

## Secondary School Students' Views on Global Warming

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### Abstract

The purpose of the current study is to investigate middle school 5th – 8th grade students' views of global warming. The participants of the research consisted of 33 volunteer students studying at 9 public schools in the city center of Mus in the first semester of the 2021-2022 academic year. In this research, a qualitative approach was adopted, and phenomenology design was used as the study design. The data of the research were collected through semi-structured interviews with students. MAXQDA qualitative analysis program and content analysis method was used to evaluate the answers of the students. As a result, most of the participants believed that the causes of global warming are fossil fuel consumption and greenhouse gas emissions, environmental pollution, unconscious consumption. The participants considered the effects of global warming as climate change, drought, disruption of the ecosystem, extinction of some living species, melting of glaciers. The participants made suggestions to prevent global warming such as keep the environment clean, avoid overconsumption, afforestation activities recycling, not using deodorant/to use less, raise awareness with families/friends, caring for all living things, preferring cycling, renewable energy, installing filters on factory chimneys, use of environmentally friendly means of transport, government regulation, protecting nature, renewable energy production, use of public transportation, manufacturing electric cars, activities for raising awareness. Moreover, It was determined that most of the students were worried about this issue, some of them were upset, and some of them were alarmed. In light of all these findings, some suggestions are made.

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### Introduction

Due to population increases and technological developments, people are not satisfied with meeting their basic needs and try to fulfill their unlimited demands by utilizing limited resources. Depending on the rapid population increase, the need for food increases and in order to meet the increasing needs, fertile agricultural areas are destroyed for the sake of urbanization, and the problem of unplanned urbanization in cities with migration to cities accelerates the process of deterioration of the natural balance (Akgün et al., 2017). Due to the rapid increase in migration from rural areas to urban centers, industrialization, unconscious consumption of the Earth's resources, rapid destruction of the natural environment, and the preference for fossil fuels in energy production, the ecological balance of the world is deteriorating leading to a rapid increase in environmental problems. Eventually, these environmental problems have become problems that pose a serious threat to the lives of human beings. One of these environmental problems is

global warming (Aksan & Çelikler, 2013; Darçın, Bozkurt & Hamalosmanoğlu, 2006; Djurayeva et al., 2023).

The most important natural factor that shapes the climate is the greenhouse effect. The greenhouse effect is the accumulation of greenhouse gas emissions in the atmosphere. It is also defined as the heating and insulating effect of the atmosphere. Greenhouse gases keep the temperature of water in balance due to their ability to retain heat, preventing the water in rivers and oceans from freezing. However, with increasing industrialization in recent years, there has been an increase in air pollution and the amount of carbon dioxide (CO<sub>2</sub>(g)) in the atmosphere is rising. In addition to increasing carbon dioxide, human activities also increase the amount of greenhouse gases such as methane (CH<sub>4</sub>(g)), ozone (O<sub>3</sub>(g)), and chlorofluorocarbons (CFC(g)). Since greenhouse gases have the ability to retain heat, this increase leads to an increase in temperature and causes global warming. If global warming,

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which poses a threat to the world, cannot be prevented, there will be irreparable consequences in the future.

Recent scientific research has revealed the irreversible effects of global warming. The increase in sea level due to melting of glaciers and warming of ocean waters, frequent and increasing severity of natural disasters, decrease in agricultural production due to abnormal climatic conditions and the threat of extinction of plant and animal species due to factors such as the above are among the disastrous consequences of global warming (Venkataramanan & Smitha, 2011). Furthermore, global warming causes various environmental problems such as water scarcity, desertification, drought, storms, floods and forced migration. As a result of global warming, there will be an imbalance in climate changes and as a result, various health problems will occur. In particular, changes in the ecosystem will cause an increase in various diseases. The scarcity of water resources will cause the spread of infectious diseases such as cholera, typhoid, etc. (Öncül, 2010). In particular, forced migrations cause epidemics to gain a global dimension and turn into pandemics affecting the world (Intergovernmental Panel on Climate Change (IPCC), 2007). In today's world, where transportation conditions between countries have become easier, global epidemics are also increasing rapidly. Since 2019, the coronavirus pandemic that has affected the whole world can be considered as the most striking example of this.

Although it is not possible to end global warming, international cooperation is crucial to slow it down and mitigate its effects. However, the efforts spent from the past to the present have not been able to bring solutions that correspond to the dimensions of the problem due to the interests in international politics and the sanctions imposed by the precautionary measures. Considering the current state of global warming, individuals should also contribute to the measures to be taken by acknowledging their responsibilities (Sever, 2013). Individuals will not reduce their quality of life by taking small measures in areas such as energy consumption, the use of natural resources, and recycling of waste, but they will take big steps to reduce the effects of global warming. In order to promote these positive

behaviors and attitudes towards protecting the environment, individuals need to be provided with effective environmental education (Aksan & Çelikler, 2015). However, environmental education is not only about informing students about basic ecological concepts or environmental pollution. Environmental education is essentially an education of sensitivity. To be sensitive is to take ownership, to think and to produce solutions. The most effective way to prevent environmental problems is to raise conscious and sensitive individuals, and for this purpose, it is necessary to provide education that will lead to changes in the behavior of individuals (Uzun & Sağlam, 2006).

In previous studies conducted to determine the global warming awareness of students at different levels, it was determined that there was conceptual confusion, the greenhouse effect and global warming were not sufficiently understood, and they did not have sufficient knowledge about the effects of global warming and what to do to prevent it (Durkaya & Durkaya, 2018). Due to the lack of education on global warming and the fact that it is an abstract concept, environmental education becomes more important. In solving environmental problems, social awareness is created by people gaining positive environmental awareness and attitudes, and thus solutions to environmental problems can be produced. Providing environmental education to children at an early age, which ensures the formation and development of environmental awareness, is a critical period for them to develop concern, interest, awareness, and knowledge about the natural world (Aksan, 2011). In fact, the earlier we can raise awareness on this issue, the earlier we can reap the fruits of the feedback we will receive. Understanding how global warming is perceived by children is important for educational scientists in particular and all social scientists in general. In addition, trying to understand the perceptions, knowledge levels and attitudes of the youth through their eyes is also important for developing policies to prevent global warming. However, it has been found in the literature that studies on global warming are more common in higher education, while there are not many studies at high school and secondary school level.

Based on the fact that global warming cannot be prevented without raising children who have the right knowledge about its causes, possible effects, the activities carried out and our individual duties and responsibilities, the aim of this study was to reveal the views of secondary school students on global warming. In accordance with the aim of the study, answers to the following questions were sought:

1. What do you think causes global warming?
2. What are the effects of global warming?
3. Are you concerned about global warming?
4. What measures can be taken to prevent global warming?

## Method

### Research design

In the study, case study pattern, one of the qualitative research methods, was used. Case study; It is expressed as a method in which a single situation or event is examined in depth longitudinally, data is collected systematically and what is happening in the real environment

is examined. The results obtained reveal why the event occurred that way and what should be focused on in future studies (Davey, 2009). For this reason, this method was chosen in order to ensure that students express their ideas about the concept of global warming in detail in the direction they want.

### Study group

The participants of the study were determined using the convenience sampling method from 9 public schools in the center of Muş Province in the first semester of the 2021–2022 academic year. In the convenience sampling, a situation that is close and easy to access was used (Yıldırım & Şimşek, 2013) and secondary school students were included in the study on a voluntary basis. The study group consisted of 33 students from the 5th, 6th, 7th, and 8th grades. The reason why the study group was selected from students in these grades was that environmental issues are included in the curriculum of social studies and science courses starting in the 5th grade.

Demographic information of the students participating in the study is presented in Table 1 below.

**Table 1.**

Demographic information of the study group

	Grade				Total
Gender	5th grade	6th grade	7th grade	8th grade	
Female	2	3	7	4	16
Male	5	5	4	3	17
Total	7	8	11	7	33

Among the secondary school students, 7 were in the 5th grade (2F, 5M), 8 were in the 6th grade (3F, 5M), 11 were in the 7th grade (7F, 4M), and 7 were in the 8th grade (4F, 3M). A total of 33 secondary school students participated in the study.

### Data collection tool

Data for the study were obtained through semi-structured interviews. The main purpose of the interview was to enable the interviewee to express their feelings, thoughts and experiences related to the subject being studied (Merriam, 2009). Therefore, the data of this phenomenological study, which aimed to reveal the views of secondary school students on

global warming, were obtained through semi-structured interviews. In this regard, a semi-structured interview form was used. In semi-structured interviews, an interview form is prepared that includes questions created by considering the scope of the study. In addition, the researcher can influence the course of the interview by employing side or sub-questions according to the course of the interview and enable the interviewee to elaborate their statements (Merriam, 2009).

For the semi-structured interview form used in the study, a conceptual framework was developed by the researcher following a literature review. In the developed conceptual

framework, the causes of global warming, its effects, concerns, and the precautions that can be taken to prevent it were included. The draft of the structured interview form was prepared within this framework. The form was submitted for the opinions of 2 academics, 1 natural sciences teacher, and 1 Turkish language teacher, who are experts in their fields. After the reviews, some questions were removed in line with the suggestions of the experts, some questions were edited, and the deficiencies were eliminated and the final version of the interview form consisting of 4 question items was created. Ethical approval was obtained for the finalized interview form.

### ***Data collection***

All of the students in the study group were informed about the study before the interviews and their voluntary participation was taken into consideration. A sample of the interview form was given to the participants before the interviews were conducted in a quiet environment. Each of the interviews with the 33 students lasted approximately 20–25 min. The interviews conducted in 9 easily accessible secondary schools in the provincial center lasted 4 weeks in total. Permission was obtained from all of the participants for audio recording. During the interviews, the participants' confirmation was provided after each question was answered. In the last part of the interview, each participant was asked to confirm their answers to the questions again and the interviews were finalized. The audio recordings of the interviews were then transcribed on computer.

### ***Data analysis***

After the audio recordings of the interviews were transcribed on computer, the MAXQDA and content analysis methods were used to evaluate the data. Content analysis was preferred because of the in-depth analysis of the answers given by the participants to the questions in the interviews and especially the search for answers to the question “Why?” (Yıldırım & Şimşek, 2013). Content analysis is a qualitative data analysis method in which the data are systematically summarized by creating codes under the themes and categories determined from the qualitative data obtained, and it is aimed to reach conclusions by analyzing and interpreting in depth (Yıldırım & Şimşek, 2013). Themes and categories were

created by content analysis from the data obtained from the interviews conducted within the scope of this study, and codes were created under these themes. The frequency table of the codes was created, and it was attempted to analyze the participants' views on the determined themes. The opinions of 2 academics, 1 natural sciences teacher, and 1 Turkish language teacher, who are experts in their fields, were taken about the themes, categories and codes created, and no changes were needed to be made in line with these opinions. Figure 1 presents the themes, categories, and codes obtained.

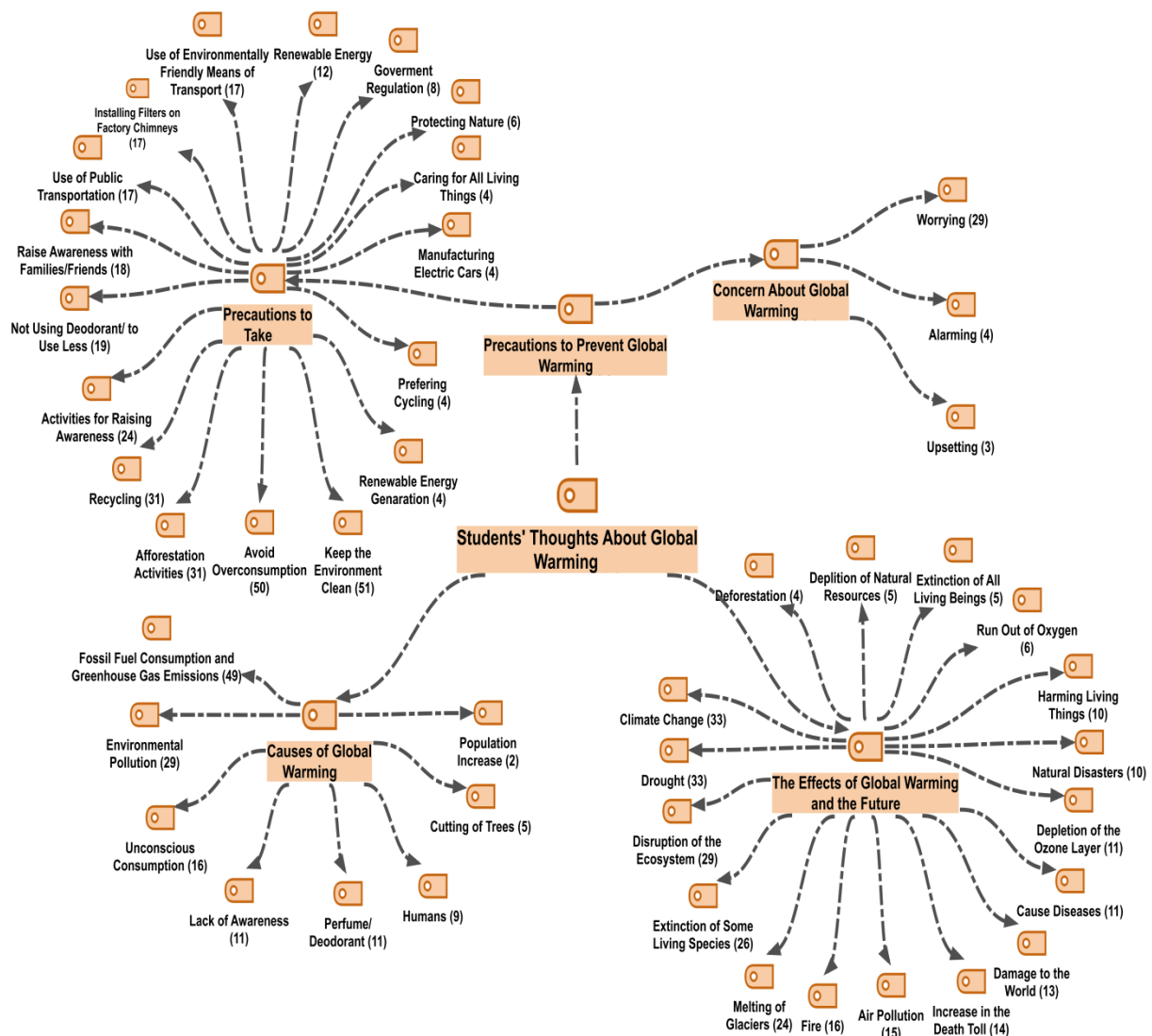
### ***Credibility and reliability***

While developing the data collection tool in the study, the opinions of 2 academics, 1 natural sciences teacher, and 1 Turkish language teacher, who are experts in their fields, were requested. Necessary changes were made according to the feedback obtained from the expert opinions. Students were given sufficient time during the data collection phase. After the data were collected, the same students were re-interviewed for the answers that did not serve the purpose. Participants who did not feel ready for the interviews were re-interviewed at a time they deemed appropriate. All of the interviews were audio recorded to ensure data consistency. All of the audio recordings were transcribed to a Word document. The data were first coded by the researcher, and then the themes and codes were reviewed twice at 2 different time periods (November & February 2022). After all of these procedures, the codes and themes were submitted to the expert opinion of 2 academics, who are experts in their fields. The real names of the students were not used, instead coding was done with letters and numbers (S1, S2, ..., S33).

### ***Findings***

Participants' opinions on global warming are categorized under Students' Thoughts About Global Warming. Information on the categories, codes, and code frequencies of the Students' Thoughts About the Global Warming theme is presented in Figure 1.

**Figure 1.**  
Hierarchical code sub-code representation of the theme of students' thoughts about global warming



**Causes of Global Warming**

Participants' statements about the causes of global warming are coded under the causes of global warming category. In the causes of global warming category, the code Fossil Fuel Consumption and Greenhouse Gas Emissions is the code in which the participants made the most statements. Participants stated that the causes of global warming are fossil fuels and the greenhouse gas effect. Participant statements related to the subject are as below:

*“Environmental damage caused by fossil fuels, the impact of greenhouse gases” (S2-Male-5)*

*“Mostly because of us humans. If we were a bit more frugal and could manage*

*our environment if we could conserve if we didn't waste electricity, if we planted saplings and watered them, or It wouldn't be like this if we could stop the fumes from car exhausts. Mostly so it's from us.” (S13-Female-5)*

*“Global warming is caused by the poisons of garbage that people unconsciously leave in nature, fossil fuels, unfiltered chimneys, and then greenhouse gases from perfumes, deodorants and their pollution of nature are gradually warming the world. So when there is water scarcity, food scarcity is yes.” (S22-Female-8)*

Another code in the causes of global warming category in which participants made statements is the code Environmental Pollution. Participants stated that global warming occurs due to environmental pollution. Participant statements related to the subject are as below:

*“Polluting the world and using and wasting natural resources unconsciously, air pollution comes to mind.” (S31-Female-7)*

*“Global warming damages nature due to the warming of the weather, that is, when families go on a picnic, they harm nature without extinguishing the picnic fire they make. In other words, when they go, they extinguish the fire from the soil around them, that is, they take sand with them or take something else, they cover the fire, they take the garbage they throw and do not harm nature, and when the sun hits, the items they leave in nature damage nature. Yes, sir, it does. When the sun hits, global warming increases, so I don't know much about the temperature.” (S23-Male-5)*

*“Discarded garbage is what destroys the earth's atmosphere, which is formed by car exhausts, mostly carbon dioxide and carbon monoxide gases.” (S19-Male-7)*

Another code in the causes of global warming category in which participants made statements is the code Unconscious Consumption. Participants stated that unnecessary consumption causes global warming. Participant statements related to the subject are as below:

*“People waste energy resources such as exhaust gases, waste electricity, use unnatural sprays and pollute the environment, so many animals die and environmental pollution and global warming begin.” (S3-Male-7)*

*“Well, they use more than enough, like more... Uh, the smoke from the factories... Uh, nature suffers because they don't put filters on it and pollute the air. They don't save water, so our lakes run out more. They cut down trees, so we have less oxygen.” (S12-Male-7)*

*“I don't know much about it. When I think of global, I think of the earth, I think of warming, I think of using too much electricity, but I don't have any idea about that.” (S28-Female-7)*

Another code in the causes of global warming category in which participants made statements is the code perfume/deodorant. Participants stated that perfume/deodorant causes global warming. Participant statements related to the subject are as below:

*“People using personal vehicles rather than public transportation, wasting electricity in vain, and then constantly using things that harm the environment such as perfume.” (S5-Female-8)*

*“Especially the use of perfume and car exhausts, there are too many cars, everyone uses their car instead of using public transportation, which I think is a bad thing.” (S30-Male-8)*

*“Deodorants, for example, for example, people usually use a lot of deodorants. So the long layer might be thinning.” (S17-Female-7)*

Another code in the causes of global warming category in which participants made statements is the code Lack of Awareness. Participants stated that the cause of global warming is a lack of awareness. Participant statements related to the subject are as below:

*“Because nobody cares, they don't know what will happen in the future. For example, garbage, if they throw the garbage in the recycling bins instead of throwing it directly, in the future. For example, let's say when we throw a bag, that bag stays there for a century, you don't know what kind of damage that bag will cause in the future.” (S9-Female-6)*

*“People waste things that they don't need themselves.” (S12-Male-7)*

*“Teacher, people unconsciously spray fuel-spray. The greenhouse effect. Exhaust gases from cars enter the Earth and cause glaciers to melt. It causes*

*climate change. It causes drought.”*  
(S24-Female-5)

Another code in the causes of global warming category in which participants made statements is the code, Humans. Participants stated that the cause of global warming is humans. Participant statements related to the subject are as below:

*“Because of people”* (S3-Male-7)

*“It is mostly caused by humans because forest fires are caused by garbage and living things.”* (S8-Male-5)

*“Because of the people. They cut down our forests, our trees. We have less oxygen. And they build too many factories by the sea. They pollute the seas. There is air pollution because they don't install filters on their chimneys. Everyone has their cars, they don't prefer public transportation.”* (S15-Male-8)

Another code in the causes of global warming category in which participants made statements is the code Cutting of Trees. Participants stated that the cause of global warming is the cutting of trees. Participant statements related to the subject are as below:

*“Well, they use more than enough, like more... Uh, the smoke from the factories... Uh, nature suffers because they don't put filters on it and pollute the air. They don't save water, so our lakes run out more. They cut down trees, so we have less oxygen.”* (S12-Male-7)

*“There are many concepts that come to my mind when I think of global warming. I think of many concepts such as cutting down trees, dumping waste into the environment, wasting electricity, the greenhouse effect.”* (S13-Female-5)

*“Trees are being cut down and oxygen is decreasing”* (S31-Female-7)

Another code in the causes of global warming category in which participants made statements is the code Population Increase. Participants stated that the cause of global warming is population increase. Participant statements related to the subject are as below:

*“If the population increases, the current energies will increase even more, which will cause more global warming, which is even worse..”* (S3-Male-7)

*“I mean, this may vary from environment to environment, for example, since Ankara is a metropolitan city, car use is more and more air is polluted. In other words, since it is more metropolitan, factories, car exhausts, and chimneys pollute the environment more, more carbon dioxide gas is given to the air.”* (S32-Male-5)

The density matrix of the Causes of Global Warming category codes according to the participants is given in Figure 2. Accordingly, participants coded s1, s3, s21, s29, and s31 made intense expressions for code unconscious consumption. Participants coded s2, s3, s4, s5, s6, s14, s19, s21, s22, s24, s30, s32, s33 made intense expressions for code Fossil Fuel Consumption and Greenhouse Gas Emissions. Participants coded s24, and s30 made intense expressions for code perfume/deodorant. Participants coded s2, s4, s9, s15, s16, s19, s21, s23, s26, s31 made intense expressions for code environmental pollution. Participants coded s31 made intense expressions for code cutting of trees. Participants coded s8 made intense expressions for code humans. Participants coded s9, s23, and s24 made intense expressions for code lack of awareness.

**Figure 2.**  
Code Matrix Presentation of Category Causes of Global Warming

Code System	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	SUM
Students' Thoughts About Global Warming																																		0
Causes of Global Warming																																		0
Fossil Fuel Consumption and Greenhouse Gas Emissions	1	3	3	4	2	3	1	1	1	1	1	1	2	1	1	1	2	1	3	2	2	1	1	1	1	1	1	1	3	1	2	2	49	
Environmental Pollution	2	1	3					2	1	1	1	1	1	2	2		2		2	1	2			1	2						3		29	
Unconscious Consumption	2		3		1						1									1	2						1	2			3		16	
Perfume/Deodorant					1												1	1			1	1	1	3						2		11		
Lack of Awareness									3			1					1		1			1	2	2								11		
Humans			1		1	1		2				1			1						1							1				9		
Cutting of Trees												1	1																	3		5		
Population Increase				1																											1	2		
<b>Σ SUM</b>	3	5	9	7	5	4	1	3	5	2	2	5	3	3	4	3	2	3	4	2	9	5	5	7	2	3	1	2	3	5	10	3	2	132

### Effects of Global Warming and the Future

Participants' statements about the effects of global warming are coded under the effects of global warming and the future category. In the global warming and the future category, the code drought is the code in which the participants made the most statements. Participants stated that the effects of global warming will be drought. Participant statements related to the subject are as below:

*“It will cause health problems in the future, people's skin will be irritated because of drought, it will be a desert, some people will die because of drought in the desert.” (S1-Male-8)*

*“There is little rain in Eastern Anatolia, for example, and then the snow is not as abundant as it used to be. Our fruits rot immediately. There are many reasons. Our animals start to die, they start to get sick. People also seem to have more diseases. There are many reasons I see now. Desertification is happening all over the world and drought has started now.” (S11-Female-8)*

*“Not a lot, but we see it. For example, in countries like Africa, the water dries up because it is too hot, and the people there drink dirty water as the animals' drink. There is no effect of global warming that I see in my close environment.” (S16-Male-6)*

Another code in which participants made statements about the effects of global warming is code climate change. Participants stated that global warming would lead to climate change. Participant statements related to the subject are as below:

*“Yes, I do. I see things like changes in seasons, climate change, forest fires, increase in natural disasters. For example, longer winters, shorter summers, or no/very little fall and spring are the effects of global warming.” (S14-Female-7)*

*“I usually think of the ozone layers. Concepts like ozone depletion and climate change.” (S17-Female-7)*

*“Now the water is evaporating more, the poles are melting and we are warmer in the summer. In winter it is colder.” (S19-Male-7)*

Another code in which participants made statements about the effects of global warming is the code Disruption of the Ecosystem. Participants stated that global warming would lead to disruption of the ecosystem. Participant statements related to the subject are as below:

*“No, but we are consuming some animals and because we can't consume them, some people will starve. The ecosystem will be disrupted.” (S1-Male-8)*

*“Animals become extinct, the ecosystem is disrupted, the food chain is disrupted.” (S30-Male-8)*

*“Reduction of habitats” (S18-Female-7)*

Another code in which participants made statements about the effects of global warming is the code Extinction of Some Living Species. Participants stated that global warming would lead to the Extinction of Some Living Species. Participant statements related to the subject are as below:



*“There are no animals that live in glaciers, they live in glaciers, and as the temperature on earth increases, the glaciers begin to melt, and as the glaciers begin to melt, their habitats disappear and they disappear.” (S5-Female-8)*

*“Fish in the first place because people are polluting the seas, so fish and their homes like birds in the forest are disappearing.” (S8-Male-5)*

*“I think there will be more forest fires in the future, there will be no ozone layer, human and animal life will be very short and there will be no habitats left.” (S14-Female-7)*

Another code in which participants made statements about the effects of global warming is the code Melting of Glaciers. Participants stated that global warming would lead to the Melting of Glaciers. Participant statements related to the subject are as below:

*“Climate change is like this, that is, it gets too hot. After that, we can give an example of the poles, for example, in the poles, for example, the life of polar bears is endangered because the lambs melt.” (S31-Female-7)*

*“When we talk about global warming, the first thing that comes to mind is the environment, air pollution, and melting ice,” (S25-Male-6)*

*“The destruction of our world, the melting of our glaciers, the extinction of animals” (S15-Male-8)*

Another code in which participants made statements about the effects of global warming is code fire. Participants stated that global warming would lead to a fire. Participant statements related to the subject are as below:

*“Forest fires.” (S8-Male-5)*

*“Forest fires, smoke from the chimneys of schools are examples of these.” (S10-Male-5)*

*“Yes, I do. I see things like changes in seasons, climate change, forest fires,*

*increase in natural disasters. For example, longer winters, shorter summers, or no/very little fall and spring are the effects of global warming.” (S14-Female-7)*

Another code in which participants made statements about the effects of global warming is code air pollution. Participants stated that global warming would lead to air pollution. Participant statements related to the subject are as below:

*“It pollutes the air” (S4-Male-6)*

*“For example, the floors are very dirty. Then the air sometimes smells too smoky to breathe. There are a lot of people throwing garbage on the ground.” (S9-Female-6)*

*“I haven't thought about it right now. But bad things can happen. How can I put it like this, we can hardly breathe because of air pollution, breathing difficulties may occur?” (S20-Male-7)*

Another code in which participants made statements about the effects of global warming is code increase in the death toll. Participants stated that global warming would lead to an increase in the death toll. Participant statements related to the subject are as below:

*“The harmful effects of the sun's rays come to us and the number of deaths increases.” (S2-Male-5)*

*“The glaciers could melt and the animals living there could become extinct. They cut down a lot of trees, we may not have oxygen. People's lives are in danger. For example, the glaciers are melting and animals can't live there. When the glaciers melt, the water rises and there is no clean water in those waters. That is harmful to people.” (S15-Male-8)*

*“As I said, global warming is a lot, hodja, the negative effects of people in a hurry. I am very worried, yes, hodja. Soon people may have no place to live. How else can we say global warming? People's water resources may run out. Yes, yes, hodja, when trees are destroyed*

*due to forest fires, you know that most of the oxygen comes from trees. When trees disappear and oxygen decreases, people may be more likely to lose their lives.” (S21-Female-6)*

Another code in which participants made statements about the effects of global warming is code damage to the world. Participants stated that global warming would lead to damage to the world. Participant statements related to the subject are as below:

*“Environmental damage caused by fossil fuels, the impact of greenhouse gases” (S2-Male-5)*

*“It comes to notions of melting ice or degradation of the earth. Or the disappearance of trees, the loss of greenery.” (S11-Female-8)*

*“For me, global warming is the destruction of water, the warming of the world threatens the world and the destruction of the world.” (S22-Female-8)*

Another code in which participants made statements about the effects of global warming is the code Depletion of the Ozone Layer. Participants stated that global warming would lead to the depletion of the ozone layer. Participant statements related to the subject are as below:

*“He explains that garbage, gases, carbon dioxide and carbon monoxide gas damage the earth's atmosphere and that the sun's rays harm us more.” (S19-Male-7)*

*“Evaporation of water, piercing the atmosphere” (S27-Male-6)*

*“I think there will be more forest fires in the future, there will be no ozone layer, human and animal life will be very short and there will be no habitats left.” (S14-Female-7)*

Another code in which participants made statements about the effects of global warming is code Cause Diseases. Participants stated that global warming would lead to diseases.

Participant statements related to the subject are as below:

*“The balance of the world is disturbed and people develop diseases such as asthma.” (S5-Female-8)*

*“There is little rain in Eastern Anatolia, for example, and then the snow is not as abundant as it used to be. Our fruits rot immediately. There are many reasons. Our animals start to die, they start to get sick. People also seem to have more diseases. There are many reasons I see now. Desertification is happening all over the world and drought has started now.” (S11-Female-8)*

*“It worries me, people have asthma, people can be affected badly by carbon dioxide emissions, especially I think. After all, both green space will decrease and carbon dioxide emissions will increase, so people will be negatively affected.” (S30-Male-8)*

Another code in which participants made statements about the effects of global warming is the code Natural Disasters. Participants stated that global warming would lead to natural disasters. Participant statements related to the subject are as below:

*“Forest fires, floods, droughts, rising sea levels” (S8-Male-5)*

*“Forest fires and natural disasters occur after the destruction of the ozone layer due to the fumes coming out of the goods, materials and recyclable goods made by people, from car exhausts, from the factories they build.” (S14-Female-7)*

*“Well, in my city it's not very common, but in our country it is. So we come across them. For example, the increase in natural disasters, for example, climate changes such as earthquakes. Apart from that, there may be different natural disasters. These may increase.” (S17-Female-7)*

Another code in which participants made statements about the effects of global warming is the code Harming Living Things. Participants

stated that global warming would lead to harming living things. Participant statements related to the subject are as below:

*“Everything, everyone, because there was an ozone layer that reflected harmful rays, and the ozone layer will be pierced and it will cause such damage.” (S1-Male-8)*

*“Threats to human and animal life, shortening of human and animal life and forest fires.” (S14-Female-7)*

*“For me, global warming means evil in the world, it means evil for us, for the world, for living beings.” (S33-Female-6)*

Another code in which participants made statements about the effects of global warming is code run out of oxygen. Participants stated that global warming would lead to running out of oxygen. Participant statements related to the subject are as below:

*“My teacher may be concerned about the loss of land, extinction of animal generations, and a gradual decrease in the oxygen content.” (S18-Female-7)*

*“If the trees disappear, yes, if the trees disappear, yes, if the oxygen decreases, people start to die. Because people need oxygen. If people cannot get oxygen, they may lose their lives.” (S21-Female-6)*

*“There is enough oxygen in the Earth's atmosphere for most people to breathe. But if global warming continues like this, we will run out of oxygen and we will run out of breath.” (S33-Female-6)*

Another code in which participants made statements about the effects of global warming is code extinction of all living beings. Participants stated that global warming would lead to the extinction of all living beings. Participant statements related to the subject are as below:

*“Global warming could soon cause famine, drought so bad that people will have no place to live. In several countries, in short, it could destroy our*

*world in the future. If people behave efficiently, as I said, it may not be destroyed. Its future effects could destroy our world.” (S21-Female-6)*

*“Teacher, I think bad things will happen. For example, my teacher is much more like this. If they don't do anything, if they are insensitive to this issue, our world may disappear soon. So we should not be unconscious of this. People should not remain unconscious.” (S24-Female-5)*

*“In other words, when both the air is polluted and water is wasted too much, the water may not be enough for future people and the lives of future people and living creatures may be in danger, that is, they may be left without water.” (S31-Female-7)*

Another code in which participants made statements about the effects of global warming is code depletion of natural resources. Participants stated that global warming would lead to the depletion of natural resources. Participant statements related to the subject are as below:

*“I think there will not be much electricity in the future because we use too much now. I think that trees will be cut down and there will be infertile soils. I think that people will not be able to consume the things they consume now. Nowadays, everyone behaves very unconsciously. Whether it is against the soil, against nature, or living things, they all act in an imprudent way. They act as if the world is not ending, as if it is not running out. That's why I think like this” (S13-Female-5)*

*“Yes, we are. We worry that our world is disappearing. We may not have clean water in the future. They're already destroying our forests. We may have climate change.” (S15-Male-8)*

*“I have this concern. As I just said, for example, there could be a drought. There could be a decrease in the water ratio of the country. For example, they know that they cannot produce energy because they*

*use water from dams. Things like this can happen.” (S17-Female-7)*

Another code in which participants made statements about the effects of global warming is code deforestation. Participants stated that global warming would lead to deforestation. Participant statements related to the subject are as below:

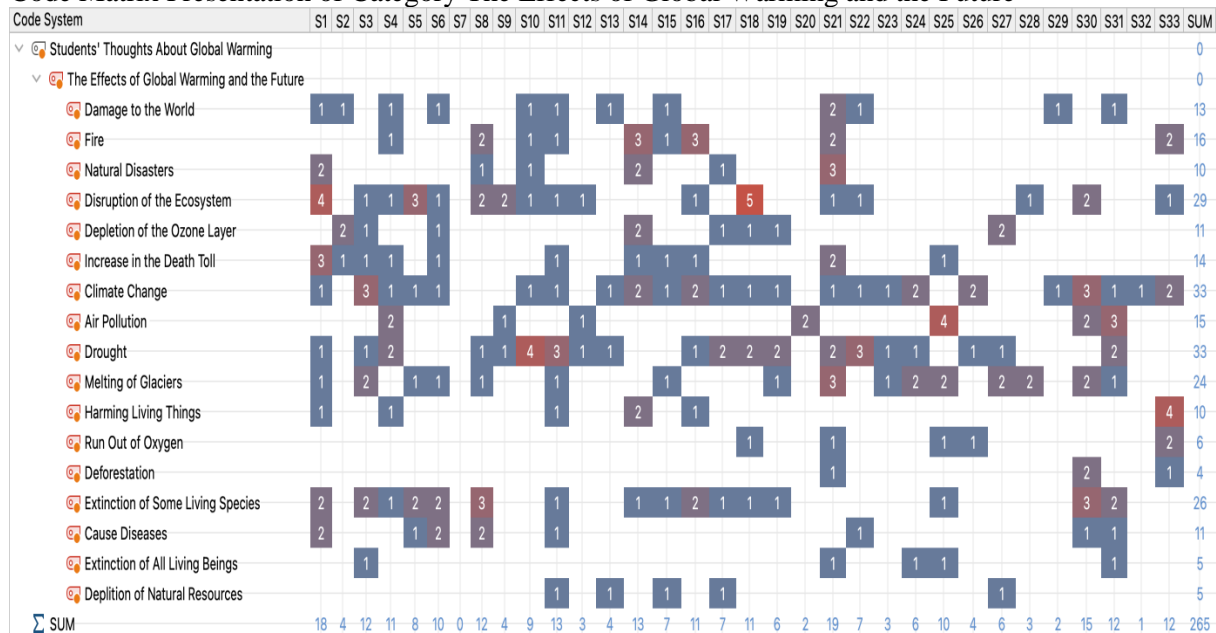
*“If the trees disappear, yes, if the trees disappear, yes, if the oxygen decreases, people start to die. Because people need oxygen. If people cannot get oxygen, they may lose their lives.” (S21-Female-6)*

*“The decrease in green space will increase carbon dioxide emissions, climate change being at the forefront. I see this in the future.” (S30-Male-8)*

*“There is enough oxygen in the Earth's atmosphere for most people to breathe. But if global warming continues like this, we will run out of oxygen and we will run out of breath.” (S33-Female-6)*

The density matrix of the effects of global warming and the future category codes according to the participants is given in Figure 3. Accordingly, participants coded s14, and s16 made intense expressions for code fire. Participants coded s21 made intense expressions for code natural disasters. Participants coded s1, S5, and S18 made intense expressions for code disruption of the ecosystem. Participants coded s1 made intense expressions for code increase in the death toll. Participants coded s3, and s30 made intense expressions for code climate change. Participants coded s25, and s31 made intense expressions for code air pollution. Participants coded s10, s11, and s22 made intense expressions for drought. Participants coded s21 made intense expressions for code melting of glaciers. Participants coded s33 made intense expressions for code harming living things. Participants coded s8, and s30 made intense expressions for code extinction of some living species.

**Figure 3.**  
Code Matrix Presentation of Category The Effects of Global Warming and the Future



**Precautions to Prevent Global Warming**

Participants' concerns about global warming and their suggestions for prevention are coded under the category precautions to prevent global

warming. Two sub-categories are formed under this category.

**Concern About Global Warming**

Participants' concerns about global warming are coded under this subcategory. The code worrying is the code in which the participants made the most statements. Participant statements related to the subject are as below:

*"It worries me because one of my favorite animals is polar bears, which are now extinct. I'm very worried about polar bears. And that's because of global warming."* (S3-Male-7)

*"How much global warming worries me, worries our village because the further we go, the worse global warming gets. Uh... we have to prevent it."* (S12-Male-7)

*"I have this concern. As I just said, for example, there could be a drought. There could be a decrease in the water ratio of the country. For example, they know that they cannot produce energy because they use water from dams. Things like this can happen."* (S17-Female-7)

Another code that participants made statements in the category is code alarming. Participant statements related to the subject are as below:

*"Yes, teacher, the world will come out of the world and the world will become uninhabitable."* (S8-Male-5)

*"It worries me. Because even if we live a long life, it won't be long. There are forest fires because humans and animals will be harmed, and they will have no living space. Seasonal change, climate change, even food may not grow anymore, there may be price hikes, people may go hungry because there will be price hikes when there is no food."* (S14-Female-7)

*"Yes, it is worrying. In the future it will be impossible to find water, and that could be a danger for the human future."* (S19-Male-7)

Another code that participants made statements in the category is code upsetting. Participant statements related to the subject are as below:

*"Yes, teacher, it worries me. For example, the death of animals makes me unhappy. Like that, teacher. Teacher, we feel very bad things."* (S4-Male-6)

*"For me, global warming is the rise of global warming because of the rise of global warming, the global warming of the penguins in the poles, that is, the polar bears that live in the polar ice of many things that live in the poles, global warming is global warming when the weather gets warmer. When it melts, the death of those animals makes me very sad."* (S23-Male-5)

### **Precautions to Take**

The statements of the participants about preventing global warming are coded under this subcategory. In the precaution to take a category, the code Keep the Environment Clean is the code in which the participants made the most statements. Participants stated that it is necessary to keep the environment clean to prevent global warming. Participant statements related to the subject are as below:

*"It needs to reduce water pollution. Chimneys and factory chimneys need to be filtered. Teacher, he should also not throw garbage into nature."* (S4-Male-6)

*"warning people not to litter, warning people not to cut down forests, protecting people in forests, cleaning the seas, using clean things instead of factory fumes"* (S8-Male-5)

*"We can keep the environment clean, for example, we can collect garbage once a week. Let's say we couldn't collect it, but we can also raise awareness of the people at home, to install filters so that they don't throw garbage on the floor at home. After that, we can raise their awareness to save money."* (S9-Female-6)

Another code in the precaution to take a category in which participants made statements is the avoid overconsumption code. Participants stated that excessive consumption should be avoided. Participant statements related to the subject are as below:

*“There are more global vehicles, not public transportation, I use public transportation, I don't waste electricity, I don't use things that harm the environment like perfume.” (S5-Female-8)*

*“When we go to the restroom at school, we can turn off the lights when we are done, or they leave the faucets open, we can turn them off, for example, the smart board is sometimes left on for no reason, it consumes electricity, we can turn it off, we can turn off the board by unplugging it... I mean like this.” (S31-Female-8)*

*“They can take precautions, like not turning on the lights too much. The environment... They should not turn on the lights. They should reduce the use of cars in close quarters. They should throw their garbage in a trash can, not in the neighborhood. How else can I put it... That's it.” (S25-Male-6)*

Another code in the precaution to take a category in which participants made statements is the Recycling code. participants expressed the necessity of recycling to prevent global warming. Participant statements related to the subject are as below:

*“Yes, teacher, waste. Instead of throwing our garbage on the ground, we can throw it in bins, recycling.” (S26-Female-7)*

*“States use cars, not exhaust cars, but mostly electric cars. Keeping a regular rhythm in the light thing. If the light is on all the time in a house, I don't know how to say, that state should set a period and there should not be more than that amount of light used per day. And there is a ban on littering, which is now in effect in one or two countries. There should be a ban on littering. There should be more recycling bins, teachers. Thanks to this - how can I put it - global warming will decrease. Thanks to this, our glaciers will gradually multiply again and our world will return to its previous state.” (S25-Male-6)*

*“For example, paper is made of trees, and if we don't recycle the paper, more*

*trees will be cut down to produce that paper again.” (S18-Female-7)*

Another code in the precaution to take a category in which participants made statements is the Afforestation Activities code. Afforestation Activities. Participant statements related to the subject are as below:

*“What else can they do? Wind panels can be installed in places where the wind is excessive. The use of other sprays can be prohibited, garbage should not be done to pollute the environment, and there should be afforestation work, afforestation prevents global warming, and the more afforestation is done, the more global warming is reduced, but today's people cut down trees instead of afforesting. And the 10 trees cut down are only one of the 10 trees, 9 of them are all wasted. This hurts global warming.” (S3-Male-7)*

*“For example, a beautiful play can be screened to save people. In the future, let's say in the future, there could be a show where trees are cut down. They can ask the municipality to plant trees and distribute a sapling to every house.” (S9-Female-6)*

*“I try to take precautions as much as I can. If there are saplings planted in our school, I plan to participate. I prefer to recycle items such as batteries so that the soil does not become inefficient.” (S13-Female-5)*

Another code in the precaution to take a category in which participants made statements is the Activities for Raising Awareness code. Participants stated that awareness should be raised. Participant statements related to the subject are as below:

*“I think governments should warn people or install filters in factory chimneys. Instead of cars with exhaust gases, electric vehicles can produce much more recyclable goods. They can care about environmental cleanliness.” (S14-Female-7)*

*“For example, when they see an animation or a movie, they can tell their friends or relatives about the news they have heard or bad news, about the extinction of animals, as I just said. They can spread them and I think the state can do its best for this.” (S17-Female-7)*

*“If they don't use anything, people have social media all the time. He can publish a video from there. The effects of global warming, how precautions can be taken, and its damages can be explained to people shortly and concisely without boring them for awareness-raising purposes. He can then tell those around him. They can broadcast from groups. If nothing happens, they can tell those around them. Yes. He can also do it face-to-face. If nothing can be done, on social media. Yes, they can show exemplary behavior. I mean, they don't use deodorant, they don't use perfume, they don't use fossil fuels a lot. So it saves money. Does not pollute nature. Recycles garbage. It's exemplary behavior. To prevent global warming.” (S22-Female-8)*

Another code in the precaution to take a category in which participants made statements is the Not Using Deodorant/ to Use Less code. Participants stated that the use of perfume should be reduced to prevent global warming. Participant statements related to the subject are as below:

*“For example, not using too much perfume, I don't use it at all, for example, I turn off the lights until nine o'clock in the evening, I don't spend much, I planted a sapling and that's it.” (S7-Male-6)*

*“Some students use perfumes a lot. Especially girls use perfumes to beautify themselves. But they don't know what kind of global warming the gases in those perfumes cause. They can reduce global warming by using perfumes more efficiently. This is also true for men. As I said, if both girls and boys do some behaviors that reduce global warming, global warming will decrease and the poles will not melt and natural disasters will not occur. There will be no global warming because of fossil waste. These*

*and similar things will not happen.” (S21-Female-6)*

*“Then we might not use so much electricity when we do our homework and stuff. Then we might not use perfume when we come to school.” (S11-Female-8)*

Another code in the precaution to take a category in which participants made statements is the Raise Awareness with Families/Friends code. Participants stated that to prevent global warming, it is necessary to raise awareness of the immediate environment. Participant statements related to the subject are as below:

*“We should raise awareness of our family. We should raise awareness of people who consume unconsciously. We should prevent wasted electricity. We can participate in tree-planting campaigns. We can green our environment. We should warn those who throw garbage on the ground and pollute the environment in this way.” (S1-Male-8)*

*“We can keep the environment clean, for example, we can collect garbage once a week. Let's say we couldn't collect it, but we can also raise awareness of the people at home, to install filters so that they don't throw garbage on the floor at home. After that, we can raise their awareness to save money.” (S9-Female-6)*

*“As I said, again, everyone should start from their own family and environment. Videos, with the support of teachers, I mean everything, in fact, one of the only reasons for this, in my opinion, is that we use many things in a wasteful way or without environmental awareness, so they can learn about global warming. I think these things fall to us in our own lives, in our environment, it can also be to teach people through social media.” (S29-Female-8)*

Another code in the precaution to take a category in which participants made statements is the Installing Filters on Factory Chimneys code. Participants stated that filters should be installed in factory chimneys to prevent global

warming. Participant statements related to the subject are as below:

*“Ensuring that no factory that does not install filters is allowed to open can provide public transportation between cities.” (S5-Female-8)*

*“They should provide recycling bins and we should still ask for filters. Apart from that, they can put up signs everywhere so that we don't litter the ground. There could be demonstrations like that to make people aware, but apart from that, there are all kinds of things.” (S9-Female-6)*

*“What measures can the state take? Iuu... instead of cars, for example, instead of 3 cars, it can make public transportation. You know, this carbon dioxide, carbon dioxide from cars can be taken away. Public transportation. Then people need to plant trees. I think the state should tell people that. Or the state may need to plant them on its own. Too much stone is used in cities. They can make more green areas instead of stone. They can install filters on factory chimneys. These can happen with the measures the state can take” (S11-Female-8)*

Another code in the precaution to take a category in which participants made statements is the Use of Public Transportation code. Participants stated that public transportation should be used to prevent global warming. Participant statements related to the subject are as below:

*“We all need to take precautions together, not with one person, people can install filters in the factory chimney, they can use public transportation, they can use public transportation, they cannot waste electricity in vain, they do not leave their chargers in the socket for no reason.” (S5-Female-8)*

*“One of their own could be the use of public transportation or bicycles instead of personal cars and something that could reduce carbon dioxide emissions for example.” (S30-Male-8)*

*“I mean, I don't usually throw garbage on the ground, I suggest that people use public transportation. I explain to them that if you don't use them, there is a danger for our future.” (S19-Male-7)*

Another code in the precaution to take a category in which participants made statements is the Use of Environmentally Friendly Means of Transport code. Participants stated that the Use of Environmentally Friendly Means of Transports should be used to prevent global warming. Participant statements related to the subject are as below:

*“People should use public transportation instead of individual vehicles, they should use electric vehicles in the future, they can save more, they can recycle waste, they can plant saplings, there are many ideas.” (S7-Male-6)*

*“It can prevent global warming by not allowing hotels and settlements to be built in forested areas, or by teaching children about global warming in schools, by making advertisements about global warming, and by not taxing electric vehicles, as in other countries, but taxing vehicles that produce exhaust fumes more.” (S18-Female-7)*

*“I mean, people can use less gasoline vehicles. People can use electric vehicles.” (S32-Male-5)*

Another code in the precaution to take a category in which participants made statements is the Renewable Energy code. Participants stated that Use of Renewable Energy is used to prevent global warming. Participant statements related to the subject are as below:

*“People can take many measures but they do not take any measures. For example, cars can be switched from the exhaust cars we currently use to electric cars. Vehicles such as oil and coal that we currently use can be switched from those energies to renewable energy sources. Renewable energy sources are of course using renewable energy sources such as water, sun, electricity from water, wind energy.” (S3-Male-7)*



*“They can plant trees, they can raise awareness, they can drive electric cars, they can use electric cars instead of cars with exhaust so that they do not emit exhaust fumes. They can prevent it by using renewable energy sources.” (S18-Female-7)*

Another code in the precaution to take a category in which participants made statements is the Government Regulation code. Participants expressed that states should take preventive decisions to prevent global warming. Participant statements related to the subject are as below:

*“The state is more about making factories compulsory, making it compulsory to install filters, penalties for littering, recycling metals, making profits for other countries as well as their own.” (S10-Male-5)*

*“They can fine those who throw garbage on the ground. Those who have factories should be warned, they should install filters on their chimneys. Those who pollute the seas should be fined. The state needs to control.” (S15-Male-8)*

*“States should pass a new law and penalize those who throw their garbage on the ground or leave too many car exhausts. Otherwise, our future is in danger.” (S19-Male-7)*

Another code in the precaution to take a category in which participants made statements is the Renewable Energy Generation code. Participants stated that renewable energy should be produced to prevent global warming. Participant statements related to the subject are as below:

*“What else can they do? Wind panels can be installed in places where the wind is excessive. The use of other sprays can be prohibited, garbage should not be done to pollute the environment, and there should be afforestation work, afforestation prevents global warming, and the more afforestation is done, the more global warming is reduced, but today's people cut down trees instead of afforesting. And the 10 trees cut down are*

*only one of the 10 trees, 9 of them are all wasted. This hurts global warming.” (S3-Male-7)*

*“Governments can take such measures. For example, people could recycle things that can or cannot be recycled, instead of throwing them into nature... More recycling sites could be created and people could sort them. In this way, nature is not polluted. It is not poisoned. Because for example, when we throw medicine into nature, it poisons it. But when we recycle it, it is not poisoned. Because we use it again. No, it also creates air pollution. It pollutes the underground water sources, so yes. They can store energy, a lot of energy, so they can be recommended to save energy.” (S22-Female-8)*

Another code in the precaution to take a category in which participants made statements is the Caring for All Living Things code. Participants stated that all living things should be taken into consideration to prevent global warming. Participant statements related to the subject are as below:

*“I think we should think about many living beings and prevent them from dying, just as we don't want to die ourselves.” (S33-Female-6)*

Another code in the precaution to take a category in which participants made statements is the Manufacturing Electric Cars code. Participants stated that electric cars should be produced to prevent global warming. Participant statements related to the subject are as below:

*“For example, producing electric cars, installing filters in factory chimneys where the smoke comes out, building fewer houses, for example, not cutting down trees in nature.” (S31-Female-7)*

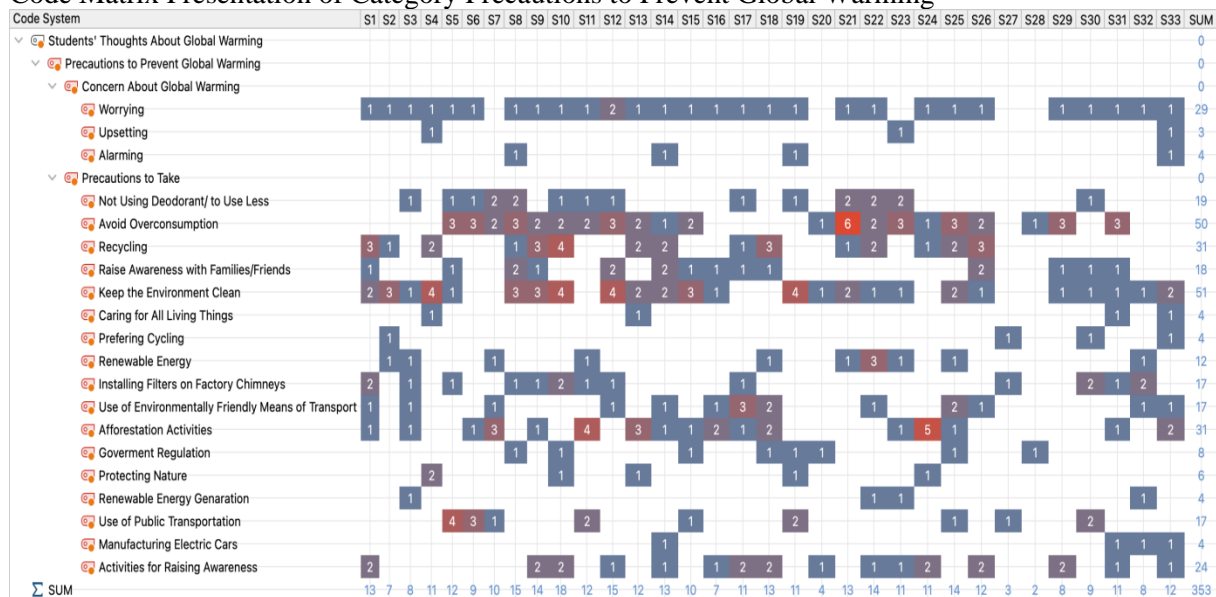
Another code in the precaution to take a category in which participants made statements is the preferring cycling code. Participants expressed the necessity of using bicycles to prevent global warming. Participant statements related to the subject are as below:

*“They can use bicycles instead of cars”*  
(S2-Male-5)

The density matrix of the precautions to prevent global warming category codes according to the participants is given in Figure 4. Accordingly, participants coded s4, s6, s8, s12, s21, s23, s25, s29, s31 made intense expressions for code avoid overconsumption. Participants coded s1, s9, s10, s18, and s26 made intense expressions

for code recycling. Participants coded s2, s4, s8, s9, s10, s12, s15, and s19, and made intense expressions for code to keep the environment clean. Participants coded s22 made intense expressions for code renewable energy. Participants coded s7, s11, s13, and s24 made intense expressions for code afforestation activities. Participants coded s5, and s6 made intense expressions for code use of public transportation.

**Figure 4.**  
Code Matrix Presentation of Category Precautions to Prevent Global Warming



The distribution of participant statements according to intensity is shown in Figure 5. Codes with larger font sizes indicate more intensively used statements, while

statements with smaller font sizes indicate less intensive use of the codes.

**Figure 5.**

Cod cloud





caused by humans. The fact that students consider the causes of global warming to be only human-induced can be evaluated as having incomplete knowledge about the causes of global warming and not knowing the natural causes of it. Özcan and Demirel (2019) stated in their study that secondary school students saw environmental problems, including global warming, as human-induced. The results of the studies conducted by Koca (2019), Mahanoğlu (2019) and Kılıçoğlu and Akkaya Yılmaz (2021) with secondary school students were in parallel with this study.

In the second category of the study, the participants were asked the question “What are the effects of global warming?” to determine the consequences of global warming. The participants considered the effects of global warming as climate change, drought, disruption of the ecosystem, extinction of some living species, melting of glaciers, fire, air pollution, increase in the death toll, damage to the world, cause diseases, depletion of the ozone layer, natural disasters, harming living things, run out of oxygen, extinction of all living beings, the depletion of natural resources and deforestation. It was observed that the participants were knowledgeable about the effects of global warming. As a matter of fact, they evaluated the effects of global warming in terms of many dimensions such as physical effects, effects on living things, and economic effects. When the studies in the literature were examined, a similar situation was observed. In these studies, the effects of global warming were identified as the melting of glaciers, seasonal changes, drought and desertification, extinction of living things, increase in heavy rainfall, flooding, sea level increase, and the emergence of new diseases (Ay & Yalçın Erik, 2020; Aydın, 2014; Ayvaci & Çoruhlu, 2009; Bozdoğan & Yanar, 2010; Eroğlu & Aydoğdu 2016; Kılıçoğlu & Akkaya Yılmaz, 2021; Koca, 2019).

In the third category of the study, the participants were asked the question “Are you concerned about global warming?” to determine the state of concern caused by global warming. It was determined that most of the students were worried about this issue, some of them were alarmed and some of them were upset. In a study conducted by Aksan and Çelikler (2013) to determine the views of prospective primary school teachers on global warming, it was found

that the participants stated that global warming would have very serious consequences and that their level of concern was high. Öncül (2010) found that the majority of 7th-grade students had concerns based on the idea that the consequences of global warming could pose a threat to their families and themselves. In a study conducted by Koca (2019) with 8th-grade students, it was concluded that the students were concerned about the future due to potential disasters that may occur as a result of global warming. In a study conducted by Emli (2014), the majority of students were concerned that the world would be a dangerous place (the world would be destroyed and face various disasters) due to the possible consequences of global warming. In another study conducted by Tuncer, Ertepinar, Tekkaya, and Sungur (2005) on 6th- and 10th-grade students, it was concluded that young people were concerned about the effects of environmental problems on nature. In Giddens’ (1990; 1991) studies, most of the students stated that their families and themselves were under threat due to the consequences of global warming and that they had concerns because of this. The results of the studies in the literature are in line with the results of this study. Students witness increasing environmental problems and disasters every day. Currently, the increasing technology and communication network reveals the disasters in any part of the world. The news they watched or read about environmental problems may have also caused their level of concern to increase. Possibly, the negative examples about the environment in the subjects taught in their courses also cause their level of concern to increase. However, the high level of concern of the students can be interpreted as that they are aware of environmental problems and care about future disasters. While this result causes students to draw a pessimistic world picture for the future, it can also be explained by their belief that global environmental problems can be solved.

In the fourth category of the study, the participants were asked the question “What measures can be taken to prevent global warming?” to determine the measures that can be taken against global warming. The participants made suggestions such as keep the environment clean, avoid overconsumption, afforestation activities, recycling, activities for raising awareness, not using deodorant/to use

less, raise awareness with families/friends, use of public transportation, installing filters on factory chimneys, use of environmentally friendly means of transport, renewable energy, government regulation, protecting nature, caring for all living things, manufacturing electric cars, preferring cycling and renewable energy production. In the study, the secondary school students offered solution-oriented and realistic suggestions about the precautions that can be implemented against global warming. It is promising that the students had high awareness in this sense. In a study by Eroğlu and Aydoğdu (2016), the majority of pre-service teachers made suggestions such as increasing tree planting and avoiding fossil fuel consumption, saving electricity, using renewable energy sources, recycled paper and preferring public transport in order to reduce the effects of global warming. In a study conducted by Boyes and Stanisstreet (1992), participants thought that planting trees, using vehicles less, preferring renewable energy sources, and using recycled paper would reduce the greenhouse effect. Similarly, in a study conducted by Kılınç, Stanisstreet, and Boyes (2008), the participants stated that planting trees, using recycled paper, and reducing the use of vehicles would mitigate global warming. In a study conducted by Daniel, Stanisstreet, and Boyes (2004), most students emphasized that a decrease in industrial and vehicle emissions has an important role in mitigating global warming. In addition, it was found that the majority of students thought that precautions could be initiated by obtaining energy from renewable sources. In the studies conducted by Boyes and Stanisstreet (1992) and Kılınç et al. (2008), the majority of the students thought that in order to mitigate global warming, recycling in the use of paper, planting trees, reducing the use of vehicles, and using alternative energy sources were necessary. In another study conducted by Tuncer et al. (2005) on 6th- and 10th-grade students, the students stated that natural resources should be protected for future generations. In a study conducted by Aydın (2017) with university students, it was determined that the participants had high levels of knowledge about the precautions that can be adopted against global warming. The findings of Kılıçoğlu and Akkaya Yılmaz (2021), Öncül (2010), Yalçın (2010) and Koca (2019) also support the findings of this study.

### Suggestions

When the results of this study were evaluated, one could state that although students have knowledge about the consequences of global warming and how it can be prevented, they have deficiencies about the causes of global warming and do not know the natural causes of it. Various educational programs can be organized in schools to overcome these deficiencies.

Students' concerns about global warming and their awareness that the most important cause of global warming is humans should be turned into opportunities. Students should be taught that if the necessary precautions are not taken and our duties and responsibilities as individuals are not fulfilled, greater disasters may occur. They should also be given the hope that it is possible to eliminate the effects of global warming and that the effects of this problem can be mitigated with the cooperation of all segments of society. Students' concerns can be alleviated by giving good examples of recycling, clean energy sources, healthy and clean transportation alternatives, and efficient use of natural resources that are available today.

In addition to the theoretical education on global warming in schools, campaigns and activities for afforestation and recycling can be organized. Considering that education starts in the family environment, a comprehensive awareness can be created by including children and families in environmental education programs. Within the scope of environment days, green classes can be created, and activities can be organized to involve students and families in environmental education with topics such as recycling, energy saving, and protection of the natural environment.

A joint protocol can be prepared with the Ministry of National Education, the Ministry of Interior and the Ministry of Energy, and environmental projects prepared by students can be presented at the end of the semester to inform the community. During these presentations, brochures and handbooks on recycling, energy saving, global warming, and the greenhouse effect can be distributed to raise public awareness.

This study was limited to interviews with secondary school students. Additionally,

the study can also be conducted with high school students and teachers. In quantitative studies, different demographic characteristics of teachers and students can be taken into account to check whether the data differ or not.

### Ethical Statement

Ethical approval for the study was obtained from the Muş Alparslan University Scientific Research and Publication Ethics Committee under decision number 96388, dated 14.06.2023.

### Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

### Conflict of interest

None

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