ISSN: 2146 - 9466
www.ijtase.net
International Journal of New Trends in Arts, Sports &Science Education *2022, volume 1, issue 4*

ENVIRONMENTAL PROBLEMS ACCORDING TO THE GIFTED AND TALENTED STUDENTS AND THEIR SOLUTION PROPOSALS: A QUALITATIVE RESEARCH

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Received: June 19, 2022 **Accepted:** September 11, 2022 **Published:** October 31, 2022

Suggested Citation:
Özarslan, M. (2022). Environmental problems according to the gifted and talented students and their solution proposals: A qualitative research. *International Journal of New Trends in Arts, Sports & Science Education (IJTASE), 11*(4), 201-216.

Abstract

In this study, it was aimed to determine the opinions and solution proposals of gifted and talented students. The study group was comprised of 19 gifted and talented students who were attending the Science and Art Centers (SACs) in the Marmara Region in the fall semester of 2015-2016 education year. These students were attending the 7th to 10th grades in their formal education. In order to determine the study group, the convenience sampling method was used which is among the sampling methods. The qualitative research approach was used in the research. As the data collection tool, the "Environmental Problems Semi-Structured Interview Form" was used, which was developed by the researcher. The data were analyzed though the content analysis and descriptive analysis methods. As the conclusion of the research, it was determined that gifted and talented students mostly emphasized environmental problems in our day such as water and air pollution, and global warming. However, it was also determined that the students emphasized less about the environmental problems such as biodiversity loss, acid rains, the loss of agricultural lands, deforestation, and genetically modified products. Students mostly mentioned that the environmental problems mainly result from lack of education and consciousness in the society, and due to environmental polluting elements. As a solution for the environmental problems, students proposed recycling and treatment of waste, educating individuals about the environment, re-regulating laws, and increasing inspections. Students stated that, in the future, water pollution, global warming, and radiation pollution will emerge as the environmental problems. The majority of the gifted and talented students stated that they will make contributions to solve the environmental problems in the future, but a significant number of students mentioned that they did not want to deal with these issues.

Keywords: Gifted and talented students, environmental education, environmental problems, Science and Art Centers, qualitative research

INTRODUCTION

Today, the environment is being destroyed by factors such as the development of industry and technology, rapid population growth and construction (Li, 2018; Uğulu, 2015). The environment is a natural habitat created through an interaction between living beings and non-living things (Yavetz, Goldman & Pe'er, 2014). The environmental problem is the destruction in nature occurring as a result of uncontrolled and improper use of the resources that constitute the structure of this living environment (Yüksel, 2009). Researchers indicate the problems such as air, water, and soil pollution, global warming, depletion of ozone layer, biodiversity loss, destruction of green spaces, desertification, and erosion as today's environmental problems (Harris, 2012; Li, 2018; Tsekos and Matthopoulos, 2009). Destruction of the environment adversely affects all living things. Therefore, environmental problems are of interest to all human beings, they are the subjects of frequent media coverage, and they are constantly discussed (Marinopoulos & Stavridou, 2002).

Providing environmental education to individuals is of significant importance since the main cause of environmental problems is the human (Kocabaşoğlu & Şahin, 2021; Pınar & Yakışan, 2017). Environmental education includes comprehensive lifelong education in order to become sensitive to changes in the world (Khan, 2018). This training will enable individuals to avoid environmental problems and to gain environmental awareness and sensitivity (Valderrama-Hernández, Alcántara, & Limón, 2017). At this point, another important group that should acquire environmental awareness and sensitivity is the group of gifted and talented individuals.

Gifted and talented individuals can be an important opportunity for environmental protection and solutions to environmental problems of our day. Because it is stated that the gifted and talented individuals are interested in humane problems and they strive to propose solutions (Piechowski, 1997; Sak, 2012; Stuart & Beste, 2011; Şahin, 2015; Önal, 2020). Additionally, Silverman (1993) reported that the strong emotional intensity, justice, and empathy traits of the gifted and talented individuals rendered them particularly sensitive to problems such as the destruction of nature, overfishing, starvation and endangered species (Lovecky, 1993; Piechowski, 1997; Silverman and Ellsworth, 1981). Moreover, gifted and talented individuals perform better in terms of productivity, creativity, analytical thinking, and problem solving compared to their peers (Ataman, 2009; Gubbins, Callahan & Renzulli, 2014; Stenberg, 1986, 1999; Yıldırım Doğru, 2013).

The advanced characteristics of gifted and talented students also differentiate their expectations and requirements from environmental education. Environmental education approaches that do not take into account the characteristics of gifted and talented students are not considered sufficient to meet their needs (Şahin & Levent, 2015). In addition, before organizing activities and trainings to support gifted and talented students to develop positive behaviors and attitudes towards the environment, it is important to determine their thoughts and perceptions of environment and environmental problems (Özarslan, Çetin & Yıldırım, 2017). Because these variables are closely related to awareness levels, attitudes, and approaches of students towards the environment and environmental problems (Roczen, Kaiser, Bogner & Wilson, 2014). However, it is stated that the number of the studies in the literature is insufficient which examine the perceptions, opinions, level of knowledge and similar traits of gifted and talented students concerning environmental problems (Karakaya, Ünal, Çimen & Yılmaz, 2018).

When the literature was examined, a small number of studies were found investigating the thoughts, attitudes, behaviors, etc. of the gifted and talented students concerning the environment and environmental problems. As examples of these studies, Aydın, Coşkun, Kaya, and Erdönmez (2011), Uğulu (2013), and Esen (2011) stated that the attitudes of gifted and talented students towards the environment were at a very high level. Esen (2011) determined that gifted and talented students were able to develop solutions to environmental problems; however, they were not creative ideas. In addition, it was determined that most students suggest penal sanctions as the solutions to environmental problems. Uğulu (2015) stated that the attitudes of gifted and talented students towards recycling are at a very good level. Sontay, Gökdere, and Usta (2014) demonstrated that gifted and talented students are more sensitive in displaying positive attitudes towards the environment than their peers. Concerning the literature, this study can both contribute to the reorganization of environmental education for gifted and talented students according to their characteristics and contribute to revealing different solution proposals of these students concerning the environmental problems.

The aim of the study is to determine the thoughts and solution proposals of gifted and talented students on environmental problems. For this purpose, answers were sought for the following sub-problems:

Sub-Problems

1. What are the thoughts of gifted and talented students about the environmental problems?
2. What are the thoughts of the gifted and talented students about today's most important environmental problems and their causes?
3. What are the solution proposals of gifted and talented students for the environmental problems?
4. What are the thoughts of the gifted and talented students about the future environmental problems?
5. What is the possibility of the gifted and talented students to consider working on environmental issues in the future?

ISSN: 2146 - 9466
www.ijtase.net
2022, volume 1, issue 4

METHOD

The qualitative research method was used in the study (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2011). "Environmental Problems Semi-Structured Interview Form", which was developed by the researchers, was used as the data collection tool.

Study Group

The study group was determined according to the convenience sampling method within a Science and Art Center (SAC) in Marmara Region in the fall semester of the 2015-2016 education year. Convenience sampling method is a sampling method that is widely used among the qualitative research studies (Yıldırım and Şimşek, 2011). The study group was comprised of 19 gifted and talented students who were attending 7th to 10th grades in their formal education. Identification of these students as "gifted and talented individuals" was concluded through the general ability and intelligence tests conducted by the experts of Ministry of National Education. Semi-structured interviews were conducted with these students. The interviews were implemented on a voluntary basis. Necessary permissions were gained from the relevant institutions. The information concerning the study group is given in Table 1.

Table 1. Descriptive statistic values of the students in terms of gender and grade variables

Variable		7th grade	8th grade	9th grade	10th grade	Total
		N				
Gender	Female	1	1	1	-	3
	Male	4	3	6	3	16
	Total	5	4	7	3	19

In our country, the education of the gifted and talented students is provided in the SACs which are functioning under the Ministry of National Education (MNE). In general, during their spare times after the formal education hours and weekends, students participate in certain science and art activities such as harmony, support, recognizing individual skills, developing special skills, and project production, respectively (MNE SAC Directive / BILSEM Yönergesi, 2007).

Data Collection Tool

The data of the study were collected through the "Environmental Problems Semi-Structured Interview Form" that was prepared by the researcher. In preparation of this form, initially, necessary literature review was conducted. The questions of the form were decided in line with the objectives of the research. The views of scholars were obtained in order to determine the content validity of the interview form, its compliance to the language and to the field. Necessary changes were made on the questions in line with the views of two scholars from the environmental education and biology education field and a teacher from the Turkish Language and Literature field. The pilot test of the interview form was conducted on 2 students and the views of students were asked about the clarity and understandability of the questions. The interview form was comprised of seven questions investigating the thoughts and proposals of students about environment problem, current environmental problems, the reasons and solutions of these problems, future environmental problems that humanity will face, etc. The interviews were recorded with a recorder after gaining the consents of the participants. Each interview lasted about 20 minutes.

Data Analysis

The sound recordings of the interviews were transcripted by the researcher. These qualitative data were analyzed through content and descriptive analysis techniques (Yıldırım and Şimşek, 2011). During the content analysis, the data were coded and organized as themes and sub-themes. The coding of the data was separately conducted by the researcher and a doctoral student, who was experienced in content analysis. Using the data obtained from the both coders, the reliability of the study was calculated through the agreement formula of Miles and Huberman (2002). In an attempt to reach a consensus, the coders re-evaluated the points of dissensus. It was determined that the agreement level

of the coders was 90%, which was enough for the reliability (Miles and Huberman, 2002). The multiple answers of the participants for each question were taken into consideration. Therefore, the frequencies of the answers of the participants can sometimes be more than the number of the participants. Additionally, the views of the participants were stated in the findings section, indicating the number of the participant, like (K_1) (Yıldırım & Şimşek, 2011).

RESULTS

The views of the gifted and talented students concerning the environmental problems and their solution proposals are presented in this section. The views of the gifted and talented students concerning the environmental problems are given in Table 2.

Table 2. The views of the gifted and talented students concerning the environmental problems

Theme	Code	f
Environmental problem	Impairment of functioning of nature	7
	Impairment of the harmony of the elements comprising the environment	4
	Contamination of the nature through wastes and garbage	4
	Anything irritating	2
	Misuse of environment	1
	Unplanned construction	1

According to Table 2, concerning the environmental problem concept, the gifted and talented students mainly explained their views as 'Impairment of functioning of nature' (7), 'Impairment of the harmony of the elements comprising the environment' (4), 'Contamination of the nature through wastes and garbage' (4). The example statements concerning the findings are as follows:

K_{15}: *Environmental problem is the impairment of the harmony of the elements comprising the environment.*
K_3: *Environmental problem is destroying the nature through wastes by human beings.*
K_{19}: *Environmental problem is any problem that impedes or disrupts the continuation of the natural process around us.*

The views of the gifted and talented students concerning the environmental problems of today and future are presented in Table 3.

Table 3. Theme and sub-theme distribution of views of the gifted and talented students concerning the environmental problems of today and future

	Sub-theme	Codes	Today	Future
Environmental problem	Human induced	Noise pollution	4	1
		Light pollution	3	-
		Oil spill	3	-
		Traffic problem	3	-
		Deforestation	2	-
		Unplanned construction	2	-
		Genetically modified products	1	1
		Loss of agricultural lands	1	1
		Wastes	1	-
		Overhunting	1	-
		Rapid population growth	-	1
	Industrial and human induced	Air pollution	10	3
		Global warming / Climate change	10	8
		Water pollution	8	13
		Disruption of ecological balance	8	2

		Soil pollution	8	1
		Nuclear contamination / radiation	7	4
		Depletion of the ozone layer	3	3
		Biodiversity loss	2	3
		Environmental pollution	1	-
		Acid rains	1	1
		Electronic pollution	-	1
		Cancer-causing environmental pollution	-	1
	Natural and human induced	Famine	-	2
		Erosion	1	-
		Volcanic eruptions	-	1
Other		Wars	1	2
		Lack of education	1	-
		Miscommunication	1	-

According to Table 3, the views of gifted and talented students concerning the most important environmental problems were organized under two themes as 'Environmental problems' and 'Others'. The theme 'Environmental problems' was organized under three sub-themes as 'human induced', 'industrial and human induced', and 'natural and human induced'.

Under the 'human induced' sub-theme, students perceived 'noise pollution (today: 4; future: 1)', 'genetically modified products (1;1)', and 'loss of agricultural lands (1;1)' as the most important environmental problems of both today and future. As per the 'Industrial and human induced environmental problems' sub-theme, students perceived 'Global warming/Climate change (10;8)', 'Air pollution (10;3)', 'Water pollution (8;13)', 'Soil pollution (8;1)', 'Disruption of ecological balance (8;2)', 'Nuclear contamination/radiation (7;4)', and 'Biodiversity loss (2;3)' as the most important environmental problems of both today and future. Under the 'Natural and human induced' sub-theme, students mentioned that 'Famine (2)' will be the environmental problem of the future. As per the 'Others' sub-theme, students mentioned that 'Wars (1; 2)' will be among the important problems of both today and future. Students mentioned that 'Rapid population growth (1)', 'Cancer-causing environmental pollution (1)', 'Electronic pollution (1)', and 'Volcanic eruptions (1)' will be among the most important environmental problems of the future. Exemplary statements within the findings are as follows:

K_4: *Among the important environmental problems of today are unplanned urbanization, global warming, air and water pollution.*
K_{11}: *Traffic problem, destroying the nature, and climate change are among the important environmental problems.*
K_2: *Depletion of the ozone layer, animal extinction, and cutting trees…*
K_8: *Electronic pollution will emerge in the future. Because there is no recycling for electronic devices such as telephones and computers.*
K_6: *In the future, global warming will take place and the climates will change.*
K_{14}: *In the future, water shortage and decreasing potable waters will be a problem. Because the drinking waters are being contaminated by the acid rains.*

The views of gifted and talented students concerning the causes of today's environmental problems are presented in Table 4.

Table 4. Theme and sub-theme distribution of views of the gifted and talented students concerning the causes of today's environmental problems

Theme	Sub-theme	Codes	f
Environmental problem	Pollutant factors	Dumping garbage and waste materials into soil and water	15
		Toxic gasses and wastes emitted from factories	8

		Exhaust fumes of vehicles	7
		Radioactive leaks and waste	6
		Nuclear power plants	3
		Chemical weapons	2
		Unnecessary lighting	2
		Oil spill	2
		Radiation emitted by technological devices like computers and phones	1
		Tobacco smoke	1
	Lack of education and conscience	Lack of respect for the environment	3
		Unconscious water pollution	2
		Unconscious use of pesticides and artificial fertilizers	2
		Lack of education	2
		Unconscious attitudes of people towards environment	1
		Carelessness of people	1
	Misuse	Use of petroleum products as fuel	4
		Traffic congestion	2
		Excessive use of nature resources for energy needs	1
		Unplanned urbanization	1
		Insufficient use of public transport	1
Ecological balance	Biodiversity loss	Unplanned construction	4
		Unconscious fishing and overfishing	3
		Insufficient knowledge about the importance of living things for the nature	1
	Erosion	Insufficient reforestation	1
		Lack of education in farmers for soil processing	1
	Depletion of ozone layer	Unconscious use of hazardous gasses	3
		Excessive sunrays	1
	Global warming	Release of greenhouse gases through human activities	5
		Depletion of the ozone layer	2
		Contamination of air due to excessive use of oil-induced fuels	2
		Using nature unlimitedly for energy requirements	1
		Non-recyclable waste	1
	Genetically Modified products	Yielding more from plants and animals	1
Residence	Unplanned construction	Insufficient urban planning	1
		Building constructions in agricultural areas	1
		Destruction of green spaces	1
		Excessive population growth	1
	Traffic problem	Excessive population growth of cities	2
		Excessive increase in the number of private vehicles	1

According to Table 4, under the 'Pollutant factors' sub-theme of the 'Environmental pollution' theme, the views of the gifted and talented students concerning the causes of today's environmental problems were 'Dumping garbage and waste materials into the soil and water' (15), 'Toxic gases and wastes emitted from factories' (8), 'Exhaust fumes of vehicles' (7), and 'Radioactive leaks and wastes' (6). In the sub-theme of 'Lack of education and consciousness', students expressed their views as 'Lack of

respect for the environment' (3), 'Unconscious water consumption' (2) and 'Unconscious use of pesticides and artificial fertilizers' (2). Under the sub-theme of 'misuse', students expressed their views as 'Use of petroleum products as fuel' (4) and 'Traffic congestion' (2).

Under the 'Biodiversity loss' sub-theme of the 'Ecological balance' theme, students expressed their views as 'Unplanned construction' (4) and 'Unconscious fishing and overfishing' (3) as the results of the biodiversity loss. In the sub-theme of 'global warming', students expressed their thoughts as 'The release of greenhouse gases due to human activities' (5) and 'Polluting the air with overuse of oil-derived fuels' (2). In addition, students stated that 'Depletion of the ozone layer' (2) was one of the causes of global warming. These findings demonstrate the existence of misconceptions in students about the global warming.

Under the 'Unplanned construction' sub-theme of the 'Residence' theme, students stated their views as 'Insufficient urban planning' (1), 'Building constructions in agricultural areas' (1), and 'Destruction of green spaces' (1) as the causes of the environmental problems. The example statements concerning the findings are as follows:

K_3: *The cause of the air pollution is the exhaust being emitted from the factory chimneys and cars.*
K_1: *Loss of agricultural lands and deforestation, the bridges were constructed in the forests in our town, over-construction…*
K_6: *Nuclear contamination, insecure nuclear power plants to be built in our country.*
K_8: *Unplanned urbanization and water pollution are caused from continuous increasing of the city population and factory wastes being dumped to the seas without treatment.*

The solution proposals of the gifted and talented students concerning today's environmental problems are presented in Table 5.

Table 5. Theme and sub-theme distribution of solution proposals of the gifted and talented students concerning today's environmental problems

Theme	Sub Theme	Code	f
Environmental problems	Treatment and recycle	Installing filters to factory chimneys, vehicle exhausts, etc.	6
		Recycling of waste must be ensured	5
		Factory waste and other kinds of waste should be treated	4
		New filters and treatment systems should be developed	2
		Nuclear waste must be stored and disposed of under appropriate conditions	2
	Alternative implementations	Renewable fuel sources should be used instead of petroleum products	8
		Alternative energy sources should be used instead of nuclear energy	4
		City planning should be done more carefully	4
		Public transport should be encouraged	3
		Trees must be protected	2
		Natural fertilizer should be used instead of artificial fertilizer	1
		Cycling should be encouraged	1

ISSN: 2146 - 9466
www.ijtase.net
2022, volume 1, issue 4

		Agricultural engineers should be assigned in the relevant regions	1
		Developments in industrialization should prioritize conservation of nature	1
		Biological fight should be started against agricultural pests	1
		Sound-baffles should be placed on the roadsides	1
	Legislation and sanctions	Regulations should be revised and controls should be increased	9
		Population should be restricted and planned in the cities	3
		Migration to major cities must be prevented	2
		Greedy destruction of nature by human must be prevented	1
		Overfishing must be prevented	1
	Education and consciousness-raising	Environmental education should be given and a certain level of awareness should be raised	15
		People should be made aware of energy consumption	3
		Non-governmental organizations should be supported	2
		Unconscious and excessive lighting should be reduced	2
		Generations should be raised with love of nature	1
Negative opinions		It cannot be solved or pollution cannot be eradicated	2

According to Table 5, the solution proposals of the gifted and talented students concerning today's environmental problems were organized under the themes of 'Environmental problems' and 'Negative opinions'. 'Environmental problems' theme were categorized under the sub-themes of 'Treatment and recycling', 'Alternative implementations', 'Legislation and sanctions', and 'Education and consciousness-raising'.

Under the treatment and recycling sub-theme, students stated their views as 'Installing filters to factory chimneys, vehicle exhausts, etc.' (6), 'Recycling of waste must be ensured' (5), 'Factory waste and other kinds of waste should be treated' (4), and 'New filters and treatment systems should be developed' (2). Under the 'Alternative implementations' sub-theme, they mentioned their suggestions as 'Renewable fuel sources should be used instead of petroleum products' (8), and 'Alternative energy sources should be used instead of nuclear energy' (4).

Under the 'Legislation and sanctions' sub-theme, they mentioned their suggestions as 'Regulations should be revised and controls should be increased' (9), and 'Population should be restricted and planned in the cities' (3). As per the 'Education and consciousness-raising' sub-theme, they stated their views as 'Environmental education should be given and a certain level of awareness should be raised' (15), and 'People should be made aware of energy consumption' (3). Under the 'Negative opinions' sub-theme, some students stated the view 'It cannot be solved or pollution cannot be eradicated' (2). The example statements concerning the findings are as follows:

K_{18}: *Air pollution can be solved through alternative fuel sources and using filters in the chimneys.*
K_{10}: *In order to prevent soil pollution, natural fertilizers can be used instead of artificial ones.*
K_9: *Noise pollution and traffic problem can be solved through the use of public transportation.*
K_5: *In order to prevent biodiversity loss, hunting should be forbidden. Significance of living beings should be taught to the people.*

The views of the gifted and talented students concerning their future interests in studying environmental problems are presented in Table 6.

Table 6. The distribution of views of the gifted and talented students concerning their future interests in studying environmental problems

Interest in studying	f	Study field	f
I want	11	I can join/support non-governmental organizations (NGOs) founded for environmental issues.	4
		I can study on environmental law.	2
		I'm going to be a journalist writing on environmental issues.	1
		I want to be useful to people about environmental issues.	1
		I want to be an electrical engineer and work on natural energy sources.	1
		I'm going to study on organic chemistry, I can work on solving water pollution in this field.	1
		I want to work on soil pollution in the future.	1
		I'm going to be an aircraft engineer. I can build planes that don't harm the environment.	1
I don't want	8	No reason	4
		I did not think of studying in these fields.	3
		I am not interested in these fields.	1

According to Table 6, the views of the gifted and talented students concerning their future interests in studying environmental problems were organized under two themes as 'I want' (11) and 'I don't want' (8). Under the 'I want' theme, the students mentioned their views as 'I can join/support non-governmental organizations (NGOs) founded for environmental issues' (4), 'I can study on environmental law' (2), 'I'm going to be a journalist writing on environmental issues' (1), and 'I want to be useful to people about environmental issues' (1). Under the 'I don't want' theme, the students mentioned their views as 'I did not think of studying in these fields' (3), and 'I am not interested in these fields' (1). Examples of the statements in the findings are as follows:

K_{15}: *I will study journalism of law in the future. I can be the statutory advisor of the NGOs functioning in environment field.*
K_4: *I am thinking of being an aircraft engineer. I am planning to produce planes that do not have any threat for the environment.*
K_3: *I will be an electrical engineer, and I am thinking of studying on natural energy resources.*

DISCUSSION and CONCLUSIONS

The aim of the research is to determine the views of gifted and talented students about environmental problems and their solution proposals for these problems. In the results of the research, it was determined that the views of the gifted and talented students concerning the concept of environmental problems were often in line with the functioning of nature, the impairment of the harmony between the elements comprising the environment, and the pollution of nature with waste or garbage. It was also determined that the students explained the environmental problems as the deterioration of the natural functioning and harmony of the living and non-living elements comprising the environment. These results coincide with the explanation of environmental problems defined in the literature as arising from the change of the elements comprising the environment and a change in its functioning, or deterioration of its structure due to negative factors (Torunoğlu, 2013; Yüksel 2009). This conclusion was interpreted as that the majority of students had accurate views about the environmental problem. It was also determined that many students perceived the concept of environmental problems by associating them with environmental pollution. These results were also interpreted as that students perceived environmental problems as environmental pollution in general. In this respect, the environmental education activities of the gifted and talented students can involve certain subjects such as the elements that comprise the environment, and the interaction, functioning, and ecological balance between these elements. In addition, environmental problems other than the environmental pollution can be emphasized more in these trainings. Environmental education can be

enriched by using different teaching methods and techniques such as non-class activities, project studies, and problem-based learning for environmental problems.

As the conclusion of the research, it was determined that the gifted and talented students mostly emphasized air pollution, global warming, water pollution, disruption of ecological balance, soil pollution, nuclear contamination/radiation contamination as the environmental problems of today. However, it was determined that students less emphasized environmental problems such as biodiversity loss/extinction, acid rains, loss of agricultural areas and deforestation, unplanned construction, genetically modified products, and overfishing. Similar to the results of studies conducted on normally developing peers of gifted and talented students in the field, the results of this research are in parallel with those of previous studies, in which the participants emphasized air, water, and soil pollution as the environmental problems (Alerby, 2000; Barraza, 2001, Genç, Genç, Ergenç & Erkuz, 2016; Doğan, Saraç, & Çiçek, 2017; Duan & Fortner, 2005). It was also determined that gifted and talented students emphasized some global environmental problems such as nuclear pollution/radiation problems and global warming. According to this conclusion, it was considered that students were aware of the environmental issues discussed by the society. However, it was determined that the gifted and talented students did not adequately emphasize environmental problems such as biodiversity loss/extinction, acid rains, loss of agricultural areas and deforestation, unplanned construction, genetically modified products, etc. This result demonstrated that gifted and talented students were less aware of the mentioned environmental problems (Nacaroğlu & Bozdağ, 2020). This can be due to the insufficient environmental education in their formal education. Because routine environmental education approaches that do not take into account the characteristics of gifted and talented students do not adequately meet the needs of gifted and talented students (Şahin and Levent, 2015). For this reason, a learning environment can be established where the gifted and talented students can conduct research in the field of environment, think about environmental problems, and discuss their solutions. The subjects of the environmental education can be preferred from among the issues about which students have low levels of awareness.

In the research results, gifted and talented students mentioned that, in the future, mostly the environmental problems such as water pollution, global warming/climate change, and nuclear contamination/radiation contamination will occur. It was determined that water pollution was the most frequently emphasized environmental problem by the students to occur in the future. Additionally, students stated rapid population growth, cancer-causing environmental pollution, electronic pollution, famine, and volcanic eruptions as the important environmental problems of the future. In the literature, it was stated that gifted and talented individuals demonstrate a better performance compared to their peers in terms of creativity, analytical thinking, advanced imagination, etc. (Ataman, 2009; Gubbins et al., 2014; Stenberg, 1986, 1999; Yıldırım Doğru, 2013). The predictions of these students arising from the abovementioned characteristics are considered important. At this point, environmental problems that will affect the environment more in the future such as water pollution, global warming, cancer-causing environmental pollution, electronic pollution, and famine can be addressed in environmental education activities. Projects can be conducted in terms of determining the causes and solutions to these problems. An environment without these problems can be modeled. In this way, the awareness levels of the gifted and talented individuals can be increased in solving future environmental problems.

The research results demonstrated that the gifted and talented students emphasized environmental problems such as miscommunication and lack of education. It was also determined that students stated ‘everything disturbing’ as an environmental problem, in their perception of environmental problem. These stated ideas were in line with the environmental problems and description reported in Erduran, Avcı, Demirekin, Hare, Özlü & Özkan (2013), Doğan & Simsar (2018), and Özcan & Demirel (2019). Students mentioned the depletion of the ozone layer as one of the causes of the global warming problem. This result was interpreted as that some gifted and talented students have misconceptions about environmental problems. The results of this study is in parallel with the previous studies in the literature emphasizing that normally developing peers of the gifted and talented students have misconceptions about the environmental problems (Boyes, Chambers, & Stanisstreet, 1995; Doğan et

al., 2017; Emli & Afacan, 2017; Khalid, 2003; Kocabaşoğlu & Şahin, 2021; Mutlu & Nacaroğlu, 2019; Rye, Rubba & Wiesenmayer, 1997; Özcan & Demirel, 2019; Wals 1992). According to these results, it was notable that the misconceptions of the gifted and talented students were similar to their normally developing peers. This result may be due to inadequacy of formal education concerning environmental education. Therefore, different teaching methods and techniques such as non-class activities, projects, and problem-based learning method can be included in environmental education in order to eliminate misconceptions. The works and conferences of experts or well-known environmentalists can be followed.

Research results demonstrate that the gifted and talented students mainly emphasized certain factors causing environmental pollution such as dumping waste materials and garbage into soil and water, factory wastes and toxic gases emitted from their chimneys, and exhaust smoke of vehicles. In addition, students particularly emphasized factors such as fossil fuels, lack of public transportation, and unplanned construction. These results are consistent with the results of previous research studies conducted by Genç et al., (2016), Nacaroğlu and Bozdağ (2020) and Doğan et al., (2017) concluding that the factory smoke, liquid waste of factories, and the cutting trees caused environmental pollution. In order to solve these problems, the gifted and talented students proposed filtering factory chimneys and exhausts, and purifying or recycling polluting wastes such as factory and household waste. In addition, students proposed encouraging community to use bicycles and public transport, and suggested using renewable fuel sources instead of fossil fuels. The gifted and talented students addressed the greenhouse gases and overuse of fossil fuels as the main cause of global warming. Based on this result, it was considered that students had a certain level of awareness about global warming. However, it can be accepted as a negativity that some students had misconceptions about global warming. Therefore, in environmental education, the subjects that students' have misconceptions can be particularly emphasized.

Among the factors that pollute the environment, radioactive leaks and waste, nuclear power plants, chemical weapons, and the radiation emitted from technological devices such as computers and telephones have an important place in the minds of the gifted and talented students. As a solution for these problems, students proposed storing or disposal of the nuclear waste under appropriate conditions and using alternative energy sources instead of nuclear energy. It is thought that the gifted and talented students are highly sensitive about radiation/nuclear pollution. It is considered that recent debates concerning nuclear power plant accidents and the safety of newly built plants in our country and around the world have raised awareness among students. Including subjects about radiation/nuclear contamination in environmental education activities can positively affect the interest, curiosity, and motivation levels of students.

In the research results, the students stated that lack of education and unconsciousness are among the most important causes of environmental problems. Students often proposed educating and raising awareness of individuals to solve environmental problems. According to these results, it was determined that students considered deficiencies in environmental education as one of the most important causes of environmental problems. At this point, projects can be developed or discussion environments can be created with gifted and talented students about the content of environmental education for the individuals in our country.

According to the research results, it was determined that only one student emphasized the issue of genetically modified organisms (GMO) that can be considered among environmental problems, and the motive behind this was determined as the intention of people to yield more from plants and animals. In the literature, it was stated that GMO products have some possible negative effects on the environment and nutrients (Hail, 2000; Losey, Rayor and Carter, 1999; Gianessi, Silvers, Sankula and Carpenter, 2002). Based on these results, it is thought that gifted and talented students do not have a sufficient level of awareness concerning the potential damage of GMOs to the environment and human health and about the fact that it is an environmental problem. This can be caused by a lack of knowledge in students concerning biotechnology and GMO (Demir & Düzleyen, 2012; Leslie &

Schibeci, 2003). Therefore, in order to raise awareness, the GMO knowledge levels of the gifted and talented students can be increased by enriched activities in biology and science courses. In this context, biotechnology laboratories of universities and research centers can be visited.

In the research results, it was determined that, as a solution for the environmental problems, the gifted and talented students proposed developing new filter and treatment systems, implementation of biological control of agricultural pests, prioritization of protecting nature in industrial developments, and use of natural fertilizer instead of artificial fertilizer. According to these results, it is noteworthy that different proposals for solving environmental problems are limited to only a few students. However, it was stated that the gifted and talented students strive to develop solutions to problems concerning humanity and nature (Piechowski, 1997; Sak, 2012; Stuart & Beste, 2011; Şahin, 2015). Moreover, it was reported that gifted and talented individuals perform at a higher level than their peers in terms of creativity, productivity, advanced imagination, analytical thinking, etc. (Ataman, 2009; Gubbins et al., 2014). In this respect, the presence of gifted and talented individuals may be an opportunity for new solutions to environmental protection and environmental problems, and creative solutions can be expected from them. However, Esen (2011) demonstrated that gifted and talented students were able to develop solutions to environmental problems, but they were not creative ideas. It is thought that these results are due to the lack of environmental education given to students both in formal education and the in the education of the SAC. Environmental education approaches that do not take into account the characteristics of these students do not adequately meet the needs of gifted and talented students (Şahin & Levent, 2015). Therefore, environmental education to be given to students can be rearranged in accordance with their requirements.

Based on the research results, students stated that regulations should be revised and inspections should be increased in solving environmental problems. In addition, as a solution to the problems arising from the growing population, the students proposed imposing population restrictions on the cities and preventing migration to the major cities. These results are in parallel with those of the Yalçınkaya (2013), and Yılmaz, Morgil, Aktuğ, and Göbekli (2002) reporting that students proposed imposing severe penalties against polluters and adoption of relevant regulations. However, the most effective way of solving environmental problems is to raise the awareness of people concerning the environment (Yalçınkaya, 2013). In line with these results, certain activities can be planned in cooperation with different disciplines such as sociology, geography, and law, brainstorming activities can be implemented and a discussion environment can be created to decide what methods can be more effective in environmental education of the gifted and talented students for solving and preventing environmental problems, what regulations should be adopted to protect the environment particular to our country, and how to plan the population growth of cities.

In the results of the research, the majority of the gifted and talented students stated that they would be involved or provide support for efforts to solve environmental problems in their future lives. Although these students do not think of having a profession that is directly related to environment or environmental problems, they have stated that they will contribute to solving environmental problems. For example, it is a hopeful development that a student to prefer law as a profession in the future mentions that he/she could work on environmental law, and another student planning to be an electrical engineer is considering working on natural energy sources. However, it is also remarkable that a significant number of students stated that environmental issues are not interesting for them and they do not intend to work on these issues. In addition, it was determined that some students thought that air pollution is an unsolvable problem and that the littering problem cannot be solved. Although the gifted and talented students, who will play an important role in the protection of the environment and solving problems in the future, have a certain level of awareness, knowledge, and attitude towards environmental problems, this level should be increased considering their role in society. Therefore, a special emphasis should be placed on environmental education of gifted and talented students. Within the scope of environmental education and in order to see the environmental problems closely, visits can be made by students to the sites that experienced environmental problems. Conferences of experts or representatives of NGOs in the field of environmental issues can be followed.

Within the scope of the research results, the following recommendations can be made to educators and researchers; in order to increase the knowledge and awareness of the gifted and talented students about environmental problems, environmental education can be enriched in accordance with the characteristics of these students. Environmental problems can be discussed in environmental education of these students and creative thinking activities and discussion environments can be planned to solve environmental problems. In environmental education, students' misconceptions, awareness, and knowledge levels can be determined about environmental problems. Certain environmental issues in which students have low levels of awareness such as biodiversity loss, acid rains, and genetically modified products and certain subjects in which the students have misconceptions such as global warming can be addressed in activities. The emotions, opinions, perceptions, and interest levels of the students concerning environmental problems can be determined and activities can be organized to develop them. In this context, certain activities for the students can be organized such as nature trips, industrial area excursions, monitoring recycling and treatment studies, and observation visits to environments where environmental problems exist. The students can participate in activities of representatives of non-governmental organizations, experts, and academicians who are active in the prevention and solution of environmental problems.

This research study has certain limitations concerning the size of the study group, determining the size of the study group, and using the qualitative research method. Therefore, researchers of further studies can include larger study groups using quantitative data collection tools in addition to the qualitative data collection tools. Moreover, in further studies, as a solution to the environmental problems, a comparison can be made between the ideas of gifted and talented students and normally developing students concerning the environmental problems in terms of certain variables such as opinions, interest levels, and perceptions.

Ethics

As the author of this study, I declare that we collected data in accordance with ethical rules during the research process and acted in accordance with all ethical rules.

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