

INVESTIGATION INTO POPULAR SCIENCE BOOKS AS CHILDREN'S LITERATURE IN TERMS OF SUSTAINABLE ENVIRONMENT AND CLIMATE CHANGE

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ABSTRACT

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This study aims to investigate how the subject of 'sustainable environment and climate change' is handled as a popular science subject in children's literature. To this end, among 346 children's books in the 2-12 age group published by TUBITAK, 25 books on the subject of 'climate change and sustainable environment' were determined as the sample of the study with criterion sampling, one of the purposeful sampling methods. Adopting a qualitative study design, the data were analyzed through document analysis. In the analysis, descriptive content analysis was used. Based on the analysis, it has been determined that all of the books include sustainable environment and climate change issues. The findings revealed that the subject of 'sustainable environment and climate change' was handled in the books in line with the developmental characteristics of the target group of children. It has also been determined that the books examined include the causes of climate change and what needs to be done for a sustainable environment. Taken together, the findings of this study have many important implications for educating children on the issues of sustainable development and climate change through popular science books.

Keywords: Children's literature, climate change, sustainable environment, popular science books

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INTRODUCTION

The general average values of the weather conditions of any geographical region are called climate. The change in the average values of weather conditions over long years is also called climate change. Global climate is a system connected to the ice sphere and the life sphere, as well as to the atmosphere, hydrosphere, and stony sphere, which are the layers of the Earth. Climate change can be seen as global and regional climate change and is caused by changes in natural conditions. These changes can be caused by natural means as well as by the human factor. The impact of climate change on humans and the environment has been the subject of research for centuries (Kahraman & Şenol, 2018). International reports on climate change are carefully followed by countries and international environmental organizations (IPCC, 2021). When we look at the studies carried out in this field around the world, "The Stockholm Conference" also known as the United Nations Conference on the Human Environment (UNCHE), attended by 113 countries in 1972 in the city of Stockholm, Switzerland, "Mediterranean Action Program prepared by the United Nations Environment Program (UNEP) in 1974 Plan (MAP)", "The establishment of the World Commission on Environment and Development (WCED) by the UN in 1983 under the chairmanship of Norwegian Prime Minister Brundtland", "The Rio Summit held in the city of Rio de Janeiro in 1992 with the participation of 178 countries", "Japan in 1997" The signing of the Kyoto Protocol at the conference held in the city of Kyoto, in 2000) 10 organization", "Organization of the Council of Europe ministerial committee meeting in 2006", "Sustained by the MB in 2015" Arrangement of the Sustainable Development Program (UNDP)" (Aktaş, 2019) attract attention.

To draw attention to climate change in Turkey, as in different parts of the world, relevant institutions, organizations and universities have been trying to attract the attention of the public by organizing congresses with wide participation. One of the important studies in this field is the "1. Turkey Climate Change Congress – TİKDEK 2007 (TİKDEK, 2007). In the conference, various issues related to climate change that concern Turkey and the world were discussed. Turkey's signing of the "Paris Agreement" (RG, 2022) is also considered an indicator of the state's sensitivity to the issue. Again, the Ministry of National Education's bringing the subject of "Global Warming and Climate Change" to the textbooks (Aktaş, 2019; Ölger, 2019) is considered as an important attitude in terms of raising awareness of the individuals who will create the future. As it is known, the subject of "Climate Change and Global Warming" is included in the learning area of global connections, which is included in the 7th-grade social studies course (MEB, 2022). Studies on global warming and awareness studies continue and various academic studies on the subject (Bozkurt & Cansüngü Koray, 2002; Kınık & Toprak, 2016; Nacaroğlu & Bozdağ, 2020; Ünlü et al. 2011) have been conducted. With these studies, it is aimed to raise awareness on issues related to global warming and climate change, and to determine the approaches of academic circles, students, and the public. On the other hand, despite many academic studies in the field, it has been reported that the theoretical foundations

on the subject are weak, the human factor is effective in climate change, climate change is a natural process, people have no effect, etc. (Dönmez & Çelik, 2016; Ünlü et al., 2011).

Changes in one or more of the elements that make up the global climate cause regional climate change, and global changes cause global climate change (Türkeş, 2013). Environmental attitudes of people in the region they live in are very important in terms of regional climate changes. Since people living in some parts of the world behave sensitively to the environment they live in, the impact of climate change is less felt in the region they live in.

After the industrial revolution, rapid developments took place in the field of technology and science in the world, and these developments are continuing rapidly. It is accepted that the foundation of the industrial revolution was laid with the invention of the steam-powered machine in Scotland in 1763 by James Watt. The developments that started with the industrial revolution in the 18th and 19th centuries caused serious population movements and wars in the world as well as in Europe, particularly England (Başer, 2011). After the industrial revolution, mechanization, the life span of people, the time they receive information and access information have accelerated faster than before (Başer, 2011).

With the establishment of industrial zones, organized production increased, and migration from rural areas to industrial cities began for the needed workforce. As a natural result of this migration, the interest in the traditional agriculture and livestock sector has decreased. A rapid population growth emerged from the industrial zones, and consumption increased in parallel with this increase. Rapidly increasing urbanization in Europe in the beginning, then in the countries that were exploited by Europe and in the important industrial regions of the world brought along many problems such as illegal construction, transportation, education, housing, and heating. Both the rapidly increasing population and the necessary production works to meet the needs of this population and, many problems, especially the environmental pollution caused by this population, are closely related to the atmosphere (Başer, 20; Haradhan, 2019; Türkeş, 2013). For this reason, it is thought that the discussions on climate change and a sustainable environment will be among the important agenda items of the world's states in the future.

To meet the needs of the rapidly increasing population, production wheels turn non-stop 24 hours a day, new settlements are built on agricultural lands, and the environment is rapidly polluted as a result of the consumption emotions pumped by the press and media. Due to their nature, people primarily seek solutions to the problems they first encounter; they did their best to meet their basic needs such as heating, shelter, food, and drink, and as a result, they ignored the damage they caused to the environment. In this destruction, the degeneration, insensitivity (Çelik & Küçük, 2020), singular and selfish philosophy of life, and self-centered thinking that emerged with the developing technology have a great effect. It is after a period of one hundred and fifty years that people become aware of climate change. From the industrial revolution to the present, unusual diseases, droughts or excessive precipitation, melting in glaciers, extraordinary changes in living things and plants have attracted the attention of people, and

their causes have begun to be investigated with developing medicine and technology. As a result of the research, the reality of regional and global climate change has been encountered.

It can be deduced that if the earth and its finite resources are continuously used carelessly, it will become difficult to shelter soon. For this reason, keeping the earth as a livable place concerns the entire world. If the necessary precautions are not taken and the necessary regulations are not introduced, the rapidly increasing world population will face major environmental disasters (Akin 2006; Karademiz et al. 2018) in the next century. Realizing this, scientists have increased their studies on climate change and livable environments. Relevant national, regional and international agreements are signed, meetings are held on certain dates, and training is held. Since minimizing climate change and having a sustainable environment is a problem that concerns the whole world, it will be possible to reach a satisfactory result with the work of all nations and states in collaboration. It is considered that international studies such as "Paris Climate Agreement" and "Kyoto Protocol" are important (Genç, 2021; Öztürk & Öztürk, 2019). While the people living in some regions are sensitive to nature, the insensitivity of those living in other regions will prolong and complicate the solution of the problem. Everyone has some responsibilities that they must fulfill. These responsibilities to protect the environment should be taught to children from an early age to increase their awareness of the subject. According to UNESCO, people of all ages all over the world should have quality education and gain knowledge, skills, and values having key roles *for a sustainable future and positive societal transformation* (UNESCO, 2005, p.6). In this context, it is our responsibility to educate children on issues such as sustainable environment and climate change since these issues will have more damaging effects for today's children in the future. Their knowledge and skills and awareness on these issues are directly related to a better future for them and also for the adults. The issue of climate change and a sustainable environment should therefore be taught in schools and should be addressed in social media inappropriate ways for all age levels.

TUBITAK is the institution at the center of scientific research in Turkey and is one of the important institutions that work on climate change and a sustainable environment on behalf of the public. At the same time, it supports this field with its publications and tries to raise awareness of our people on the subject.

The current study aims to draw attention to how children's books deal with the issue of 'climate change and sustainable environment' by investigating how these issues are handled as a popular science topic in children's literature. The obtained results are expected to shed light on the issue in terms of raising children's awareness of climate change and sustainable environment through popular science books. To this end, the following research questions guided the study:

1. Is the sustainable environment and climate change, a popular science subject, included in children's literature?

2. In which age group is the subject of ‘sustainable environment and climate change’ included in children's books and how it is dealt with?

METHODOLOGY

Research Design

This qualitative study aiming to investigate how the subject of ‘sustainable environment and climate change, a popular science subject in children's literature, is handled, was carried out using the document analysis technique. The document analysis technique was used in the current research because it was aimed to reveal an existing situation. The research sample was determined by criterion sampling, one of the purposive sampling methods. Qualitative research has been expressed with different names and definitions such as natural research, interpretive research, and field research due to its characteristics. Observation, interview, focus group interview and document analysis techniques are commonly used to collect data in qualitative research. According to Yıldırım and Şimşek (2018), since the validity of the data and the accuracy of the results are important in qualitative research, the researcher can benefit from more than one research technique depending on the subject and the characteristics of the target audience.

Reviewed Documents

Children's books published by TUBITAK for children between the ages of 2 and 12 constitute the research area of the study, which aims to investigate how ‘sustainable environment and climate change, a popular science subject in children's literature, is handled. From the popular books, 25 books on climate change and sustainable environment were taken as samples. The research is limited to the analysis of 25 books on the subject of ‘climate change and sustainable environment’.

Data Collection and Analysis

The books published by TUBITAK were examined and it was determined that the subject was included directly or indirectly in 25 books. After the relevant books were obtained, they were read, necessary examinations were made, notes were taken and the places in the books that would answer the problem sentence were determined. Findings of 25 books out of 346 children's books in the 2-12 age group published by TUBITAK are given within the framework of the relevant titles. The data collected in the research were subjected to document analysis, one of the data analysis techniques in qualitative research. For the document analysis, first of all, among the children's books published by TUBITAK for children between the ages of 2 and 12, books dealing with the subject of ‘climate change and sustainable environment’ were determined and studied in accordance with the purpose of the research. In this study, content analysis technique was used to evaluate the obtained data. In content analysis studies, according to Yıldırım and Şimşek (2018) data is coded and categorized, themes are found, data is

organized and defined according to codes and themes, and the findings are interpreted. However, in the current study for the research aims of the study, descriptive content analysis was used and a thematic analysis was not preferred.

FINDINGS

Findings Regarding the First Sub-Problem

The first sub-problem of the research is ‘Is "sustainable environment and climate change’, a popular science subject, included in children's literature? In the research, children's books, which are among the publications of TUBITAK Popular Science Books, were examined and it was determined that the subject of ‘sustainable environment and climate change was included in 22 books directly or indirectly. The books that directly or indirectly include the subject of “sustainable environment and climate change” and the pages they include are shown in the table below.

Table 1: List of books that directly or indirectly include the subject of Climate Change and Environmental Pollution.

Rank	Book name	Age Group	Page/s
1	Do not throw, use.	3	2, 27
2	Caring for our environment	3	12
3	What if we cope natural disasters?	6	38
4	Weather	6	-
5	Weather Conditions	7	-
6	Natural disasters	7	38
7	Rain forests	7	27
8	Why should I care the world?	7	22
9	Polar bears, Why are the glaciers melting?	7	30
10	Nature, Trees	8	54
11	Ecology	8	52
12	Climate change	8	2, 60, 63
13	Energy	8	60
14	The Kalundborg Gang	8	32
15	Arctic and Antarctic	8	-
16	Is wind power reliable?	12	3
17	Are Biofuels a Threat to Our Food Sources?	12	12, 16, 17,
18	Is Natural Gas a Clean Fossil Fuel?	12	25
19	Human vs. Nature	12	2,4,39
20	Energy Crisis	12	3,5,32
21	Rainforest Food Chains	12	45
22	River Food Chains	12	46

23	Ocean Food Chains	12	25, 41
24	Grassland Food Chains	12	36,43
25	Mountain Food Chains	12	46

Findings Regarding the Second Sub-Problem

The second sub-problem of the research is ‘in which age group and how is the subject of sustainable environment and climate change included in TUBITAK children's books. The findings regarding the books examined in the study and published by TUBITAK for children between the ages of 3 and 12 are presented in Table 1.

Table 2: List of books showing how and in which age group the sustainable environment and climate change issue is included

Rank	Book name	Age Group
1	Do not throw, use.	3
2	Caring for our environment	3
3	What if we cope natural disasters?	6
4	Weather	6
5	Weather Conditions	7
6	Natural disasters	7
7	Rain forests	7
8	Why should I care the world?	7
9	Polar bears, Why are the glaciers melting?	7
10	Nature, Trees	8
11	Ecology	8
12	Climate change	8
13	Energy	8
14	The Kalundborg Gang	8
15	Arctic and Antarctic	8
16	Is wind power reliable?	12
17	Are Biofuels a Threat to Our Food Sources?	12
18	Is Natural Gas a Clean Fossil Fuel?	12
19	Human vs. Nature	12
20	Energy Crisis	12
21	Rainforest Food Chains	12
22	River Food Chains	12
23	Ocean Food Chains	12
24	Grassland Food Chains	12
25	Mountain Food Chains	12

Table 2 shows that there is a total of 25 (books, two of which are for the three age groups, two for the six-year-olds, five for the seven-year-olds, six for the eight-year-olds, and ten for the twelve-year-olds.

Findings Related to Sustainable Environment and Climate Change in Three-Year-Old Children's Books

In the book titled 'Don't Throw, Use', the following statements about 'climate change and sustainable environment' are included: *"If we waste less and separate what we can recycle, there will be less environmental pollution and we can live longer in our world, breathe smoke-free air, swim in clean waters, and wander in litter-free forests and mountains"* (Roca, 2010, p. 28). In the book, attention is drawn to waste and environmental pollution caused by wastage. The importance of recycling the ones we consume to prevent environmental pollution was emphasized. The subject is explained in accordance with the developmental levels of children in the three age groups.

In the book 'Caring for Our Environment', attention is drawn to recycling on the subject of 'sustainable environment'. With the headline **"I Protect the Environment by Recycling"**, the following statements are included: *"We came back from the attic with a lot of useless things: bottles, old newspapers, and a doll with a broken leg... Let's throw them in the recycling bins for reuse," my mother said*" (Cabrera, 2011, p. 12).

Findings Related to Sustainable Environment and Climate Change in Six-Year-Old Children's Books

In the book named 'Weather', the effects of climate change are mentioned under the title of 'weather in the future'. It is stated that *"Across the world, air temperatures are slowly rising. This change in our world's climate is known as global warming. In many countries, winters are now warmer, spring comes earlier and summers are drier. Pollution has an impact on our climatic conditions. With winters getting warmer in the Arctic, the ice is melting faster than ever before. This negatively affects animals such as the Polar bear living in the Arctic"* (Chancellor, 2012, p. 28).

In the book named 'What If We Cope with Natural Disasters?', climate change due to global warming is shown as causing natural disasters. It is stated that *"Exhausts increase the greenhouse effect that causes our world to overheat. This increase in temperature also causes climate change on our planet. This is why hurricanes, droughts, and fires are now both more frequent and more destructive"* (Palattı, 2012, p. 24).

Findings Related to Sustainable Environment and Climate Change in Seven-Year-Old Children's Books

The book 'Weather Conditions' provides encyclopedic information about weather conditions and weather events. With the title of 'Global Warming', information about global warming is given and it is stated that oil, coal, and similar fuels cause global warming. It is mentioned that as a result of global warming, *"the atmosphere warms up because these gases trap the heat of the Sun"* (Clarke, 2013, p. 28).

In the book titled, ‘Why Should I Care About the World?’ encyclopedic information is given on various topics related to life on earth. Under the title of ‘**Overheating**’, it is pointed out that our planet is getting warmer and information about greenhouse gas is given (Meredith, 2012, p. 8). In the title of ‘**Climate Change**’, information about climate change is given and it is stated that if the climate gets too hot, it will cause droughts and floods, and if it gets too cold, it will cause the destruction of agricultural products (Meredith, 2012, p. 9). Information about recycling is given under the heading ‘**Use Less, Reuse, Recycle**’, and it is stated that more than 60% of household waste can be recycled. Under the title of ‘**What Are the Leading Threats to the Environment?**’, brief information about the environmental problems awaiting our planet is given and what we can do is briefly mentioned (Meredith, 2012, p. 40).

In the book called ‘Natural Disasters’, encyclopedic information about natural disasters and their causes is given and what can be done against natural disasters is explained. Under the title of ‘**A Huge Greenhouse: The World**’, it is stated that motor vehicles, factories, and power plants are constantly pumping gas into the atmosphere. It is stated that these gases cover the atmosphere like a quilt and cause climate change and our planet to become warmer. What we can do against global warming is pointed out by stating “*We can help our Earth by consuming less energy, throwing our garbage in recycling bins and using less fuel as possible*” (Guire Mc, 2013, p. 38). It is noted that climate change causes the melting of glaciers in the polar regions, and it is pointed out that the animals living in that region are in danger of extinction (Guire Mc, 2013, p. 30).

The book ‘Rainforests’ provides encyclopedic information about rainforests, the creatures living in them, and the climate of rainforests. Under the title of ‘**Endangered**’, it is stated that rainforests are being destroyed and may disappear in the next fifty years. Drawing attention to the extinction of many plants and animals with the depletion of rainforests, it is stated that “*This loss will also be disastrous for the climate of the world*” (Ganeri, 2013, p. 27).

In the book titled ‘Polar Bear, Why Are the Glaciers Melting?’, the polar bear and the glacial region it lives in, the reasons for the melting of the glaciers, and what can be done against this danger are explained. It is emphasized that scientists are worried, that the temperature of the Arctic region is gradually increasing every year and that the glaciers are melting (Wells, 2015, p. 7). In the book, the greenhouse gas and greenhouse effect is defined and the benefit of the greenhouse effect to the earth is emphasized. The damage to the global climate with the level of greenhouse gases above normal is explained by “*if there are too many greenhouse gases in the air, the air can get too hot. This is what is happening now in the Arctic and around the world*” (Wells, 2015, p. 14). The causes of climate change are indicated and information is given about what we can do to prevent it (Wells, 2015, pp. 28-33).

Findings Related to Sustainable Environment and Climate Change in Eight Age Group Children's Books

In the book called 'Trees', encyclopedic information about the tree is given under different titles from seed to adult. Under the section title of "Trees and People", the human-tree relationship has been mentioned in general. In the section where how the tree is used by human beings, the place of the tree in daily life, and the importance of the tree in our life are explained, attention is drawn to the important functions of trees in maintaining the heat balance in the world. After expressing "*But without trees that maintain this balance, too much carbon dioxide builds up in the air, causing less and less heat to escape from the atmosphere. This causes the entire planet to heat up like an oven*" (Howell, 2019, p. 70), the section gives information about what can be done to protect the trees (Howell, 2019, p. 71).

In the book named 'Ecology', ecology is defined and encyclopedic information is given under the main headings on the subjects related to ecology in general. Under the main title of '**Nature's Cycles**', nature's cycles are explained and information about fossil fuels is given. It has been stated that the excessive consumption of fossil fuels for the last 150 years has caused the greenhouse gas effect and triggered global warming (Eason, 2019, p. 18). Climate information is given under the main title of '**Climate and Earth**'. In the section where information about the factors affecting the climate is given, it is stated that the temperature of the world has increased by 50°C in the last fifty years due to human-induced pollution under sub-titles such as "ozone layer, greenhouse effect", and it is stated that this causes global warming (Eason, 2019, p. 27). Under the main heading of '**Ecology**', it is stated that modern production techniques started after the industrial revolution, and accordingly, industrial facilities consume huge amounts of energy and natural resources, and the world population is increasing rapidly. To meet the rapidly increasing needs, it is pointed out that the unconscious destruction of rainforests increases global warming (Eason, 2019, p. 47). In the main title of '**Environmentalism**', information about the environment and environmentalism is given and the principles of environmentalism are discussed. In the section where information about what should be done for a sustainable environment is given, it is pointed out that the biggest duty belongs to humans (Eason, 2019, pp. 57-62).

The book 'Climate Change' provides encyclopedic information on climate and climate change under different headings. Emphasizing that climates are changing in the main title of '**World Climate**', attention is drawn to climate change by expressing "*Climate scientists working at research centers like this station in Antarctica are sure that temperatures are increasing worldwide*" (Woodward, 2015, p. 7). Under the heading of '**Controls and Balances**', it is stated that the ever-increasing global temperature will make the world warmer in the coming years and may have serious consequences for all humans (Woodward, 2015, p. 12). Under the title of '**Human Impact**', the human impact on global warming is emphasized. Concerning the cause of the overheating in the last century, it is stated that "*the acceleration in global warming is*

most likely due to our modern lifestyle, which is dependent on energy consumption” (Woodward, 2015, p. 16). With the title ‘**Burning Forests**’, it is pointed out that burning forests triggers global warming (Woodward, 2015, p. 18). In the ‘**Additional Issues**’ heading, information is given about the burning of forests that cause global warming and various factors other than fossil fuels. The heading ‘**Forecasting Future Climates**’ provides predictive information about what kind of problem will be faced in the future if global warming continues in this way and mentioned that “if we do nothing to stop climate change, temperatures may increase by 3°C or more by 2100, which may cause serious problems” (Woodward, 2015, p. 37). With the title of ‘**Next Century**’, it is emphasized that global warming will continue to increase throughout the 21st century and what kind of dangers await the world in this period. The title of ‘**Climate Change and Society**’ describes the effects of climate change on society (Woodward, 2015, p. 44). Under the title of ‘**Combating Climate Change**’, what has been done and what can be done against global warming has been examined. It is emphasized that developed countries do not want to give up on modern technologies that cause warming in the fight against global warming. It is also highlighted that new and harmless technologies can offer positive opportunities and stated that “*therefore, agreements are being worked on to combat climate change gradually*” (Woodward, 2015, p. 48). Under the title of ‘**Energy Efficiency**’, the importance of efficient use of energy for a sustainable environment is highlighted.

In the book called ‘Arctic and Antarctica’, encyclopedic information is given under different headings about plants, living things, and people living in the Arctic and Antarctic regions. Under the main title of ‘**Climate in the Past and Future**’, it is emphasized that the world is currently experiencing a rapid warming period and that the effects of this warming will have very dramatic consequences in the polar regions and other parts of the world. In addition, it is emphasized that the level of carbon dioxide in the atmosphere has increased continuously since 1958, and this situation is caused by excessive fuel use, and it is pointed out that excess carbon dioxide released into the atmosphere causes global warming (Taylor, 2015, pp. 66-67).

In the book called ‘Energy’, encyclopedic information is given on the topics related to energy, types of energy, areas of use of energy, etc. under different headings. Under the title of ‘**Energy on a Global Scale**’, it is stated that the source of the energy we use is fossil fuels. It is pointed out that if energy consumption continues at this rate, oil and natural gas may run out after a certain period, and coal within 200 years. It is emphasized that this increase in the use of fossil fuels also causes global warming (Challoner, 2015, p. 55). In the section titled ‘**Alternative Energy**’, it is stated that such a large consumption of fossil fuels causes global warming, and energy resources will be depleted. By explaining what can be done against the danger of depletion of energy resources in the future, attention is drawn to alternative energy sources. Solar energy, hydroelectric energy, and wave energy are specified as alternative energy sources (Challoner, 2015, p. 57).

In the book called ‘Kalundborg Gang’, some activities done by the children named Viggo, Victor, Alan, Emil, and Oliver to protect the beach and ducks in Kalundborg, a small port city in the early 1980s were mentioned. The children found a baby duck by the lake and took it under protection. From time to time, the children write letters to the baby duck's family, expressing what they have done for the environment along with the condition of the baby duck and what more needs to be done. After the children's demonstration, the authorities took some decisions to protect the environment. According to this decision, energy use and polluted water will be controlled and used more efficiently (Nam, 2017, p. 23). Thus, the environment will be protected (Nam, 2017, p. 27).

Findings Related to Sustainable Environment and Climate Change in Twelve-Year-Old Children's Books

In the book named ‘Wind Energy’, encyclopedic information about wind energy is given and attention is drawn to the importance of wind energy for global warming and a sustainable environment. Under the title of ‘**What is the problem?**’, it is emphasized that using fossil fuels pollutes the atmosphere and causes global warming. In response to this situation, it is stated that “*the challenge ahead of us is to find reliable alternative energy sources that do not increase our environmental problems*” (Pipe, 2013a, p. 3). In addition, it is stated in the book that wind energy alone cannot be a solution to all energy needs because the wind does not blow on some days.

In the book named ‘Biofuels’, encyclopedic information about biofuels is given. Under the title of ‘**What is the Problem**’, it is stated that the energy we use is generally obtained from fossil fuels, but fossil fuels cause global warming. It is emphasized that biofuels can be used as an alternative to fossil fuels. On the other hand, it means that the product to be used to obtain biofuel is the use of the fields that provide us food and the water used to irrigate the fields for biofuel (Pipe, 2013b, p. 3). At the end of the book, information is given about the pros and cons of biofuels and renewable energy sources (Pipe, 2013b, p. 29).

In the book called ‘Natural Gas’, encyclopedic information is given on the subjects of natural gas, its production, use, contribution to the environment, etc. Regarding the use of natural gas, it is considered that “*Although burning gas causes global warming due to greenhouse gas emissions, it causes much less pollution than burning coal*” (Pipe, 2013c, p. 3). It is emphasized that natural gas emits 45% less carbon dioxide than coal and 30% less carbon dioxide than oil, emphasizing the importance of natural gas in reducing global warming (Pipe, 2013c, p. 7).

In the book called ‘Humans vs. Nature’, encyclopedic information is given on natural disasters, planning the future, and the effect of humans on nature. Under the title of ‘**Human's Impact on Nature**’, information about harmful gases is given and the concern of fossil fuels is expressed by stating “*Every day, with the burning of fossil fuels used to run power plants, factories, airplanes, and cars, enormous amounts of carbon dioxide (CO₂) and other gases are*

released into the air, which scientists think that this causes global warming” (Mason, 2013, p. 36). In the book, information about global warming is given, and what can be done to reduce it is emphasized.

In the book called ‘Energy Crisis’, there is encyclopedic information about various subjects under different titles such as energy types, energy sources, and energy crisis. Under the subtitle of **‘Problems Related to Fossil Fuels’**, the problems caused by fossil fuels are listed and it is emphasized that fossil fuels cause global warming (McLeish, 2013, p. 11). Under the title of **‘Global Warning’**, global warming caused by fossil fuel use and its effect on our planet is explained and it is stated that *“these effects will have some costs for humans; economies will suffer, global food production will change, and societies will deteriorate”* (McLeish, 2013, p. 29).

In the book ‘Rainforest Food Chains’, encyclopedic information is provided on the subjects of the rainforest food chain, rainforest habitat, what needs to be done to protect rainforest food chains, etc.

With the title of **‘How Are Humans Harming Rainforest Food Chains?’**, information about the damage caused by humans to rainforests is given. The importance of rainforests for our world is emphasized and it is pointed out that rainforests are a “carbon sink” and contribute to reducing global warming (Moore, 2013a, p. 35).

In the book ‘River Food Chains’, encyclopedic information is given on subjects such as the river food chain, river food chains around the world, etc. under the relevant headings. Under the title of **‘Climate Change’**, it is stated that global warming causes climate change and that many rivers all over the world face the danger of drying up due to climate changes. It is also expressed that the waters of the rivers that are in danger of drought decrease so that the river beds that turn into swamps become the nest of flies, which are the carriers of diseases (Lynette, 2013a, p. 39).

In the book ‘Ocean Food Chains’, information about subjects such as the ocean food chain, where the ocean food chains are in the world, how the ocean food chains are in different parts of the world, etc. is given under different headings. Under the heading of **2Losing a Link in the Chain: Southern Ocean Krill’**, the impact of global warming on ocean food chains was emphasized by stating that *“the number of krill in the Southern Ocean has decreased by about 80 percent since the 1970s. Many krill in the Southern Ocean depend on algae living in sea ice. Global warming has caused this sea ice to melt. Therefore, the number of algae required to feed the krill has decreased. If krill numbers continue to decline, the entire Southern Ocean food chain will be endangered”* (Moore, 20014b, p. 19). More information is given about the oceans. Global warming threatens many species in the oceans. The rising temperature of the ocean is causing the death of sensitive corals. A study has shown that 95% of corals will disappear by 2050 (Moore, 20014b, p. 33). Corals are a food source for many reef-dwelling

species. The disappearance of corals means that other species will also be endangered. Depending on the climate that changes with global warming, the glaciers melt, the sea rises, the direction and characteristics of the currents change. With the melting of glaciers, the amount of ice that polar bears will rest on while swimming is decreasing. As this situation makes it difficult for polar bears to hunt, their species are endangered (Moore, 20014b, p. 36).

In the book called ‘Grassland Food Chains’, encyclopedic information about grassland food chains is given under different headings. Under the title of ‘**Climate Change**’, it is stated that the temperature has increased all over the world in the last hundred years, and accordingly the temperature has increased in the meadows. Some bird species will migrate to other areas to find cooler places during their nesting season. On the other hand, it will be more difficult for the grasses that the birds will eat to grow in the meadows (Silverman, 2014, pp. 38-39).

In the book called ‘Mountain Food Chains’, encyclopedic information is given on the subjects such as the mountain food chain, the creatures in the mountain food chain, how people harm the mountain food chains, etc. under headings. It is stated that as a result of global warming, the number of Vancouver marmots living in the high mountains of Canada's Vancouver Island has decreased (Lynette, 2014, p. 17). Continuing their lives in cold weather conditions, picas have had to migrate to colder places with global warming. If global warming continues, if they cannot find a cold place to migrate, they will become extinct (Lynette, 2014, p. 33). For a sustainable environment, it is important to teach people about food chains (Lynette, 2014, p. 42). Thus, people will act more consciously towards nature.

CONCLUSION and DISCUSSION

Children are faced with problems of climate change, environmental pollution, and loss of biological diversity (Hedefalk et al., 2015). Therefore, teaching children about environmental issues has become an important issue. Such an education in schools may bring about positive results in terms of environmental protection (Nikolaeva, 2008). Moreover, raising awareness of children on sustainable environment and climate change has a significant role in developing their life-long protective and caring attitudes towards the environment (Barratt-Hacking et al., 2007). Apart from a need for integrating sustainable environment and climate change issues into the school curriculum, it is important to provide resources for children such as books to increase their knowledge on the issues. In line with this, the current research aimed to investigate how the subject of ‘sustainable environment and climate change’ is handled as a popular science subject in children's literature. To this end, children’s books published by TUBITAK for children aged 2-12 were examined, and among these books, those that touch on the subject of "sustainable environment and climate change" were selected for research. In this context, 25 books among 346 books were examined through document analysis.

The findings revealed that the subject of sustainable environment and climate change is handled with different aspects in all of the books examined for seven different age groups. In the study, it was determined that the perception levels of children in different age categories about environmental and climate problems are different (Doğar & Başbüyük, 2005). For this reason, the same problem takes place with different expressions and visuals in children's books for different age groups. In children's books, "theme, heroes, language and expression, images used, interior and exterior design of books" etc. It is known that the subjects vary according to the age groups of the target audience children (Çiftçi, 2013). The subjects in the books written for younger children are handled with shorter sentences, while for older children, long sentences, numbers, and statistical information are provided. In the images used in preschool children's books, "pictures" instead of "photographs" (Külük, 2013) are preferred. It has been determined that the visuals used in the examined books are suitable for the age and developmental characteristics of the children. The visuals used in the books are also suitable for the age and developmental characteristics of the children. In the books prepared for preschool children, pictures are preferred instead of photographs. In the books prepared for school-age children, it has been determined that photographs are used instead of pictures. Such differences in the books based on the age groups are important to note. The selection of images and length and complexity of the information given is important criteria when presenting the issue to the different age groups through popular science books. Addressing the issue of sustainable environment and climate according to the level of children is evaluated positively (Çiftçi, 2013) in terms of developmental periods of the targeted children age group.

In the books examined, the mistakes made by the states and people for a sustainable environment are emphasized in connection with the subject. It has been determined that there are common mistakes about the environment. As it is known, the issue of global warming, climate change and sustainable environment is an issue that concerns all parties living in the ecosystem (Kaymaz & Tut, 2020). States, institutions and organizations, and citizens have separate duties. It is known that there are internationally accepted attitudes on the subject (Özkaya, 2013). In all of the books, reasons such as the destruction of forests for various reasons, the unconscious use of fertilizers and water for more production, the opening of fertile lands, and pastures to settlement and tourism have been identified as mistakes made on the subject of a sustainable environment. Natural disasters caused by people's wrong attitudes and behaviors also pose another problem for the sustainable environment. Forests that are burned to make agricultural land and cut illegally for commercial purposes cause landslides. The settlements established on the stream bed result are another reason for the environmental disaster after floods. Unconscious and illegal fishing in the seas is another danger for the sustainable environment. Endangered species as a result of overhunting may increase the number of other species and disrupt the life chain, posing a threat to the sustainable environment. It is thought that global warming, climate change, and sustainable environmental education should start in the family from a young age and continue in environmental and educational institutions, and it is important to include the subject in the programs of educational

institutions (Tanriverdi, 2009). The subject is considered an important issue concerning the future of the world that individuals and societies should internalize in their daily lives.

Although the books examined were written for children, what adults and children should do about the sustainable environment are also partially emphasized in the books. It has been determined that the targeted books include suggestions: children should have a picnic in the countryside with their families and friends, plant new trees, not pollute the environment, leave the waste in suitable places, send the used items for recycling, etc. It has been evaluated as a positive situation in the context of sustainable environment and climate change that solutions are presented along with the problems experienced in the environment and climate.

The issue of global climate change is covered in all of the books reviewed. Excessive use of fossil fuels is shown as the main cause of global warming. With the mechanization that started after the industrial revolution, mass production was started in the industry. Continuous and more energy was needed in mass production. Continuity of energy is possible with the use of fossil fuels. Excessive use of fossil fuels also creates a greenhouse effect and causes global warming (Kahraman & Şenol, 2018). The effects of global warming on our world are explained in connection with the subjects in the books. The warming in the poles and the melting of glaciers threaten both the world's water resources, settlements, and agricultural lands for a long time. At the same time, many species living in the Antarctic region are in danger of extinction in the future. Global warming causes floods with more rain in other parts of the world. As a result of floods, agricultural and residential areas are damaged. On the other hand, as a result of global warming, many species living in drought-ridden regions are in danger of extinction. While the books examined tell what children can do against global warming in accordance with their age, the inclusion of what adults can do as well against global warming is considered a positive approach.

Sustainable environment and climate change is a major problem faced by the earth. This problem is also the main source of other problems that are experienced. To solve the problem, people need to be informed and educated on the subject from a young age. Based on the analysis in the current research, TUBITAK children's books can be recommended for out-of-school reading to raise awareness about the sustainable environment and climate change. Moreover, in developing projects for raising the awareness of children on the subject, these popular science books by TUBITAK can be benefitted. Further research can be conducted on different children's books in terms of age and handling of sustainable environment and climate change. It is considered that popular science books published by TUBITAK can have positive influences on raising the awareness of children about the sustainable environment and climate change.

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