels, some others (it is pentagonal in structure) were observed only in one grade level and some others (it is a planet) were observed in more than one grade level.

Findings obtained for the 4th question:

The findings obtained from the analysis of the students' responses to the question "What is planet? Please, explain." are given in Table 5.

Table 5. Students' responses to the 5th question

	1 st grade		2 nd grade		3 rd grade		4 th grade	
	f	%	f	%	f	%	f	%
Heavenly body	8	19.04	9	21.42	10	32.25	7	21.21
Structures on which there is life	3	7.89	11	28.94	9	29.03	5	15.15
Structures located in the solar system	5	11.90	3	7.89	4	12.90	16	48.48
Circular	8	19.04	10	26.31	7	22.58	3	9.09
World	9	21.42	3	7.89	-	-	2	6.06
Huge stones	3	7.89	5	13.15	3	9.67	3	9.09
Mars	4	9.52	-	-	-	-	-	-
Jupiter	2	4.76	-	-	-	-	-	-
Environment without air	-	-	2	5.26	-	-	-	-
Place where aliens live	1	2.38	-	-	-	-	-	-
I do not know	6	14.28	3	7.89	4	12.90	-	-

As can be seen in Table 5, of the 144 students, 34 described planet as a heavenly body. Of these students, 8 are fifth grade students, 9 are sixth grade students, 10 are seventh grade students and 7 are eighth grade students. As can be seen in Table 5, 28 students explained planet as a structure on which there is life. Of these students, 3 are fifth grade students, 11 are sixth grade students, 9 are seventh grade students and 5 are eighth grade students. The number of students explaining planet as the structures located in the solar system is 28. Of these students, 16 are eighth grade students. As can be seen in Table 5, the number of students describing planet as circular is also 28. Of these 28 students, 8 are fifth grade students, 10 are sixth grade students, 7 are seventh grade students and 3 are eighth grade students. Relatively fewer students used the terms "World", "Mars", "Jupiter", "Huge stones", "Environment without air", "Place where aliens live" while explaining the concept of planet. A total of 13 students stated that they do not any information about planets. When the findings in Table 5 are generally evaluated, it can be argued that a high majority of the students have misconceptions about planet. While some of these misconceptions (Structures on which there is life, structures located in the solar system) were observed across all the grade levels, some others (place where aliens live) were observed in one grade level.

Findings obtained for the 5th question:

The findings obtained from the analysis of the students' responses to the question "What is constellation? Please, explain." are given in Table 6.

Table 6. Students' responses to the 5th question

	1 st grade		2 nd grade		3 rd grade		4 th grade	
	f	%	f	%	f	%	f	%
Structures formed by the combination of stars	11	26.19	17	44.73	27	87.09	25	75.75
Stars making up an animal figure	8	19.04	2	5.26	3	9.67	3	9.09
Stars determining horoscopes	-	-	-	-	-	-	3	9.09
Gathering of planets	1	2.38	-	-	-	-	-	-
I do not know	22	52.38	19	50	1	3.22	2	6.06

As can be seen in Table 6, there are four different phrases used in the students' responses. Of the 144 middle school students, 80 students used the phrase "structures formed by the combination of stars" in their explanations. Of these students, 11 are fifth grade students, 17 are sixth grade students, 27 are seventh grade students and 25 are eighth grade students. On the other hand, 16 students used the phrase "stars making up an animal figure" in their

explanations. Half of these 16 students are fifth grade students, 2 are sixth grade students, 3 are seventh grade students and 3 are eighth grade students. Relatively fewer students used the phrases “stars determining horoscopes” and “gathering of planets” in their explanations. When the findings obtained for the 5th question are generally evaluated, it can be argued that some students do not have any information about constellations and a high majority of them (N=100) have misconceptions about constellation.

4. Discussion

In the current study aiming to determine the middle school students’ opinions about some concepts of astronomy, the participating students could not give correct answers to a great extent.

The first question in the data collection tool is related to the universe. When the students’ misconceptions about the universe are examined, it is seen that it is associated with the space and defined as the place where living things live by students from all the grade levels. Other findings obtained in relation to the students’ perceptions of the universe are their associating the universe with the world and defining it as the place where planets are located. Similar results have been reported by Emrahoglu and Ozturk (2009) and Ekiz and Akbas (2005). Emrahoglu and Ozturk (2009) found that the pre-service teachers associated the universe with the world and were of the opinion that the universe has the same characteristics as the world. Ekiz and Akbas (2005) conducted their study on 6th grade elementary school students and found that the students cannot understand the concept of universe precisely and think that the universe and solar system are the same things.

The second data collection tool is related to the solar system. The analysis of the students’ responses given to the question revealed that none of the 144 students could both produce a correct drawing of the solar system and make a correct explanation of it. When the students’ drawings in this category were examined, it was found that the students did not draw the structures in the solar system proportional to their actual sizes and they have misconceptions about the shape and structure of the solar system. Thus, the findings of the current study concur with the findings reported in the literature. Frede (2006) conducted a study with the participation of 50 pre-service teachers, focusing on the issues such as the structure of the solar system and the size of the universe. As a result of the study, it was concluded that the pre-service teachers have some non-scientific information about the solar system. Summers and Mant (1995); in their study, attempted to determine how pre-service teachers perceive the concepts of Solar-World system and the Solar system. At the end of the study, the information possessed by the teachers and pre-service teachers does not match with the program and they experience some difficulties in relation to the related concepts.

Canales et al. (2013) attempted to elicit the middle school students’ mental models of the solar system and revealed that the students have six different models. Ozturk and Ucar (2012) attempted to determine the students’ misconceptions about the sun, world and moon and found that the students have misconceptions about the sizes and shapes of heavenly bodies. Similarly, Jones, Lynch and Reesink (1987) investigated the elementary school students’ perceptions of the sun, world and moon in terms of the shapes and movements of them and found that the students have world-centered and sun-centered models (cited in Kurnaz and Degermenci, 2012). Senel Coruhlu (2013) detected the misconception “The sun located within the solar system is a planet” among the seventh graders. Similar situation was detected among the pre-service teachers from different programs by Iyibil (2010). Some of the pre-service teachers thought of the solar system as a planet. Uluc et al. (2016) attempted to determine the eighth grade students’ mental models of the solar system and found that the students drew the order of the planets located in the solar system correctly but they did not pay much attention to the sizes of the planets.

The third question in the data collection tool is related to star. When the students’ responses to this question were examined, it was determined that the students have some misconceptions such as it appears at night, it is a planet and it is pentagonal in structure. Two of the students thinking that star is a planet are fifth grade students, 8 are sixth grade students and 3 are eighth grade students. In the current Natural Sciences program, the characteristics of planets and stars are addressed within the spring term subjects of the seventh grade curriculum. The reason for not being able to detect this particular misconception among the seventh grades might be due to fact that the students have just studied these topics. This finding of the current study concurs with the findings reported by Emrahoglu and Ozturk (2009). Emrahoglu and Ozturk (2009), in their study, pinpointed that the pre-service teachers have the misconception that stars are planets. All of the students thinking that stars have pentagonal structures are fifth graders. This misconception was not encountered among the other grade level students. Though the topic of star is addressed within the subjects in the 7th grade curriculum, the sun is mentioned within the subjects in the 6th grade curriculum. The finding that some students define the sun as pentagonal concurs with the findings of some studies in the literature (Iyibil, 2010; Iyibil & Saglam-Arslan, 2010; Kurnaz, 2012; Senel-Coruhlu, 2013, Alın & Izgi, 2017; Can & Gorecek-Baybars, 2018). This might be because the students have been affected from the

observations in their daily lives and cultural values. In their explanations, some students stated that stars appear at night this might be because of their life experiences.

The fourth question in the data collection tool is related to planet. The misconceptions encountered among the students from all the grade levels are that planets are located in the solar system, they are structures on which there is life and they are made up of huge stones. Some students associated planet only with the World. Planets and the solar system are addressed within the subjects of the 7th grade curriculum and also the characteristics of the solar system are taught within the same curriculum. Some findings of the current study concur with findings reported by Emrahoglu and Ozturk (2009). Emrahoglu and Ozturk (2009) found that the pre-service teachers associated planets with the place we are living in and defined it as constituted by rocks.

The fifth question in the data collection tool is related to constellation. The widely encountered misconceptions among the students from all the grade levels are that they are structures formed by the combination of stars and stars making up an animal figure. Constellations are stars not found together but seem to be together. The findings related to constellation are in compliance with the findings reported by Kurnaz (2012). Kurnaz (2012) found that the participants think that stars in a constellation are found together. This might be because of the inadequacy of the instructional environment or instructional materials because drawings in textbooks are two-dimensional; thus, the stars in a constellation seem to be lined side by side (Kurnaz, 2012).

The concepts addressed in the current study seem to be not developing scientifically according to grade level. Though the concepts of astronomy are taught at elementary level, the results of the current study indicate that some mistakes are made somewhere. There might be many reasons for the students' not being able to scientifically conceptualize these concepts. Some of them stem from the students themselves (Personal development, personal capacity, prior knowledge of the individual, personal observations and experiences etc.) some others stem from the materials used in the learning environment (textbook, three-dimensional visuals etc.) or from the person delivering the instruction (the teacher may have misconceptions about the subject taught). Therefore, it seems to be important to conduct research on the misconceptions held by teachers or pre-service teachers. In the instruction of the concepts addressed in the current study, the use of audio and visual materials can be increased, students can be provided with opportunities to watch videos and documentaries about the concepts and modeling activities can be carried out through active participation of students. Similar research can be conducted in different regions, with different variables and on larger samplings; thus, other factors that can be influential on students' understanding these concepts can be explored. Field trips to planetariums and observatories can be organized so that students' awareness of the activities performed in the field of astronomy can be raised.

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