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İKLİM DEĞİŞİKLİĞİNE ÇÖZÜM OLABİLSEM: ÖZEL YETENEKLİ ÇOCUKLAR[1]

IF I COULD BE A SOLUTION TO CLIMATE CHANGE: GIFTED CHILDREN

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Özet

İklim değişikliği, günümüzde en önemli küresel sorunlardan biridir. Yeryüzündeki tüm canlıların yaşamını tehdit eden iklim değişikliği konusunda tüm bireylerin bilinçlenmesi gerekmektedir. İklim değişikliği konusunda farkındalıkları geliştirilmesi gereken bireylerin merkezinde özel yetenekli çocuklar yer almaktadır. Çünkü özel yetenekli çocukların toplumların çevresel sorunları aşmalarında etkileri büyüktür ve çevresel sorunlara akranlarına göre daha fazla duyarlıdırlar. Bu çalışmada özel yetenekli ilkokul öğrencilerinin iklim değişikliğine yönelik farkındalıklarının arttırılması ve duyarlılıklarının geliştirilmesi amaçlanmıştır. Çalışma nicel ve nitel yöntemin bir arada kullanıldığı karma yöntem ile tasarlanmıştır. Çalışma nicel araştırma yöntemlerinden tek gruplu ön test son test modeli kullanılarak tasarlandı. Nitel araştırma yöntemlerinden tipik durum çalışması yöntemi kullanıldı Araştırmanın katılımcılarının seçiminde amaçlı örnekleme yöntemlerinden ölçüt örnekleme yöntemi kullanılmıştır.. Bu doğrultuda 30 özel yetenekli çocuk çalışma grubunu oluşturmuştur. Çalışmanın nicel verileri "İklim Değişikliği Farkındalık Ölçeği" ile nitel verileri görüşme, kompozisyon yazma ve günlük tutma ile toplanmıştır. Çocuklara altı oturum halinde İklim Değişikliği Farkındalık Eğitimi uygulanmıştır. Her oturumda dörder etkinlik yer almıştır. Veri toplama araçları İklim Değişikliği Farkındalık Eğitimi'nden önce ve sonra çalışma grubuna uygulanmıştır. Çalışmanın sonucunda uygulanan iklim değişikliği eğitiminin özel yetenekli çocukların iklim değişikliği kavramına, iklim değişikliğinin nedenlerine ve önlenmesine, iklim değişikliğine yönelik çözüm önerilerinde bulunmaları üzerinde olumlu etkisi olduğu belirlenmiştir Bu doğrultuda iklim değişikliği eğitiminin özel yetenekli çocuklar üzerinde etkili olduğu söylenebilir.

Anahtar kelimeler: *iklim değişikliği, iklim değişikliği farkındalığı, özel yetenekli çocuklar, özel yetenek*

Abstract

Climate change is one of the most important global issues today. All individuals need to be aware of climate change, which threatens the lives of all living things on Earth. Gifted children are at the center of individuals who need to develop awareness about climate change. This is because gifted children have a significant impact on societies' efforts to overcome environmental problems and are more sensitive to environmental issues than their peers. This study aims to increase the awareness of gifted elementary school students about climate change

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and develop their sensitivity. The study was designed using a mixed method that combines quantitative and qualitative methods. The study was designed using the single-group pre-test post-test model from quantitative research methods. The typical case study method was used from qualitative research methods. The criterion sampling method was used from purposeful sampling methods in the selection of the study participants. In this context, 30 gifted children formed the study group. The quantitative data of the study were collected using the "Climate Change Awareness Scale," and the qualitative data were collected through interviews, composition writing, and journaling. Children were given six sessions of Climate Change Awareness Training. Each session included four activities. Data collection tools were applied to the working group before and after the Climate Change Awareness Training. The results of the study showed that the climate change training had a positive effect on gifted children's understanding of climate change, its causes and prevention, and their ability to propose solutions to climate change. In this regard, it can be said that climate change training is effective for gifted children.

Keywords: *climate change, climate change awareness, gifted children, giftedness*

Introduction

The current century has witnessed the emergence of numerous global issues. Among these issues, climate change, which has harmful effects on the health and development of individuals, stands out as the most significant. In the fight against climate change, it is not only scientific and political measures that are critical, but also the cultivation of individuals who are conscious and creative in their thinking on this issue. Especially gifted children, due to their potential, can become important actors who can guide society when they are made aware of climate change from an early age (Denham et al., 2021). Therefore, developing their awareness in this area is of utmost importance.

The impact of climate change on the natural environment is a significant concern. However, it is important to recognise that climate also affects human beings and their human and economic activities. For centuries, human beings have been engaged in the endeavour of organising their shelters, food and energy production in order to create a lifestyle that is compatible with the prevailing climate and environmental conditions, and to adapt themselves to this resource (Türkeş, 2008). However, alterations in the climate change the typical sequence of natural occurrences in nature, and the extraordinary changes occurring affect the lives of all living beings in conjunction with nature (Seddon et al., 2020).

Throughout the history of the world, the world climate has undergone natural change in different dimensions over the course of geological periods. This natural change process continues to the present day (Judd et al., 2024; Lear et al., 2021; Thomas, 2010). Climate change, which causes all these changes in the world and has been occurring as a result of natural causes since the existence of the world, has accelerated especially after the industrial revolution, when the use of fossil energy resources increased. In addition to natural processes, the effects of human activities have also begun to contribute to climate change since the Industrial Revolution (Mikhaylov et al., 2020). The Industrial Revolution and the acceleration of the urbanisation process it brought with it caused the amount of CO2 gas released into the atmosphere to increase, thereby increasing the greenhouse effect of the atmosphere. The greenhouse effect is a natural phenomenon that already occurs around the Earth. The average temperature near the Earth's surface increased from 15°C to 15.6°C (Albergel et al., 2010). As a consequence of the continuous increase in the amount of CO2 released into the atmosphere as a result of the utilisation of fossil energy sources, the number of green leafy plants and algae that convert CO2 in the atmosphere into oxygen by photosynthesis has decreased for various reasons (Gowdy, 2020).

The glass or other transparent covers on greenhouses serve to prevent the loss of heat inside the greenhouses. In addition, the atmosphere of the world also keeps the temperature in the world by making a natural greenhouse effect. However, the increase in the proportion of gases such as carbon dioxide, water vapour, methane gas, which are referred to as greenhouse gases, in the atmosphere increases the greenhouse effect of the atmosphere. In the absence of greenhouse gases in the atmosphere, the average temperature of the Earth's surface would be approximately -18°C, as opposed to the current 15°C (Montenegro et al., 2007). However, the increase in the rates of greenhouse gases released into the atmosphere as a consequence of human activities has led to an intensification of the greenhouse effect of the atmosphere, resulting in a rise in the average temperature of the Earth's surface (Bala et al., 2005).

Climate change is not merely an increase in temperature; it also affects pressure, wind, humidity and precipitation. As a consequence of these changes, plants, animals and ecosystems, as well as human communities, are at risk. Factors such as an increase in the frequency and impact of extreme weather events, including drought, floods, severe hurricanes, rising ocean and sea water levels, increasing acidity of the oceans and the melting of glaciers, contribute to this risk (Duan et al., 2022). As glaciers melt more rapidly, sea levels rise, the amount of moisture in the atmosphere increases, significant fluctuations occur in the amount and annual periods of precipitation, and changes are observed in the development of plants and animals (Yarzábal et al., 2021).

All members of the global community must collectively address climate change. In order to achieve this goal, individuals must gain a deeper understanding of the factors that contribute to climate change and the extent of their individual and collective impact on this phenomenon. The ultimate strength of a society is embodied in the individuals it nurtures, and among them, highly gifted individuals stand at the apex of this collective capacity. Gifted individuals represent one of the most valuable resources for any society, and they should be encouraged at an early age to develop their talents for the benefit of the wider community (Al-Tal et al., 2022). Gifted students perform at a higher level than their peers in special academic areas or in terms of intelligence, creativity, art and leadership capacity. Such individuals display remarkable proficiency, clarity, and extraordinary achievements in a specific area compared to their peers (Al-Tal et al., 2022). Gifted students develop solutions to problems in an accelerated manner, employing creativity and a scientific approach. Furthermore, gifted individuals are characterised as being extremely persistent in solving the problems they encounter; they do not accept information in its purported form and instead engage in a rational process of thinking, observe carefully, research, and question. These characteristics have been identified in various studies (Johnsen, 2021; Levent, 2014).

Gifted individuals are sensitive to global problems and have a developed sense of responsibility (Piechowski, 1997; Rimm et al., 2017). In order to enhance the awareness and sensitivity of gifted individuals with regard to climate change, which is arguably one of the most pressing global concerns, it is recommended that they be supported during their primary school years (Hestness et al., 2014). As gifted students are able to develop creative solutions to global problems, there is a belief that gifted people will play an important role in addressing climate change. The critical and creative thinking skills of gifted individuals allow them to consider a variety of perspectives on climate change. Since gifted individuals develop critical and creative thinking skills, they can develop different perspectives on climate change (Unesco, 2013). In particular, gifted individuals who are educated on climate change may assume a protective and problem-solving role when making and implementing critical decisions on this topic (Esen, 2011; Tirri et al., 2012). Furthermore, the implementation of preventative measures may be more effective when climate change-related factors are addressed at the earliest possible opportunity. Consequently, it is considered crucial for gifted

individuals to develop an awareness of climate change. In this context, the objective of this study was to facilitate the reflection of gifted primary school students on the consequences of global warming and environmental awareness through the implementation of activities on climate change, which represents the most pressing issue of our era. Furthermore, the aim was to enhance awareness and sensitivity towards this matter.

In accordance with the defined objective, the hypotheses of the study are as follows:

- How is climate change education effective in increasing awareness?
- How is climate change education effective in increasing knowledge?

Method

Research Design

The study was designed with a mixed method approach, employing both qualitative and quantitative research methods in a unified manner. The study was designed using a one-group pre-test post-test model, which is a common approach in quantitative research. The typical case study method was employed within the context of qualitative research. This method allows for a detailed examination of a sample case that has the qualities to represent the research topic. Thus, the findings contribute to the understanding of similar situations and add contextual depth to the research.

Study Group

The study group comprised 30 gifted students. The criterion sampling method, one of the purposive sampling methods, was employed in the selection of the participants for the study. The main criteria for inclusion in the study were as follows: the participants were required to be gifted, to be at the fourth and fifth grade level in the Science and Art Centre, to have not received training on climate change before, and to not have any problems that would prevent them from participating in the applications. All participants were selected from the same Science and Art Center. Science and Art Centers are institutions where gifted children receive education in accordance with their abilities during out-of-school hours after being identified in primary school grades one, two and three. Education in Science and Art Centers is different from students' formal education. In BİLSEM, education is provided with a project-based learning model and students are expected to realize products/projects in accordance with the desired qualifications. In BİLSEM, students are enrolled in a 5-stage education program. These are Adaptation, Support Education, Individual Talents Recognition, Project Period.

Table 1. *Demographic Characteristics of the Participants*

Demographic characteristics		n	%
Gender	Girl	14	46.7
	Boy	16	53.3
Grade Level	4th	21	70.0
	5th	9	30.0
Duration of education in BİLSEM	1 year	14	46.7
	2 years	16	53.3
Mother's Education Status	Primary School	1	3.3
	High School	5	16.7
	Bachelor's degree	19	63.3
	Master's Degree	4	13.3
	PhD	1	3.3
Father's Education Status	Secondary school	1	3.3
	High School	2	6.7
	Bachelor's degree	21	70.0
	Master's Degree	3	10.0
	PhD	3	10.0
Mother Occupation	Officer	24	80.0
	Self-employed	2	6.66
	Unemployed	4	13.34
Father Occupation	Officer	20	66.66
	Self-employed	9	30.0
	Unemployed	1	3.33

Data Collection Tools

Qualitative and quantitative data collection methods were used together in the study. The 'Personal Information Form' was used for descriptive information about the study group. Quantitative data was collected using the Climate Change Awareness Scale. Qualitative data were collected through interviews, essay writing and diary keeping.

Personal information form. The researchers' prepared form includes questions regarding the ages, genders, grade levels, duration of education at the Science and Art Centre, educational statuses, and occupations of the children's parents. The form was completed by the students themselves.

The Climate Change Awareness Scale. The scale was developed by Esringü, Canpolat, and Barış (2021) with the objective of determining students' awareness of climate change. The scale employs a three-point Likert-type response format (i.e., "Agree," "Undecided," and "Disagree") and is unidimensional in structure. The scale comprises 15 items, with five items

representing positive statements and 10 items representing negative statements (Esringü et al., 2021). The cronbach alpha reliability coefficient of the scale is .82. The scale was administered to the students prior to and following the training (pre-test and post-test).

Interview Form. The interview form was designed to ascertain the participants' perspectives on climate change. The semi-structured interview forms, developed by the researchers, will be used before and after the application. The forms consist of open-ended questions. The interview form questions were subjected to analysis by three field experts. The interview form was subsequently edited in accordance with the recommendations of the field experts. Subsequently, the interview form was applied to two gifted students who were not part of the study group and subsequently finalised. The pre-interview questions seek to ascertain the students' perspectives on climate change, the causes of climate change, the effects of climate change on the life of living things, individual responsibilities in climate change, and the measures that states can take in climate change. In addition to the questions posed in the preliminary interview, the final interview included queries pertaining to the students' comprehension of climate change, their preferred pastime, and their opinions on the project.

Diaries. Throughout the implementation period, data were collected through the use of diaries, which enabled participants to reflect on their feelings and thoughts about the activities. The diaries were composed individually by the students following each activity.

Essay. At the commencement and conclusion of the project, students were required to compose an essay addressing the following question: "What is climate change and how can it be prevented?" The composition evaluated the change in the expressions used by the students about climate change.

Climate Change Awareness Training

Climate Change Awareness Training was developed with the objective of enhancing the awareness of gifted children about climate change. A comprehensive literature review was conducted prior to the development of the training plans. The activities were structured according to two categories: the causes and effects of climate change, and the measures that can be taken against climate change. The activities are divided into six sessions. Each session comprises four activities. All students were engaged in all sessions and activities. The training consists of in-class and out-of-class activities on climate change. Gifted students were primarily taught about climate change, the causes and consequences of climate change, and the measures that can be taken against climate change. The activities prepared in line with this content consisted of in-class and out-of-class applications. The activities in the sessions comprised field trips, conferences, and in-class activities. Following the creation of the activities, they were subjected to analysis by three field experts. The experts were asked to evaluate the training programme as ‘appropriate’, ‘partially appropriate’, or ‘not appropriate’ based on a set of criteria. These included the suitability of the determined objectives to the purpose of the programme, the adequacy of the learning processes, the suitability and adequacy of the materials used, the suitability in the distribution of the objectives, and the clarity of the instructions given. The experts were also invited to provide their opinions in the ‘explanation’ section. The necessary corrections were implemented in accordance with the expert opinions.

Data Collection

The students completed the Personal Information Form and the Climate Change Awareness Scale, which took approximately 20 minutes. The interviews were conducted one-on-one in a quiet, comfortable, and distraction-free environment. They were audio recorded

and lasted approximately 30 minutes. The compositions and diaries were prepared separately for each student and written in the project notebook. The compositions were written individually by each student. Each student was allotted 40 minutes to compose their written work. The diaries were subsequently written by each student at the conclusion of each activity.

Data Analyses

In descriptive statistics, categorical data characteristics are presented in percentage form along with frequency, whereas continuous data characteristics are presented in mean form with a standard deviation, median, minimum and maximum value. The results of the Climate Change Awareness Scale were analysed according to the results of the normality test. For the results exhibiting normal distribution characteristics, the dependent groups t-test was employed in pairwise comparisons. In the case of results that did not exhibit normal distribution characteristics, the Wilcoxon Signed Ranks Test was employed in pairwise comparisons, while the Friedman Test was utilized in multiple comparisons.

A content analysis technique was be employed to analyse the interviews, diaries and compositions. In this technique, concepts related to the collected data are created and themes are formed by bringing similar concepts together (Yıldırım & Şimşek, 2016). In the analysis of the data, the following stages were employed: organising and preparing the data, making general sense of the information, coding, defining, representing and interpreting (Creswell, 2013). Initially, the interviews, compositions and diaries were converted into written text in a computer environment. The data were then subjected to a process of reading and coding by the project team. The data were then subjected to evaluation and coding by another expert in the field. The codings were discussed and revised. The data were organised according to pre-established codes and themes. The findings resulting from the examination of the themes were reported by means of direct quotations from the participants' views (Yıldırım & Şimşek, 2016). Thematic and categorical tables were created for the purpose of coding. The data were presented as frequency values. In the research, direct quotations made from the opinions of the students and the expressions they wrote in compositions and diaries were coded as C1, C2, C3, C4, etc. and presented.

Rigor

In order to ensure the rigour of the research, a triangulation approach was employed, encompassing expert review, participant confirmation, long-term interaction and analysis. The integrity of the data was maintained, and the coder agreement was adhered to. All participants were interviewed and triangulated, with responses to questions verified post-interview, and interaction maintained throughout the interview process. A review of the coding, categories and themes was also conducted by other experts. The data was analysed without modification or interpretation. In this study, the term "C" was utilised to denote children in the analysis. A consensus was reached by two researchers who examined the themes. Using Miles and Huberman's formula for calculating consensus, the result was 0.94. Given that the percentage of agreement exceeded 0.70, the results were deemed to be reliable. The themes that did not align with the study's objectives were discussed with the researchers and subsequently edited. In addition, cronbach's alpha coefficient was calculated for the reliability of the quantitative results and found to be .80.

Results

The quantitative and qualitative results from the study aimed at increasing the awareness of gifted children about climate change are presented in a consecutive order below.

Table 2. *Comparison of Participants' Climate Change Awareness Levels Before and After Climate Change Awareness Training*

	Mean	Standard Deviation	t	p
Pre Test	38,07	2,612	3,258	0,003**
Post Test	40,03	1,847		

A comparison of the scores obtained from the Climate Change Awareness Scale by gifted children in the study group before and after climate change education revealed a statistically significant difference in favour of the scores obtained from the post-test (t=3.258, p=0.003).

Table 3. *The Themes and Categories Derived from the Essay and Diaries Written by the Participants Prior to and Subsequent to the Climate Change Awareness Training*

	Pre-training	Post-training
Theme	**Category**	**Category**
Causes of Climate Change	Greenhouse gases (n=12)	Greenhouse gases (n=11)
	Deodorant (n=15)	Increase in harmful gases in the atmosphere (n= 8)
	Factory smoke (n=7)	Warming or cooling of the earth (n=8)
	Car exhaust (n=6)	Fossil fuel (n=6)
	Fossil fuel (n=6)	Human activities are effective (n=4)
	Air pollution (n=5)	Climate change (n=4)
	Dirty gas (n=2)	Pollution of nature (n=4)
	Cigarette (n=1)	Sudden weather change (n=1)
Effects of Climate Change	Ozone depletion (n=13)	Warming of the world (n=9)
	Sudden climate change (n=12)	Destruction of the ozone layer (n=8)
	Harmful sun rays (n=8)	Climate moving in the opposite direction (n=1)
	Warming of the world (n=7)	Too much sun rays (n=2)
	Melting of glaciers (n=3)	Melting of glaciers (n=4)
	Drought (n=2)	
	The world is uninhabitable (n=1)	

	Damage to nature (n=1)	
	Forest fire increase (n=1)	
Measures to be taken against climate change	Filter for factory chimneys (n=12)	Recycling of solid and liquid wastes (n=17)
	Electric car use (n=12)	Dissemination of geothermal energy (n=16)
	Recycling (n=9)	Electric car use should be increased (n=11)
	Use of renewable energy (n=7)	Water treatment facilities should be increased (n=11)
	Tree planting (f=4)	Deodorant use should be reduced (n=8)
	Co-operation of the whole world (n=4)	Filter for factory chimneys (n=8)
	Being economical (n=3)	Savings should be made (n=8)
	Taking precautions/measures (n=2)	Renewable energy should be used (n=7)
	Using public transport (n=2)	Trees should be planted (n=7)
	Using technology for nature (n=1)	Solid waste disposal facilities should be increased (n=7)
	Dirty wastes (n=1)	Public should be informed (n=6)
	Reducing building construction (n=1)	Building sustainable/ecological houses (n=4)
	Using natural gas (n=1)	Protection of nature (n=4)
	Nature conservation (n=1)	Solar energy should be installed in cars (n=3)
	Bicycle (n=1)	Social activities should be planned (n=3)
		Bicycle use should be increased (n=3)
		Reducing natural gas (n=3)
		The whole world should take measures (n=3)
		Posters should be hung (n=3)
		Games should be prepared (n=3)
		Algae should be increased (n=3)
		Quitting smoking (n=3)
		Paper consumption should be reduced (n=3)
		Public transport should be used (n=3)

Walking a short distance (n=3)	
Total	

The essays written by gifted students before and after the training included expressions related to the causes of climate change, the effects of climate change, and the measures that can be taken against climate change.

In the analysis of the theme of the causes of climate change, the categories of greenhouse gases, deodorant, factory smoke, car exhaust, dirty gas, air pollution, fossil fuels, and cigarettes emerge before the training. Following the training, the categories of 'greenhouse gases, increase in harmful gases in the atmosphere, warming or cooling of the earth, fossil fuel, human activities are effective, climate change, pollution of nature, sudden weather change' became the focus of attention. The statements of the participants regarding these themes and categories are presented below:

Climate change is caused by greenhouse gases, perfumes and factory fumes, and as a result of the weakening of the ozone layer, harmful sun rays heat the Earth and trigger global warming. ..... (C14).

Factory fumes, car exhausts, perfumes and deodorants increase climate change..... (C8).

Climate change occurs when the ozone layer is depleted. The ozone layer is pierced by the community of chimneys and other gases..... (C12)

Upon analysis of the theme of the effects of climate change, the categories of thinning of the ozone layer, sudden climate change, harmful sun rays, warming of the world, melting of glaciers, making the world uninhabitable, drought, damage to nature, and increase in forest fires attracted attention prior to the training. Following the training, the categories of 'warming of the world', 'destruction of the ozone layer', 'climate progressing in the opposite direction', 'excessive sun rays' and 'melting of glaciers' attracted particular attention. The statements of the participants regarding these themes and categories are presented below:

The ozone layer is pierced by a collection of smokestacks and other gases. The sun's rays become more intense. Forests burn, polar ice caps melt. (C12)

Climate change is a very bad thing and it causes many things such as pollution of the air, warming of the earth. (C30)

The theme "Measures that can be taken against Climate Change" encompasses a range of categories, including the use of renewable energy, the management of waste, recycling, the filtering of factory chimneys, economic efficiency, the implementation of precautions and measures, the planting of trees, the utilisation of technology for the benefit of nature, the use of public transport, the use of electric cars, the reduction of construction-related emissions, the utilisation of natural gas, the protection of nature, and the necessity for global cooperation. Following the training of this approach, the necessity for the recycling of solid and liquid wastes, the widespread utilisation of geothermal energy, an increased use of electric cars, the expansion of water treatment facilities, a reduction in deodorant consumption, the installation of filters in factory chimneys, savings, renewable energy usage, tree planting, the development of solid waste disposal facilities, public awareness initiatives, and other measures to be taken against climate change, were identified. The construction of sustainable/ecological houses, the protection of nature, the installation of solar energy in cars, social activities, cycling, the reduction of natural gas consumption, global precautions, the

hanging of posters, the preparation of games, the increase of seaweed, the cessation of smoking, the reduction of paper consumption and the use of public transport are among the recommendations that emerged from this study. The statements of the participants regarding these themes and categories are presented below:

Electric vehicles should be switched to electric vehicles, renewable energy should be used, filters should be installed in factory chimneys. (C13)

If we are more economical, more careful, if dirty wastes are not discharged into the sea, if gases are not released into the air, maybe climate change can stop and even the ozone layer can recover. (C7)

A comparative analysis of the compositions written by the gifted children in the study group before and after the training revealed that the compositions consistently addressed the themes of 'causes of climate change, effects of climate change and measures that can be taken against climate change'. Although the themes were identical, the compositions exhibited notable differences following the training. Upon analysis of the compositions written after the training, it was evident that the children had acquired a comprehensive understanding of the concepts of climate change, including its causes and effects, and had developed a more nuanced perspective on the means of preventing climate change.

Table 4. *Themes and Codes Obtained from the Interviews Before and After the Climate Change Awareness Training*

	Pre-training	**Post-training**
Theme	**Category**	**Category**
Definition of Climate Change	Ozone depletion (n=6)	Excessive solar radiation as a result of greenhouse gases damaging the atmosphere (n=13)
	Overheating/cooling of the air (n=5)	Sudden overheating/cooling of the air (n=12)
	Change of seasons (n=2)	Change of seasons (n=3)
	Unbalanced arrival of sun rays to the earth (n=1)	
	Greenhouse gases damage the atmosphere (n=1)	
	Sudden change of seasons as a result of global warming (n=1)	
Causes of Climate Change	Exhaust gases (n=9)	Greenhouse gases (n=11)
	Factory fumes (n=7)	Increase in harmful gases in the atmosphere (n= 8)
	Greenhouse gases (n=5)	Warming or cooling of the earth (n=8)
	Felling of trees (n=3)	Fossil fuel (n=6)
	Deodorants (n=3)	Human activities are effective (n=4)

	Pollution of the environment (n=2)	Climate change (n=4)
	Fossil fuels (n=1)	Pollution of nature (n=4)
Effects of Climate Change	Extinction of animals (n=6)	Sudden weather change (n=1)
	Increased deaths (n=6)	Destruction of the ozone layer (n=8)
	Melting of glaciers (n=5)	Climate moving in the opposite direction (n=1)
	Decrease in the habitat of animals (n=5)	Too much sunlight (n=2)
	Change of seasons/climate (n=3)	Melting of glaciers (n=4)
	Forest fires (n=2)	
	Extreme hot/cold weather (n=2)	
	Vegetables and fruits are not grown in season (n=1)	
Precautions that Individuals can take for Climate Change	Recycling of solid and liquid wastes (n=7)	Saving/conscious use of natural resources (n=10)
	Planting trees (n=5)	Electric car use (n=10)
	Saving use of water (n=4)	Separating waste for recycling (n=7)
	Walking/cycling (n=4)	Use of renewable energy (n=7)
	Using public transport (n=3)	Cycling/walking (n=7)
	Reducing the use of deodorant (n=3)	Reducing car use (n=6)
	Warning those who pollute the environment (n=1)	Tree planting (n=6)
		Reducing the use of deodorant (n=6)
		Keeping the environment clean (n=6)
		Not using fossil fuels (n=4)
		Warning those who pollute the environment (n=2)
		Taking public transport (n=2)
Measures to be taken by States against Climate Change	Installing filters on factory chimneys (n=9)	Installing filters on factory chimneys (n=14)
	Increasing the use/production of electric cars (n=7)	Increasing the use/production of electric cars (n=12)
	Raising awareness (n=5)	Tree planting (n=5)
	Generating electricity from solar panels/wind (n=4)	Increasing recycling bins (n=3)

	Preventing dumping of wastes into the sea and soil (n=3) Increasing recycling bins (n=2) Tree planting (n=1) Reducing the use of deodorant (n=1)	Making projects (n=2) Not cutting down trees (n=2) Reducing the use of fossil fuels (n=1) Increasing green areas, parks and forests (n=1)
Solution suggestions for raising awareness on climate change		Making awareness projects (n=10) Organising campaigns/events (n=8) Preparing boards, posters (n=6) Making TV programmes (n=4) Preparing advertisements, cartoons and public service announcements, publishing newspapers (n=4) Organising trainings (n=1) Making announcements and providing environments to increase cycling (n=1) Raising awareness by co-operating with municipalities (n=1)

In the analysis of the data obtained from the interviews with the gifted students before and after the implementation, the opinions of the participants were grouped under six themes: Definition of Climate Change, Causes of Climate Change, Effects of Climate Change, Precautions that Individuals can take for Climate Change, Measures to be taken by States against Climate Change and Solution suggestions for raising awareness on climate change.

When analysing the theme related to the definition of climate change, some of the gifted students were able to give definitions of climate change. Before the application, the participants explained climate change as the thinning of the ozone layer and the overheating/cooling of the air due to various reasons. They also explained it as the changing of the seasons, the sun's rays reaching the earth in different ways, and greenhouse gases damaging the atmosphere. After the application, the participants explained the damage caused by greenhouse gases to the atmosphere as excessive sunlight, sudden overheating/cooling of the air and the change of seasons. The students' explanations of these topics and categories are given below:

The ozone layer is being depleted by exhaust fumes from exhausts and chimneys, and sunlight is melting the poles because more sunlight comes in. Forest fires occur more and oxygen decreases. (C3)

The ozone layer was depleted because of the pollution of nature. Because of the pollution of the earth and climate change emerged... (C13)

Participants explained that especially exhaust and factory chimney gases cause climate change. The statements of the participants regarding these themes and codes are given below:

People pollute the environment unconsciously and trees are cut down, the sea is garbage, the sea, garbage, garbage, the sea, that is, throwing what they throw into the sea (C13).

There may be excessive tree cutting, dirty water that people throw into the seas or lakes. There may be dirty gases released into the air. (C21)

Participants emphasized that climate change has an impact on animal extinction, increased deaths and diseases, melting of glaciers, decrease in animal habitats and change of seasons. The statements of the participants regarding these themes and codes are given below:

Glaciers melt, the habitats of animals are gone. Then, when those glaciers melt, the oceans fill up more. Beaches and such are always flooded. It can become difficult for people to breathe because the air is polluted. (C18)

Water resources are dwindling. And animals die somewhere every day. Forest fires occur. (C23)

In the theme of measures that individuals can take against climate change, participants emphasized recycling solid and liquid wastes, planting trees, using water economically and not polluting the environment. The statements of the participants regarding these themes and codes are given below:

I can sleep with people who throw garbage on the ground. I can raise awareness about not throwing garbage on the ground and I can also make posters about it. (C13)

The duties of individuals are to keep the environment clean, first of all, not to throw garbage on the ground, to separate recycling, to separate recycling in household waste and to never, ever pour their oil into the sink. After that, they should raise awareness about this. They should warn the people who do this and warn the people who do wrong. (C4)

In terms of actions that countries can take to combat climate change, participants expressed opinions such as installing filters on factory chimneys, increasing the use/production of electric cars, raising people's awareness, and generating electricity from solar panels/wind. The participants' statements on these themes and categories are given below:

The government should not cut down trees in this area when building a house, they can take them with a crane and put them on the sides. With such projects they can raise awareness of people, students and children, they can increase solar panels and windmills. The natural resources of solar energy and wind energy should be increased and fossil fuels should not be used. (C3)

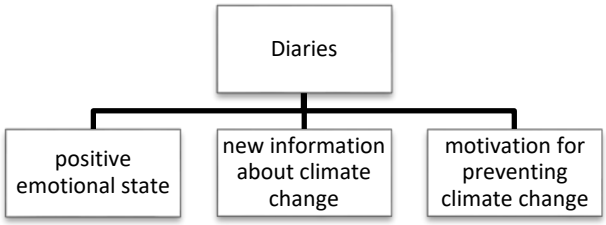
Governments should put filters on chimneys in factories. There should be more things about renewable energy, it should be spread more. Electric vehicles should be increased. (C19)

On the theme of solutions to raise awareness of climate change, participants made several suggestions. The most emphasised suggestion is to carry out projects similar to this one. Other suggestions include organising campaigns/events, preparing billboards, posters, making TV programmes, preparing advertisements, cartoons and public service announcements, publishing newspapers and organising trainings.

Different projects can also be organised. For example, the same project can be carried out in different countries or cities. (C10)

Projects like recycling should be done more often. Slogans, advertisements. (C17)

Figure 1. *Themes Obtained from the Analysis of Participants' Diaries*



The diaries of the participants were analysed. In the diaries, they expressed their feelings and thoughts about the activities they did during the day and what they learnt. The participants emphasised that they were in a positive emotional state. The participants learnt new information every day about the causes of climate change and the measures that can be taken. It was emphasised that their motivation for preventing climate change increased.

Discussion

The study was conducted to increase the awareness of gifted children about climate change. From the analysis of the study group's scores on the climate change awareness scale, there has been an increase in the participants' awareness of climate change. When analysing the results of the interviews, compositions and diaries, the children's knowledge and awareness of climate change and climate change prevention increased. In the final interviews, compositions and diaries, gifted children included more precautions, especially in the duties of individuals and states. Compared to the pre-interviews, compositions and diaries, the children made more practical suggestions. The climate change awareness training increased the children's awareness of climate change. In addition, the qualitative results of the study are compatible with the quantitative results and enrich the quantitative results.

The developmental characteristics of gifted children are more advanced than those of typically developing individuals. Their sensitivity to social problems is high. Gifted children are characterised by their sense of responsibility and interest in global issues (Rimm et al., 2017). Gifted children are able to analyse and think deeply about the issues that affect people. In addition, studies have shown that gifted children can find solutions to many problems that arise from gifted people (Hotaman, 2020; Wai & Lovett, 2021). For this reason, it is very important to provide gifted children with information about climate change, which is one of the most important global problems, and to explore its consequences. In the context of climate change, this is an opportunity to change the present and shape the future (Saeed Sanad et al., 2021).

Gifted children's competence on climate change is higher than that of typically developing children (Tolppanen et al., 2023). In another study, gifted children are also highly interested in climate change, water and renewable energy (Tirri et al., 2012). Although gifted children have a rich perception of the concept of climate change, their level of knowledge about the causes and solutions of climate change is insufficient. Therefore, more studies should be conducted with gifted children (Nacaroğlu O. & Karaaslan G., 2020). It was found that although the knowledge level of gifted children regarding the causes and possible consequences of climate change is high, their perception level regarding the solution to the problem is quite low (Mutlu & Nacaroglu, 2019) . Gifted children who are aware of issues such as climate change are more likely to act to solve the problem and improve themselves

(Spellman & Stoudt, 2013). Gifted children who are interested in global issues such as climate change are more likely to benefit from training on this issue (Schroth & Helfer, 2017).

The most important action that can be taken to prevent climate change is to raise awareness of the issue. Awareness can only be raised through education. According to the Next Generation Science Standards, climate change education should be directly integrated into the K-12 education programme (Hestness et al., 2014). Climate change and environmental education given to gifted children has been effective in improving their awareness (Esringü et al., 2021; González-Gaudiano & Meira-Cartea, 2019).

Climate change education for gifted children is a key element of the global response and prevention of climate change. Climate change education helps gifted students understand and care about the impacts of global warming, promotes changes in their attitudes and behaviour, and helps them adapt to climate change-related trends (Unesco, 2013). Beach et al., (2017) reported that the Climate Fiction application on climate change enriched gifted children's views on the possible future impacts of climate change and solutions. Saeed Sanad et al., (2021) concluded that adding lessons on climate change to the curriculum of gifted primary students in Bahrain had a positive impact on gifted students' awareness of climate change and basic science process skills. An application on climate change found positive changes in children's awareness of climate change and their views on its importance (Bodur et al., 2023) . Külegel, (2020) stated that E-STEM activities based on environmental education contribute to improving the level of environmental awareness of gifted students.

The results of the studies in the literature are similar to the results of the current study. The climate change education used in the study has a positive effect on gifted children's understanding of the concept of climate change, the causes and prevention of climate change, and their suggestions for solutions to climate change. Climate change education may be effective for gifted children.

Conclusion

Climate change awareness is important for gifted children. This study aimed to raise the awareness of gifted primary school children about climate change by educating them about climate change through activities. As a result of the study, gifted children's awareness of the importance of climate change increased. There was a positive change in the development of solutions based on the causes and effects of climate change. As gifted children have a high awareness of global problems, their perceptions and awareness of climate change should be improved. Gifted children are individuals who will shape today and develop tomorrow because of their high awareness of environmental problems. Therefore, the results of the study are important.

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