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EXAMINATION OF PERCEPTIONS OF GIFTED STUDENTS ABOUT CLIMATE CHANGE AND GLOBAL WARMING

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Abstract. *The aim of this research was to examine the perceptions of gifted students about climate change and global warming from socio-scientific topics. Phenomenology design, which is a qualitative research design, was used in the research. The sample group consisted of 53 gifted students studying in a Science and Art Center located in Anatolia in the 2018-2019 academic year. As data collection tool, the draw-write-tell technique was used. The drawings of the students were grouped into four categories as causes of climate change and global warming, their results, recommendations and unacceptable drawings; whereas, the compositions of the students and the focus group interviews were collected under three categories including causes, results and recommendations as a result of content analysis. The research results suggested that while the perception levels of gifted students about the causes and possible results of climate change and global warming were high, their perception level about the solution of these problems was quite low. In addition, it was determined that students had misconceptions about climate change and global warming. Besides, the research results showed that the draw-write-tell technique was a useful tool in determining the students' perception about socio-scientific subjects.*

Key words: *climate change, draw-write-tell technique, gifted students, global warming.*

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Introduction

It is important for societies to adapt to the rapid changes in science and technology and to have new scientific knowledge related to this because developments in science and technology cause scientific knowledge to change and develop. As scientific knowledge changes and evolves today, the needs and expectations of the societies change in this direction (Türkoğlu & Öztürk, 2019). Besides, some scientific developments have led to discussions and dilemmas with no simple consequences (Eş, Mercan, & Ayas, 2016; Sadler, 2004) in the societies (Kılınç, Demiral, & Kartal, 2017). Therefore, these scientific developments that cannot be considered separately from the society should be considered and evaluated with the participation of scientists and other individuals in the society (Sürmeli, Duru, & Duru, 2017). In this case, socio-scientific issues based on the interaction of science and society emerge (Kolstø, 2001; Topaloğlu & Kıyıcı, 2017).

Socio-scientific issues are the subjects which have scientific basis, are valuable for society (Ratcliffe & Grace, 2003), have multiple solutions (Zeidler & Nichols, 2009), are open-ended and mostly controversial (M. Genç & T. Genç, 2017) and have effective moral values in decision making process (Nuhoğlu, 2014). Bakırcı, Artun, Şahin, and Sağdıç (2018) defined the socio-scientific issues as subjects that are taken into consideration by the society and science, have no definitive solution, and include moral, political and ethical concerns. Climate change and global warming, organic farming, the use of genetically modified organisms, studies in genetic engineering, and cloning, gene therapy, and stem cell researches can be given as examples to socio-scientific subjects (Atasoy, 2018; Klop & Severiens, 2007). Climate change and global warming from socio-scientific subjects are primary ones among the most important problems encountered by the world in recent years and it has reached to a dimension that threatens not only human beings but all living creatures (Aydın, 2017).

Global warming is defined as the increase of the average earth temperature at the parts of atmosphere close to the earth surface naturally or by the effect of human (Aksay, Ketenoğlu, & Kurt, 2005). This increase is caused by the greenhouse effect developing due to the increase of ratios of some gases to values higher than normal values (Çepel, 2008). In fact, 85% of the

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greenhouse effect is composed of water vapor, 12% is composed of small water molecules in the atmosphere, and about 3% is composed of chlorofluorocarbons, methane, nitrogen oxides, ozone and CO_2, formed mostly by human activities. The most important reason in the increase of these gases is the rapid economic growth starting with the industrial revolution and in parallel, the use of more fossil fuels (Kadıoğlu, 2001). Climate change, on the other hand, refers to the changes in climate systems such as humidity, precipitation and temperature along with the increase in greenhouse gases (Doğan & Tüzer, 2011). According to the report announced by the United Nations Intergovernmental Panel on Climate Change, it is stated that the climate crisis will reach irreversible dimensions in the next 20 years unless necessary measures are taken for climate change and global warming (Yıldızoğlu, 2018). Similarly, in the Global Risks report of the World Economic Forum (2018), climate change and global warming constitute one of the important topics. When the report is examined, it is seen that more than half of the top 10 risks are caused by climate change and global warming. Therefore, it is necessary to raise awareness in all individuals about climate change and global warming and to conduct works in order for the individuals in all segments as a requirement of socio-scientific subjects not only for the scientist to take necessary steps (Aksan & Çelikler, 2013). Besides, it is also important to determine the individuals' knowledge levels about climate change and global warming and their perception style on this concept in order to take the necessary steps.

In recent years, emphasizing the human-environment relationship within the educational activities given to individuals in the school is highlighted. The special purposes of the updated 2018 Science curriculum include bringing basic information about environmental sciences, adopting scientific process skills and scientific research approach and finding solutions to the problems encountered in these fields in the process of discovering the nature and understanding of the human-environment relationship, recognizing the interaction between individual, environment and society, and developing sustainable development awareness on society, economy and natural resources (MEB, 2018). Besides, when the literature is reviewed, it is seen that individuals in different teaching levels have significant lack of knowledge and different perceptions about the concept of climate change and global warming (Aydın, 2017; Bahar, 2000; Eroğlu, 2009; Yalçın, 2010). For example, in the study conducted by Aydın (2017) to determine the knowledge level of the university students about global warming it was determined that the students had serious lack of knowledge. Therefore, it is necessary to find out the thoughts of individuals in different teaching levels about climate change and global warming constituting one of the most significant problems of today's world and to take the necessary steps to determine and eliminate their misconceptions, if they have any. One of these institutions is the Science and Art centers (BILSEM) where gifted children are educated by flexible programs (Öztürk, Eş, & Turgut, 2017).

Research Focus

BILSEMs are independent private education institutions that are opened to enable gifted students to develop and use their talents at the highest level (MEB, 2017). Gifted students who succeed in science and art exams study at BILSEMs, are subject to some programs such as integration, support education, individual talent recognition (BYF), special talent development (ÖYG) and project. The main purpose of these programs is to give gifted students the opportunity to become aware of their talents and to use them. For this purpose, activities are carried out in each program to provide students with different skills. In these institutions, it is also aimed to multi-dimensionally develop individuals who can bring important ideas in solving the world problems (Clark, 2015). In line with this goal, it is necessary to examine the thoughts of BILSEM students about climate change and global warming constituting one of the today's most important problems and to determine their misconceptions if there is any and thus to take necessary steps. However, it is necessary to use data variation technique to determine the perceptions of the students about concepts rather than a single measurement tool (Dinç & Üztemur, 2017). One of these techniques is the draw-write-tell technique that includes drawing, writing and explaining that concept by students while explaining the concepts (Üztemur & Dinç, 2018).

The draw-write-tell technique is based on the students' drawing on the axis of certain concepts, then writing down their thoughts on this concept and finally expressing their thoughts about the concepts. With the drawings, perceptions of the students about concepts can be revealed (Pınar & Yakışan, 2016) and the students can also express their opinions and thoughts more willingly and clearly (Özsoy & Ahi, 2014). In addition, conducting necessary interviews with the students along with the drawings (Ersoy & Türkkan, 2010) and asking them to write a composition explaining their drawings will allow to examine their perceptions about the concepts in more detail. In the literature, there are many studies exploring the knowledge level of individuals about socio-scientific issues

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(Türkoğlu & Öztürk, 2019); whereas, no research was found investigating the knowledge level of gifted children studying in BILSEM about climate change and global warming concepts from socio-scientific subjects. Besides, while data collection tools such as questionnaire and attitude scale have been generally used in the studies investigating the socio-scientific subjects (M. Genç & T. Genç, 2017), no study has been found based on draw-write-tell technique. In this respect, this research was considered as important in terms of contributing to the literature. This research was conducted to determine the perceptions of gifted children about climate change and global warming from socio-scientific subjects and to examine the effectiveness levels of the draw-write-tell technique in the examination of socio-scientific subjects. Within the frame of this general purpose, answers were sought to the following questions:

1. What are the perceptions of gifted students studying in BILSEM about climate change and global warming?
2. Is the draw-write-tell technique effective in determining the perception levels of the students about climate change and global warming?

Research Methodology

Research Design

In this research, phenomenology (phenomenon-science) design among qualitative research method designs was used. Phenomenology provides an opportunity to examine in depth the facts and events which are aware of but not fully understood according to the experiences of individuals (Christensen, Johnson, & Turner, 2015). In addition, phenomenological studies reveal the perspective of individuals by focusing entirely on individual perceptions (Tanyaş, 2014). In this research, the phenomenology design was also preferred to determine how the perceptions of gifted students studying in BILSEM are about climate change and global warming.

Research Group

The sample group consisted of 53 gifted children studying in BILSEM in 2018-2019 academic year. Necessary permissions were obtained from students and their families within the scope of the research. BILSEM was also contacted to conduct the research. The maximum variation sampling method was preferred to give the opportunity to access rich data from purposeful sampling methods in order to determine the sample group (Yıldırım & Şimşek, 2013). In this context, the research was conducted with BILSEM students studying in different programs. Table 1 shows the demographic data of the students included in the sample group:

Table 1. Demographic information of the participants.

Personal characteristics		*f*	%
Gender	Female	25	47.16
	Male	28	52.84
BILSEM group	Support	20	37.73
	BYF	21	39.62
	ÖYG	12	22.65
Age	6-10 age	24	45.28
	11-17 age	29	54.72

When Table 1 was examined, 47.16% of the participants were female and 52.84% were male. Likewise, the students studying in the programs of support (37.73%), recognition of individual skills (BYF) (39.62%), and improvement of special talents (OYG) (22.65%) were included in the sample group in order to ensure the variation. In addition, the ages of the participants ranged from 6 to 17 years. 24 of the participants were between 6-10 years old and 29 of them were between 11-17 years old.

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Data Collection Tool

In this research, multi-method technique was used in data collection process. The multi-method technique is the use of more than one data collection methods while collecting information about an event, phenomenon or problem (Clark & Statham, 2005). In addition, this technique includes drawing, writing and explaining steps for the individuals to express themselves more easily (Darbyshire, MacDougall, & Schiller, 2005; Freeman & Mathison, 2009). In this research, the draw-write-tell technique was used to collect the data and three stages were followed.

In the first stage, the students were asked to make four drawings about the things the "climate change and global warming" concept evoked in them. Figure 1 shows sample student drawings. In the second stage, they were asked to write down a composition by considering the drawing which was the closest to their thoughts among those made for "climate change and global warming" concept. They were ensured to state their reasons of choosing this drawing, what "climate change and global warming" concept mean in themselves and their solution suggestions for these global problems in the composition. In the third stage, focus group interviews were conducted with all students participating in the research. The focus group interviews took a week and the participants were asked to read what they wrote in the compositions and to explain what they emphasized about the climate change and global warming and their reasons. While conducting the interviews which lasted for approximately 20 minutes, a quiet environment was preferred and the interviews were then converted into a text and codes, categories and themes were determined.

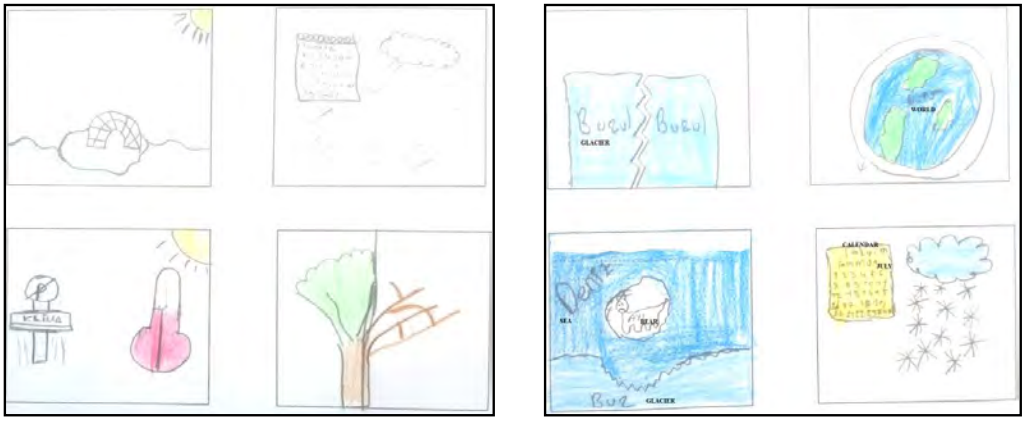

Figure 1. Example student drawings.

Data Analysis

The summative content analysis was performed to analyze the data. Summative content analysis usually aims to compare the counting of keywords or content and to interpret the content in this context. The summative content analysis is based on expressing data that are similar to each other in the form of code, category and theme that the reader can understand (Yıldırım & Şimşek, 2011; Gökçe, 2006). While analyzing data, the answers of each participant were numbered first as P1, P2, P3… P53. Then, each drawing was examined in detail and transferred into computer environment. 197 drawings drawn by the students for climate change and global warming concept were determined and the drawings were grouped under certain categories (Table 2). The categories are presented in detail in the results section. In the second and third steps of the research, codes, categories and themes for the students' responses were determined.

Studies have been conducted to control factors threatening the validity and reliability of the study (Yıldırım & Şimşek, 2013). In this context, gifted children studying in different programs (Support, BYF, OYG) were determined (variation). In preparing the interview form, expert opinion was consulted (internal validity). The interviews were conducted in a quiet environment (internal reliability). Expert opinion was consulted when determining code, category and theme in data analysis. While forming the results, direct citations were included. By ensuring the consistency of the results and findings, properly discussion of the data was ensured (External reliability). In addition, the analyses were presented to the opinion of more than one researcher to provide internal reliability of the research and the cases with consensus and disagreement were revealed (Miles & Huberman, 1994).

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Research Results

Results for the Students' Drawings

In the first stage of the research, the drawings were used in order to determine the perceptions of the students about climate change and global warming concept. Table 2 shows frequency and percentage values of the students' drawings.

Table 2. Frequency values of the students' drawings.

Codes	*f*	*f%*
Changing of seasons	35	17.76
Melting of glaciers	24	12.18
Depletion of ozone layer	22	11.16
Greenhouse effect	12	6.09
Increase of air temperature	11	5.58
Greenhouse gases	10	5.07
Increase of factories	10	5.07
The use of perfume, deodorant	8	4.06
Increase of the number of vehicles	6	3.04
Air pollution	6	3.04
Cutting of trees	5	2.53
Decrease of water resources	5	2.53
Narrowing of habitats	5	2.53
Floods	5	2.53
Destruction of living creatures	4	2.03
Reduction of biodiversity	3	1.52
Destruction of lands	2	1.01
Disruption of food chain	2	1.01
Drought	2	1.01
Desertification	2	1.01
Snowfall	2	1.01
Disruption of the economy	2	1.01
Garbage	2	1.01
Exhaust gases	2	1.01
Destruction of vegetation	1	0.50
Storms	1	0.50
Decrease of snowfall	1	0.50
Population growth	1	0.50
Public transport	1	0.50
Destruction of trees	1	0.50
Carbon-dioxide gas	1	0.50
The use of electric vehicles	1	0.50
Sea pollution	1	0.50
Urbanization	1	0.50

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When Table 2 was examined, the drawings of the students were mostly found in the "changing of seasons" code (*f*=35). In the same way, it was also seen that the number of drawings under the codes "melting of glaciers" (*f*=24) and "depletion of ozone layer" (*f*=22) was high. The drawings were categorized as causes, results, and solution suggestions of climate change and global warming (Table 34) and the drawings that did not have direct connection with climate change and global warming were gathered under the category of insufficient associations.

Table 3. Theme, categories and codes for the drawings.

Theme	Category	Code	*f*
Climate change Global warming	Causes	Greenhouse effect	12
		Greenhouse gases	10
		Increase of factories	10
		Increase of the number of vehicles	6
		Air pollution	6
		Cutting of trees	5
		Garbage	2
		Exhaust gases	2
		Destruction of vegetation	1
		Population growth	1
		Destruction of trees	1
		Carbon-dioxide gas	1
	Results	Changing of seasons	35
		Melting of glaciers	24
		Increase of air temperature	11
		Decrease of water resources	5
		Narrowing of habitats	5
		Floods	5
		Destruction of living creatures	4
		Reduction of biodiversity	3
		Destruction of lands	2
		Disruption of food chain	2
		Drought	2
		Desertification	2
		Snowfall	2
		Disruption of the economy	2
		Storms	1
		Decrease of snowfall	1
	Solution Proposals	Public transport	1
		The use of electric vehicles	1
	Insufficient drawings	Depletion of ozone layer	22
		Use of perfume, deodorant	8
		Sea pollution	1
		Urbanization	1

When Table 3 was examined, it was seen that the drawings of the students were mostly directed to greenhouse effect (*f*=12) in the category of the causes of global warming. This was followed by the drawings about greenhouse

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gases (*f*=10) and increase of factories (*f*=10). Besides, while six drawings were determined for the increase of the number of vehicles and air pollution, five drawings were determined stating that cutting of trees caused climate change and global warming.

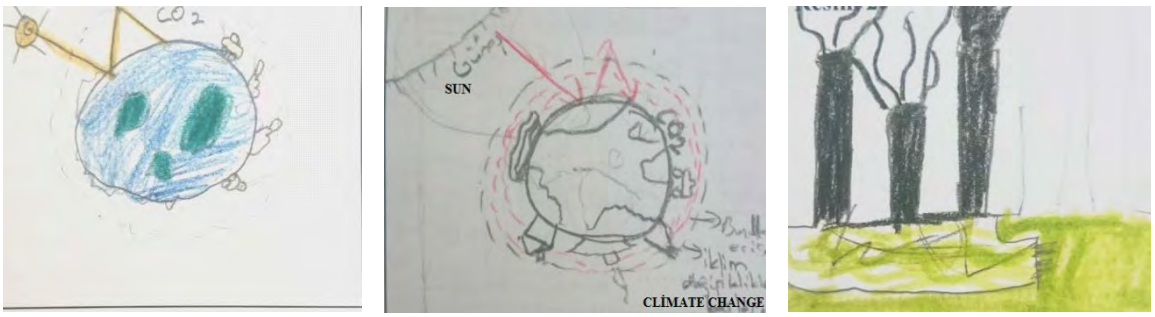

Figure 2. The drawing of P42, P33 and P39

Similarly, it was seen that the students' drawings focused on the changing of seasons (*f*=35) concept in the category of the results of climate change and global warming. This was followed by melting of glaciers (*f*=24) and increase of air temperature (*f*=11). It was also seen that the number of drawings in the solution suggestions about climate change and global warming was quite low. The students presented the suggestions with only their drawings of public transport (*f*=1) and the use of electric vehicles (*f*=1).

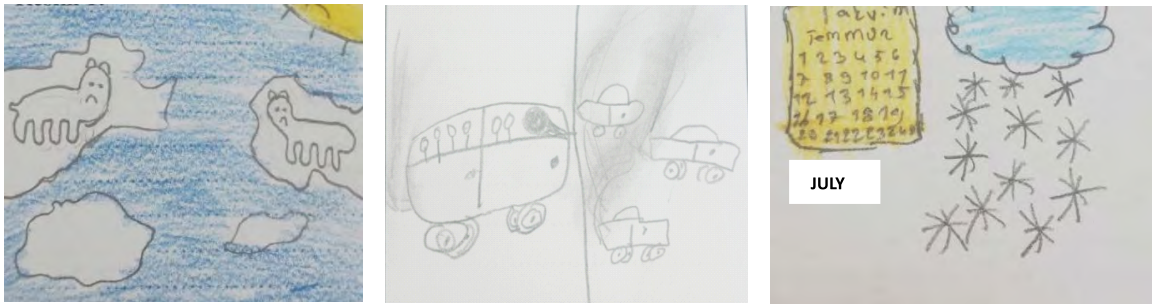

Figure 3. The drawing of P38, P41 and P10.

Besides, it was seen that the students' perception on the presence of a connection of the depletion of the ozone layer with climate control and global warming was quite high (11.6% and they made drawings about the depletion of ozone layer. There were drawings about the use of perfume and deodorant causing global warming (4.06%).

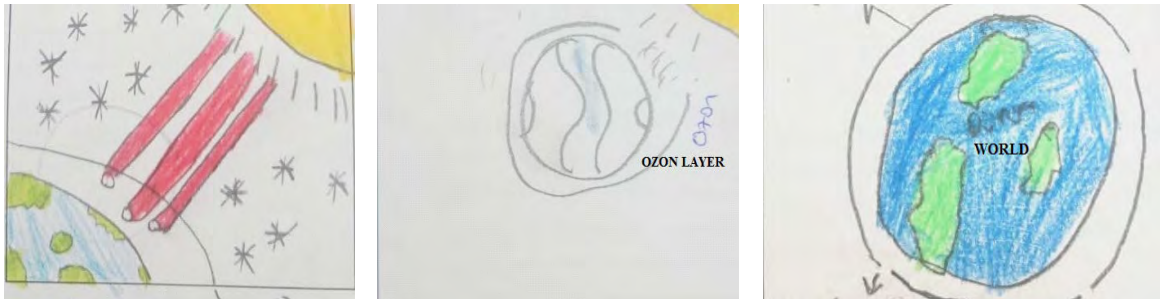

Figure 4. The drawing of P37, P30 and P11.

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The Results Obtained for Focus Group Opinions and Written Statements

Written statements and the results from the focus group opinions were given together and the participants were asked to explain what they emphasized in the texts by reading compositions they wrote about climate change and global warming and to explain their reasons. Table 4 shows the obtained results.

Table 4. Written statements and focus group opinions.

Theme	Category	Code	*f*
Climate change and Global warming	Causes	Depletion of ozone layer (20), Factory wastes (4), Greenhouse effect (3), Environmental pollution (3), Air pollution (2), Approach of sun to the world	33
	Results	Changing of seasons (6), Extinction of species (4), Melting of glaciers (3), End of humanity, Disruption of natural balance, Increase of air temperature	16
	Suggestions	Factories should be equipped with filters Vehicles should be used less Chemical substances should not be used Environment should not be harmed	4

When written statements and the students' opinions were examined, most of the students (37.23%) considered the cause of climate change and global warming as depletion in the ozone layer. For example, P2 expressed his/her opinion on this issue as *"Ozone layer is thinning. Global warming and climate change are connected with each other."*; P10 expressed his/her opinion as *"The picture I draw is related to the depletion of the ozone layer. It causes to global warming."*. Similarly, P16 expressed his/her opinions as "*Dirty gas exhaled by factory chimneys causes the depletion of ozone layer to grow by polluting the air. Therefore, global warming occurs…";* on the other hand, P30 express his/her opinion as *"The deodorants people use and car exhausts reduce the ozone layer, cause ozone layer depletion, and start the global warming. Therefore, harmful rays of the sun pass through the ozone layer."* and shows the depletion of the ozone layer as the cause of climate change and global warming. The example student opinions showing the depletion of the ozone layer as the cause of climate change and global warming are as follows:

> *The hole in the ozone layer is expanding. Thus, global warming is occurring (P35),*
>
> *Global warming, exhaust gases from the cars, the depletion of the ozone layer, and gases from the factories causes the depletion of the ozone layer and therefore the harmful sun rays come onto the world and global warming occurs (P42),*
>
> *The exhaust gases emitted from cars raise into the space, cause depletion of the ozone layer, and lead to global warming. In order to stop global warming, cars should be used less and we should prefer to walk (P29),*
>
> *Global warming refers to the depletion of the ozone layer for me (P53).*

When the participants' opinions were examined, it was seen that they expressed that factory wastes also caused climate change and global warming. P26 expressed his/her opinion about this situation as *"not attaching filter on the factory chimneys is one of the most effective factors triggering global warming. The smoke emitted from factory chimneys causes the global warming and climate change. Disposing the wastes of materials used in the factories is the cause of global warming.";* whereas, P39 stated that *"To me, disposing the factory wastes to the environment causes global warming."*. Similarly, P41 stated that *"We pollute the air without realizing. This reduces our life process. Another reason for air pollution is the increase of factories. This also affects the climate change."* and P52 expressed his/her thoughts as *"Since the number of factories is high, sun rays are trapped between the atmosphere and the world. Solution is to attach filters on factory chimneys."* and showed the factory wastes as the cause of climate change and global warming.

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When the students' opinions were examined, it was seen that only three students emphasized the greenhouse effect which is the most important reason for climate change and global warming. About this subject, P8 expressed that *"… Because greenhouse effect causes global warming the most."* and P32 expressed his/her thoughts as *"the first thing seen about global warming is greenhouse. Here, the sun rays penetrate into the greenhouse. But a bit of radiation comes out. The remaining sun rays come down again. They raise to get out again from the glass. During this process, the greenhouse starts to heat up. This can be given as an example for global warming."*. Likewise, P33 who highlighted the greenhouse effect stated his/her opinion as *"The one which is closest to my thought is the greenhouse effect. Because our atmosphere is getting dirty. It cannot get rid of carbon-dioxide. Therefore, the earth is getting polluted and climate change occurs with global warming."*.

While P6 who stated that environmental pollution causes climate change and global warming expressed his/her thoughts as *"Factories and cars pollute the environment. The number of cars increases. Number of factories increases. The environment becomes more polluted. Global warming increases."*, P15 stated that *"I think people should not harm the environment and should not use chemicals. Otherwise, our world will be in an irreversible form due to global warming and climate change arising from environmental pollution."*. Similarly, P50 who emphasized the environmental pollution as the cause of climate change and global warming stated his/her opinion as *"Glaciers melt in global warming. A major reason for this is the environmental pollution and wasteful behavior."*.

P22 who stated that air pollution causes climate change and global warming expressed his/her opinion as "Dirty smoke causes climate change and global warming." While P48 stated as "In my opinion, it is the air pollution. For this, we should use renewable energy sources instead of coal".

P13 who stated that the approach of Sun to the Earth causes climate change and global warming expressed his/her opinion as "*Global warming occurs as the sun approaches to earth*."

It was seen that the participants focused on changing of seasons, extinction of species and melting of glaciers events for the results of climate change and global warming (Table 3). While P4 who emphasized that the seasons changed stated his/her opinion as *"I think about hot winter and cold summer in climate change; melting of glaciers in global warming."*, P14 stated his/her opinion as *"In the picture I drew, a child is playing with snow in summer while the other child is sunbathing. I mean the seasons changed their places. If this continues, the climate will change and living creatures may die."*. The example student opinions expressing the results of change of season are as follows:

> *It is not snowing as it used to be. This is because of the climate change. But, the rainfall has increased thanks to the measures taken in recent years. But the glaciers are still in danger and necessary precautions for this are not taken* (P36),
>
> *What I understand from the picture I drew is the snowfall in the spring and extreme climate changes* (P40),
>
> *In my opinion, climate change is the changing of seasons. I mean, it is living winter in summer and summer in winter. The average temperature of earth increases as a result of global warming* (P46),

While P9 expressing that the species extinct as a result of climate change and global warming stated his/her opinions as *"According to a video that I have watched, we may lose some species."* P5 stated as *"Plants have begun to disappear due to climate change."*. Similarly, P23 expressing that the glaciers are melting expressed his/her thoughts as *" In the picture I drew, I drew melting of glaciers and thus the destruction of the home of polar bears. Poles are the places mostly affected by global warming."; whereas,* P49 stated that *"Glaciers melt if global warming occurs. The world gets quite hot. Storms break out frequently. People get hurt a lot."*

While P1 who expressed that climate change and global warming can cause the end of the humanity stated his/her opinions as *"Global warming can bring an end to mankind. Climate change may have effects that affect our way of life. Therefore, I believe that precautions should be taken."*, P19 who stated that the natural balance is disrupted as a result of these events expressed his/her opinions as *"The natural balance is disrupted with global warming. This leads to climate change. While there used to be cleaner air and many more living creatures, now their number is very small."*. Besides, P47 who stated that the air temperature has increased expressed his/her opinions as *"the air temperature is increasing in the picture I drew. This is the result of global warming. In order to prevent air temperature change as a result of global warming, necessary precautions should be taken"*.

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Discussion

In this research, it was aimed to examine the perceptions of gifted children studying in BILSEM about climate change and global warming by using the draw-write-tell technique. In this context, it was determined that 53 BILSEM students drew 197 drawings about climate change and global warming (Table 2). This indicated that the gifted children had different and rich perception levels (Ataman, 2004). When the drawings about climate change and global warming were examined, it was observed that the number of drawings concerning the changing of seasons and melting of glaciers were the highest and the number of drawings about the depletion of ozone layer causing climate change and global warming was also high (Table 2). The drawings emphasizing the relationship between the depletion of ozone layer and global warming pointed out that more sunlight will reach to the surface of the earth as a result of depletion of the ozone layer and thus cause global warming. Likewise, the students stated in their written statements and in the focus group interviews that depletion of the ozone layer causes climate change and global warming (Table 3). The emergence of such a result indicated that the students had misconceptions. This result is supported by numerous studies (Aksan & Çelikler, 2013; Arsal, 2010; Aydın, 2014; Boyes & Stanisstreet, 1997; Demirbaş & Pektaş, 2009; Eroğlu & Aydoğdu, 2016; Erdoğan & Özsevgeç, 2012; Oluk & Oluk, 2007; Pekel, Kaya, & Demir, 2007; Selvi & Yıldız, 2009; Summers, Kruger, Childs, & Mant, 2001). The common proposal emphasized in these studies is to determine and remove lack of knowledge and misconceptions of students regarding climate change and global warming. Thus, it is important to determine and remove misconceptions of gifted students who constitute the most important labor force of communities and have a significant potential for generating solutions to current world problems regarding climate change and global warming, which comprise one of today's most important problems. Because it is stated that gifted students who like solving current world problems by questioning them would take on significant tasks to generate solutions to global problems in the near future (Schreglmann, 2016). In this context, it is primarily required to determine the underlying reasons of lack of knowledge and misconceptions in students. This is thought to be caused especially by the effect of misconceptions of science teachers regarding climate change and global warming. For example, Eroğlu and Aydoğdu (2016) stated that science teacher candidates had incomplete and incorrect information on some subjects although they had knowledge level higher than the average about global warming. Therefore, it is important first to determine and eliminate the misconceptions of the teachers and teacher candidates about climate change and global warming which are the most important problems of our era (Aksan & Çelikler, 2013; Aydın, 2017). In addition, it is stated that news in the media that may lead to misconceptions in students regarding climate change and global warming pose a problem (Biçer & Vaizoğlu, 2015) and it is important especially for advisors and families to help students access true and reliable sources on this matter. Additionally, it has been stated that climate change, global warming and ozone layer are evaluated together by students due to teaching the aforementioned subjects together (Pekel & Kırık, 2016). In this context, when examining the Ministry of National Education (MNE) 8th grade science schoolbook; it is seen that the subjects of depletion of ozone layer and global warming are taught together under the chapter of "Matter Cycles". In addition, when examining the content of the chapter, it is determined that there are statements such as, "Technology makes life easier. However, some products that are brought in life with technology may cause depletion of ozone layer and deterioration of the greenhouse effect". It is thought that this would cause the development of misconceptions in students by evaluating depletion of ozone layer, greenhouse effect and consequently climate changes together. In this respect, it is considered important to review and update schoolbooks that are prepared according to curricula.

When the drawings of the students were categorized, it was observed that the solution suggestions about climate change and global warming were very low (Table 3). In this context, it was determined that the drawings were intended to give importance to electric vehicles and public transport. When the written statements of the students and the data of the focus group interviews were examined, it was found that they could offer very few suggestions such as factories should be equipped with filters, vehicles should be used less, chemical substances should not be used, and environment should not be damaged. This is seen as a major deficiency. Taking necessary precautions for climate change and global warming and raising awareness of everyone about precautions are important (Yıldızoğlu, 2018). Besides, it was determined that the students made more drawings in terms of the causes and results of climate change and global warming. It was an important result that students emphasized mostly greenhouse effect and greenhouse gases in the formation of these problems in their drawings. This result is supported by some studies (Aydın, 2014; Eroğlu & Aydoğdu, 2016; Kılınç, Stanisstreet, & Boyes, 2008; Koulaidis & Christidou, 1999). Besides, not mentioning water vapor which has more greenhouse effect approximately three

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thousand times than carbon-dioxide gas (CO_2) causing global warming and mentioning a little about CO_2 are striking as a shortcoming. This confirmed that the students had incomplete knowledge about the causes of climate change and global warming. Likewise, changing of seasons, melting of glaciers, increase of air temperature, decrease of water resources, narrowing of habitats, and floods were involved in the drawings of students as the results of climate change and global warming. This showed that students generally had knowledge about the results of climate change and global warming. This result is similar to the study by Aydın (2017).

Conclusions

In the light of all these evaluations, it was found that the gifted children had misconceptions about climate change and global warming constituting one of the most important environmental problems of our era and they had lack of knowledge especially about solution suggestions for these problems. The research results suggested that while the perception levels of gifted students about the causes and possible results of climate change and global warming were high, their perception level about the solution of these problems was quite low. Therefore, it is important to examinate the underlying causes of information deficiencies and misconceptions about global warming and climate change, which is one of the biggest problems of today's gifted students who have the potential to produce solutions to world problems. In this context, it is considered important to update the curricula for gifted students and especially the gifted students in the project program should be supported to produce projects on socio-scientific issues. Likewise, the results included that the draw-write-tell technique was effective in determining the perception, misconceptions and knowledge levels of the students about climate change and global warming. Asking students to draw, write down their opinions about the subject and then express this matter verbally in order to determine their perception about climate change and global warming provides an opportunity to examine profoundly the students' perspectives about the subject.

Recommendations

Necessary measures should be taken to raise awareness of students and to eliminate their misconceptions about climate change and global warming among the most important problems of today. In this context, explaining climate change and global warming to students through methods such as project-based learning, argumentation, cooperative learning and so on is important.

In order for students to reach scientific and accurate information about global warming and greenhouse effect, these subjects should be included more in the curriculum. In order to eliminate the misconceptions of students about the reasons, results and prevention of environmental problems such as global warming and climate change, practices about real life-based teaching of course contents can be developed.

It is recommended to carry out project studies with students in order to increase awareness about climate change and global warming and to reduce our ecological footprint.

Qualitative research method was used in research but quantitative research method designs can also be used for larger samples.

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