REVISITING YOUNG STUDENTS' PERCEPTIONS OF GLOBAL CLIMATE CHANGE IN RELATION TO PSYCHOLOGICAL VARIABLES

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ABSTRACT

REVISITING YOUNG STUDENTS' PERCEPTIONS OF GLOBAL CLIMATECHANGE IN RELATION TO PSYCHOLOGICAL VARIABLES

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The present study aims to identify the profiles of middle school students' perceptions toward Global Climate Change from psychological perspectives, such as the reality of climate change, the human and natural process causes of climate change, positive and negative consequences of climate change, consequences of spatial distance and proximity, and temporal distance. Data were collected from 1000 middle school students enrolled in grades 5-8, through the Turkish version of the Climate Change Perception Scale, and the Bipolar Format of the Climate Change Perception Scale originally developed by Van Valkengoed, Steg, & Perlaviciute (2021), and later, subjected to explanatory factor analyses were conducted. Explanatory factor analyses yielded a similar factor structure to the original Scale. In particular, the eight factors extracted in the Climate Change Perception Scale, and Bipolar scale have produced 3 factors. Cronbach alpha coefficient for each dimension ranged from .75 to .91. Data, then, were analyzed by using descriptive statistics, means, standard deviation, and frequency analyses. The results showed that the majority of the students thought that climate change is happening, that climate change has more negative consequences compared to positive consequences, and that human actions cause climate change more than

natural processes. However, students remained, undecided about the time and location of the consequences of climate change. This study explained the perceptions of middle school students concerning climate change changes vary with respect to its reality, causes, consequences, and consequences of distance and time.

Keywords: Global Climate Change, Perceptions of Climate Change, Spatial Proximity, Spatial Distance and Temporal Distance

ÖZ

ÖĞRENCİLERİN KÜRESEL İKLİM DEĞİŞİKLİĞİNE YÖNELİK ALGILARININ PSİKOLOJİK DEĞİŞKENLER İLE YENİDEN GÖZDEN GEÇİRİLMESİ

Aslan, Şeyma İrem
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Bu çalışma, ortaokul öğrencilerinin Küresel iklim Değişikliğine yönelik algılarını, iklim değişikliğinin gerçekliği, iklim değişikliğinin nedenleri (insan aktiviteleri ve doğal süreçler), iklim değişikliğinin olumlu ve olumsuz sonuçları, mekânsal mesafe ve yakınlığın sonuçları ve zamansal mesafe gibi psikolojik perspektiflerden tanımlamayı amaçlamaktadır. Van Valkengoed, Steg & Perlaviciute (2021) tarafından geliştirilen İklim Değişikliği Algı Ölçeği ve İklim Değişikliği Algı Ölçeğinin Bipolar Formatının Türkçe versiyonu üzerinden 5-8. Sınıf düzeyleri arasında kayıtlı 1000 ortaokul öğrencisinden veriler toplanmış ve açıklayıcı faktör analizleri yapılmıştır. Açıklayıcı faktör analizleri, orijinal Ölçeğe benzer bir faktör yapısı ortaya çıkarmıştır. Faktör analizlerinde İklim Değişikliği Algılar Ölçeği için 8 boyut, bipolar bölüm için 3 boyut bulunmuştur. Her boyut için Cronbach alfa katsayısı .75 ve .91 arasında değişmiştir. Veriler, ortalama, standart sapma ve frekans analizlerini içeren tanımlayıcı istatistikler kullanılarak analiz edildi.

Çalışmanın sonucunda, öğrencilerin çoğunluğunun iklim değişikliğinin gerçekleştiğini, iklim değişikliğinin olumlu sonuçlara kıyasla daha olumsuz sonuçları olduğunu ve insan eylemlerinin iklim değişikliğine doğal süreçlerden daha fazla neden olduğunu düşündüğünü göstermiştir. Ancak öğrenciler, iklim

değişikliğinin sonuçlarının zamanı ve yeri konusunda kararsız kaldılar. Bu çalışma, ortaokul öğrencilerinin iklim değişikliğine yönelik algılarının, iklim değişikliği sonuçlarının mesafe ve zaman açısından değerlendirilmesi, gerçekliği, nedenleri ve sonuçlarına ilişkin algılarını açıklamıştır.

Anahtar Kelimeler: Küresel İklim Değişikliği, İklim Değişikliği Algıları, Mekansal Yakınlık, Mekansal Uzaklık, Zamansal Uzaklık

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CHAPTER 1

INTRODUCTION

For many years, people faced environmental problems such as climate change, air and water pollution, drought, and global warming (The Intergovernmental Panel on Climate Change IPCC 2021; World Commission on Environment and Development, [WCED] 198. One of the significant problems considered is climate change (IPCC 2014, Lombardi &. Sinatra, 2013; Masson-Delmotte et al. 2021; Steffen et al., 2015; Trenberth, 2018). It is defined by Weber (2016, p. 125) as 'an abstract statistical phenomenon, namely a slow and gradual modification of average climate conditions, and thus a difficult phenomenon to detect and assess accurately based on personal experience. Many believe that Climate Change is a natural occurrence and can be triggered various events such as volcanic eruptions (Reddy, 2015), changes in the Earth's orbit, internal variability, fluctuations in the sun, and ocean currents (Wibeck, 2014). All of these factors can affect the climate, as can human actions (e.g., Dunlap et al., 2005). Yet, there is a scientific agreement about anthropogenic climate change (IPCC, 2007). As Rousell and Cutter-Mackenzie-Knowles (2020, p. 191) recently stated, '*the reality of anthropogenic climate change has been established 'beyond reasonable doubt' by leading scientists worldwide.'* In line with this idea, several researchers turned their attention to examining people's levels of awareness regarding the causes and consequences of climate change (positive or negative consequences) and the consequences of their actions on climate change (Brügger et al., 2015;;Duke & Holt, 2022; Hiğde, Sahin & Oztekin, 2017; Hoogendoorn, Sütterlin & Siegrist 2020; Lorenzoni et al. 2007; Steg, 2018; Van Valkengoed & Perlaviciute 2021; Wolske & Stern, 2018; Weber, 2016. Whitmarsh, 2009; 2011).

Another line of research explored the potential relationship between climate change and spatial distance and proximity Alper, Sahin, & Oztekin**,** 2021; Duke & Holt, 2022; Spence et al., 2011; Van Valkengoed & Perlaviciute, 202. While Spatial Distance and Proximity are for analyzing the effects of the consequences in which area, explaining the physical distance, the consequences of the climate will be in places far away from the participants or in the place where they live. On the other hand, Temporal Distance is used for analyzing the time distance, like whether the consequences of climate change will happen in the distant future or whether the participants will feel the consequences after a long time (Trope & Liberman, 2010).

The spatial and temporal distance items provide a deeper perspective on climate change and its consequences (van Valkengoed et al., 2021). The terms- Spatial Distance and Proximity- come from the Construal Level Theory (CLT). It is a social psychology theory that explains the relationship between psychological distance and how concrete or abstract people's thinking is about things like objects and occurrences (Trope & Liberman, 2010). The main idea of the CLT is that objects are conceived of more abstractly the more they are from the individual and more concretely the closer they are.

According to Trope & Liberman (2010), the degree to which we see an event, person, or concept as high- or low-level influences psychological distance, determining how concrete or abstract such ideas are: high- and low-level construal. The high-level construal means that when individuals think abstractly, they are constrained at a high level. When considering this level, individuals should pay more attention to specifics, but rather the greater picture. When viewing something from a distance, individuals concentrate on critical details that convey the essence of the situation or item. Low-level construal, connected to psychological proximity, occurs when individuals think more specifically. When someone is low-level construing, they pay close attention to the present. When considering at a low level, people tend to concentrate on the extraneous details that are less crucial to understanding the situation or thing. Briefly, Construal level theory states that people observe events differently depending on the type of psychological distance,

spatial distance, temporal distance, social distance, and hypothetical distance (Spence et al., 2011).

The aforementioned studies have offered a comprehensive understanding of various factors that could influence people's perception of climate change. Building upon this, the current study has employed factors such as Reality, Human and Natural Process Causes, Positive and Negative Consequences, and Consequences of Spatial and Temporal Distance to investigate the perception of climate change among young students who are already facing the reality of a changing climate (Corner et al., 2015). Therefore, this study can be seen as an initial step toward creating a typology of how Turkish middle school students perceive global climate change.

1.1. The Purpose of the Study

This study aims to identify the profiles of middle school students' perceptions toward global climate change from different perspectives, such as the reality of climate change, the human and natural process causes of climate change, positive and negative consequences of climate change, consequences of spatial distance and proximity, and temporal distance. The study's findings can be used to educate individuals about the impact of human activities on the Earth's climate system and vice versa, thereby enhancing their climate literacy *(*Shepardson, Roychoudhury, Hirsch, Niyogi & Top, 2014).

1.2. The Significance of the Study

This study has several significances. One significance relies on the topic under consideration. Climate is a complex system that includes many components, sub-components, and processes interacting with each other either directly or indirectly *(*Shepardson et al., 2014) Roychoudhury, Shepardson, and Hirsch (2017, p. 29). Climate also "is an ideal interdisciplinary theme for lifelong learning about the scientific process and how humans affect and are affected by the Earth's systems." (NOAA, 2009, p.5). Linking the different domains of science (Sneider,

Bar, & Kavanagh, 2011), climate and underlying concepts are included in the Science, Social Science, and Geography Curriculum (MoNE 2018) to develop young students' Climate science literacy levels. In fact, 'Climate science literacy is known to be part of science literacy' (NOAA 2009, p.3), which is the vision of the national science curriculum (MoNE, 2018). A scientifically literate person can understand the term climate change and its causes and consequences and can do something to change the world. Scientifically literate people ask, determine, find answers, analyze, create questions, and creatively use curiosity in everyday actions (Azevedo & Marques, 2017). Also, People with climate science literacy know how computer modeling and observations of the climate contribute to our understanding of the climate. They understand the complicated relationship between human existence and climate and how climate has always influenced human life (Azevedo & Marques, 2017). Its complex and interdisciplinary nature creates obstacles to understanding climate and underlying concepts, including climate change, and often leads to the development of misconceptions. (Jarrett & Takacs, 2020; Shepardson, Niyogi, Choi, & Charusombat. 2009).

In this aspect, curricular significance is another significant aspect of the current study. Therefore, identifying the patterns of young students' perceptions of climate change can guide future changes in the science curriculum. In this aspect, curricular significance is another significant aspect of the current study. Therefore, identifying the patterns of young students' perceptions of climate change can guide future changes in the science curriculum.

Another significant study aspect is its reliance on its target group, which includes middle school students in grades 5, 6, 7, and 8. These students are likely to be more affected by climate change than the previous generation (Kuthe, Körfgen, Stötter & Keller, 2020, p. 375), as they are the ones facing the reality of a changing climate Corner, et al., 2015). These students are regarded as the future users of the environment (Bogner and Wiseman 1997, p.120).-**.** As Lyons and Breakwell (1994, p. 224) have pointed out**,** 'young people are the ones who will directly use the environment and will directly experience the consequences of all of the actions.'

Lastly, this study utilizes a recently developed tool (van Valkengoed et al., 2021) to gather students' perceptions about climate change from a wider perspective. Thus, by taking several critical factors underlying climate change into account, including its reality, causes, consequences, and spatial and temporal distances, current study aims to provide detailed and valuable insights into young students' perceptions of climate change, which can contribute to the existing literature on the topic.

1.3. Research Questions

The study has one main research question and 5 sub-questions.

1) What are the profiles of middle school students' perceptions toward global climate change with respect to Reality, Human and Natural Process Causes, Positive and Negative Consequences, Consequences of Spatial Distance and Proximity, and Temporal Distance?

Sub-questions:

1) What are the students' perceptions with respect to Reality of Climate Change?
2) What are the students' perceptions with respect to Natural and Human Causes of climate change?
3) What are the students' perceptions with respect to Positive and Negative Consequences of climate change?
4) What are the students' perceptions with respect to Spatial Distance and Proximity of climate change?
5) What are the students' perceptions with respect to Temporal Distance of climate change?

1.4. Operational Definitions

Global Climate Change: Global Climate Change is the changes in the average situations like rainfall and temperature in a special area during an extended period. It is a fact that the climate system changes over time due to the influence of its internal dynamics or external factors. Even before people entered the environment,

the climate of Earth was continually changing. Scientists have recently noticed strange alterations, though. For instance, during the past 150 years, the average Earth's temperature has risen significantly more swiftly than predicted. These changes can be happened because of the human impact. (Dietz et al., 2020, p136)

Perceptions of Climate Change: The idea and the term of the Climate is changing and the reasons, consequences, or schedule of it includes the perception of the topic. Having knowledge and understanding of the Climate Change topic from different perspectives means that there is a perception. Awareness is also having the same meaning as perception. People's awareness and admitting that Climate Change is a real problem is also a perception. The perception also can be negative like "Climate Change is not a real problem; it is an overrating topic.". Perception is the viewpoint of the topic. The people's climate change perceptions mean people' perceptions of reality, causes, consequences, spatial proximity, distance, and temporal distance of the consequences of climate change. (van Valkengoed et al., 2021, pg. 1)

Spatial Proximity: One of the most helpful perceptual organizing principles is spatial proximity. Perceptually, objects that are close to one another are grouped. One of the most helpful perceptual organizing principles in the place of areas relative to each other is also Spatial Proximity (Ware, C., 2019, p.183). For example, the arrangement of neighborhoods in a city, or the places relatively close to the living area.

Spatial distance: The physical distance between the events' locations is known as the spatial distance. The processing level is minimal if the event, like a graduation, is taking place across the street. The graduation is handled on a high level if it happens in another state. An event is seen more abstractly when it is distant from a person. Likewise, events are perceived as having more substance when they are close by. (Trope & Liberman, 2003,2010)

Temporal Distance: One of the many forms of psychological distance that have been demonstrated to change people's perceptions of the future is temporal

distance. According to conceptual level theory, people's reactions to future occurrences are altered by temporal distance because it alters how they see such events in their minds. The wider the temporal distance, the more possible it is that events will be represented using a few high-level construal that capture the perceived substance of the events rather than more detailed and incidental information. (low-level construal). (Trope & Liberman, 2003,2010)

CHAPTER 2

REVIEW OF THE LITERATURE

In this chapter of the study, Climate change perceptions, psychological variables in climate change, and climate change perception levels among students were examined. If the perception is high or increases with time, the effects, consequences, or causes of it could be decreased. Also, the literature gives a general opinion, the importance of the topic, and the significance of the study. There could be some research about the topic, but this study combines them in one point and adds some specific points that are mentioned in the significance part of the study. This chapter starts with climate change perception studies and ends with the perception levels among students. The review of the results and some research details of the studies are examined and all of them give a basic understanding of the study and other chapters.

2.1. Climate Change Perceptions

In a research conducted by Dubel & Bas (2017), globally, people believe that climate change poses a threat to human well-being and is an obstacle to the sustainable growth of local economies and communities. While some nations and areas are predicted to benefit little from the changes in climate, others stand to lose significantly. Natural disasters are becoming more common, which is a warning sign of the changes. However, the answers to the following questions are crucial for effective and efficient adaptation in different parts of the world: do people notice the changes, do they experience their negative effects, are they satisfied with the government's efforts to mitigate and adapt to climate change, and are they willing to participate in these efforts? The way that people view and feel about these issues has a significant role in how well climate policies are implemented. A study was conducted in Poland and Turkey to gather information on people's attitudes and

views about climate change, as well as the mitigation and adaptation strategies that are associated with it. These two nations were picked to represent the range of climatic conditions. The paper's objective is to present and analyze the data gathered from nationwide Internet polls (N=156) on how people in both nations perceive climate change and what the public expects to happen to address it. Understanding the issues and societal demands associated with climate change is made easier with the analysis of the survey findings.

Climate Change is a popular topic nowadays. Climates are changing because of global warming and people's perceptions about this topic are important for everyone (Brechin & Bhandari, 2011). There are many studies and research about climate change. Some of them are related to the theoretical and knowledge part of it and some of them are about the perceptions of it. Perceptions can be related to all of the topics. In a study conducted by Ajuang et all (2016), researchers used typical climate change indicators, such as heavy rainfall, floods, droughts, and temperature, to estimate the awareness levels of families in Upper Nyakach Division, Kisumu County, Kenya. 384 household heads were chosen as respondents from 11 sub-locations, all of which were found in the Upper Nyakach Division, using a cross-sectional survey methodology. Data collection involved using a questionnaire. The results show that the majority of responders (90.9%) have seen alterations in the general atmosphere. Most homes (87%) stated that temperatures had risen during the previous 20 years. The majority of responders (55.2%) reported seeing a decline in rainfall, with age groups showing substantial variances. According to up to 75% of respondents, the frequency of droughts has grown over the past 20 years, with gender having a substantial impact on this claim. It is advised to launch an awareness campaign to improve community members' knowledge of climate change indicators.

In a study conducted by Crona et al. (2013), researchers indicate that there are some researches about perceptions, and they are informative but comparative studies among sites play an important role in developing a broad theory explaining why and how individuals perceive and comprehend the threats linked with climate

change. They present a cross-sectional study with 6 countries for illustrating to demonstrate a cutting-edge comparative method for understanding the subtle differences between local and global perspectives on climate change. The results demonstrate that even though the data was gathered through the use of place-based approaches and ethnographically generated objects, there is still evidence of a common cultural model of climate change that is present throughout the various locations in the six nations. Furthermore, the findings indicate that both gender and educational attainment are positively associated with an individual's global cultural competency. The study makes the tentative suggestion that researchers are witnessing the emergence of a "global," cross-cultural mental model around climate change and its potential impacts, which is itself connected to higher education. It also suggests that people with higher education are more likely to have common perceptions about climate change across cultures.

The perception of climate change can bring actions to prevent it. The government can do something to prevent but public awareness and a high perception level could be more effective and permanent. There is a study conducted by Semenza, Hall, Wilson, Bontempo, Sailor, & George, (2008) about the perceptions of the consumers. The researchers think that decreasing the effect of climate change is not only the responsibility of the government, but it also requires the cooperation of the consumers. They made cross-sectional surveys with 1202 participants in Portland OR and Houston TX in 2007 with the awareness, concern, and acting changes related to climate change. The results indicated that the awareness levels are in high levels, and it is universal because 98% of Portland, and 92% of Houston participants reflected it. also, a large number of the participants had some concern about climate change (90 % in Portland, 82% in Houston). The study also examined the level of education, age ranges, areas, and relationships with the results of climate change perceptions. The high level of education, younger ages, and Portlanders had higher perceptions and concerns. For reducing the concern and consequences of climate change, 43% of the participants decreased their energy consumption at home, 39% of them decreased their consumption of gasoline, and

26% engaged in different and essential behaviors like recycling. This also helped to compare the distances.

In a study conducted by Weber, (2016), researchers stated that since climate change is an abstract statistical phenomenon—that is, a slow, steady alteration of the average climate conditions—it is challenging to adequately identify and evaluate the phenomenon using human experience alone. In this study, the effects of political ideology, age, gender, and nationality, as well as contextual influences, were studied, as well as the role of various processing modes in climate change perception and the low level of visceral response (dread) associated with climate change risks. Personal experience with climate change, particularly extreme weather events, was also explored.

In the research conducted by Lee et al (2015), they assess the relative impact of socio-demographic traits, location, perceived well-being, and beliefs on public climate change knowledge and risk perceptions at national scales using an unprecedented survey of 119 nations. In the results, they found that in some of the African and Asian nations, perception of local temperature change is the strongest predictor, but understanding the human nature of climate change is the strongest predictor, notably in Latin America and Europe. Also, increasing basic education, climate literacy, and public awareness of the local impacts of climate change are essential to fostering public participation in and support for climate action. They concluded that education is the key point of awareness. This study explains the effect of education and its importance of it. Climate education can be useful for all age groups like in kindergarten or at the university level.

Global warming leads to climate change and awareness about the global warming is an important point. In a study conducted by Sterman & Sweeney (2002), researchers present findings from studies evaluating people's innate comprehension of climate change. They used the nontechnical reports of the IPCC to provide highly educated graduate students with explanations of greenhouse warming. The next task for the subjects was to predict the most likely course of events regarding

CO2 emissions or concentrations. Just a rudimentary comprehension of stocks and flows and climate change facts will enough for the activities; no mathematics is required. The performance was subpar overall. Individuals frequently choose paths that defy the conservation of matter. Many participants thought that changes in CO2 emissions or concentrations would instantly affect temperature.

Also, there is research about awareness of climate change, and the questionnaire in this research is used in this study. That study aims to create and verify a scale that can accurately measure public views about climate change. People's views of the existence and causes of climate change, as well as the perceived valence, distance in space and time, and repercussions of climate change, are what we refer to as "climate change perceptions." Literature research and expert evaluation were used to create an item pool that would assess these perceptions. Three empirical investigations in the US and the Netherlands that assessed the resultant scale provided evidence for its component structure, reliability, measurement invariance, convergent, predictive, and discriminant validity. After these steps, researchers create a questionnaire. (Van Valkengoed, et al, 2021).

2.2. Climate Change Awareness among students

There are studies about the awareness of climate change. Education is the key point of awareness (Lee at All, 2015) so the studies about the students are important to realize the awareness levels and also importance of the education. In a study conducted by Rahman et all (2014), secondary school students have a curriculum that has information and knowledge about climate change in Bangladesh. This study researches the role of demographic profiles and students innate academic backgrounds on their knowledge. The study was conducted with secondary school students in Bangladesh, and they used the Climate Awareness Index (CAI). The results show that the quality of schools and their grade levels affect the CAI values. In addition, the study concluded that factors such as religion, gender, parental education, employment, and wealth might influence how well-informed Bangladeshi pupils are about climate change.

There is a study about teenagers and their classification with climate change awareness. This research divided teens into groups depending on their degree of climate change awareness on the theory that the young generation of teenagers cannot be regarded as uniform. Utilizing a hierarchical cluster analysis, 760 adolescents (aged 13 to 16) from Germany and Austria filled out questionnaires. The teens were divided into four groups based on how aware they were of climate change on a cognitive, emotive, and consequential level. The authors contend that diverse subgroups of young people exist in terms of their knowledge of climate change, which should be taken into account when developing climate change education, based on the empirical findings. (Kuthe, et al., 2019).

In a study conducted by Roychoudhury et al. (2017), studies on teaching climate change, system thinking, the current reform in science education, and reform-oriented assessment suggest that rather than focusing just on testing for incremental disciplinary knowledge gains, researchers should also investigate students' understanding in more detail. They evaluated the specifics of students' achievements and difficulties in thinking about climate change and the climate system using open-ended questions. In this study, 457 pupils from four schools in a Midwestern state and twelve instructors of the seventh and eighth grades took part. A significant ($p<.0001$) increase in knowledge was revealed by statistical analysis of student responses to the pre- and post-test. However, more significantly, qualitative analysis of student responses revealed that while they had learned that our climate is changing, they had only established a linear relationship between variables like surface temperature and drought. The pupils failed to acquire a coherent body of information or a systemic grasp of climate.

The climate change literacy is an important part for improving the awareness and perception levels. In a study conducted by Kuthe et al. (2020), teenagers' understanding of climate change is to be improved by this project. Given that the participating teens had varying degrees of climate change literacy before to the project, the evaluation of the project focuses on how the specific deficiencies are addressed by the project in order to offset the circumstances. Thus, a pre-survey (N

¼ 392) was used to identify the preconditions. A t-test for paired samples was then used to assess the teenagers' project-related growth. The findings indicate that the majority of the flaws were fixed and that it might be helpful to evaluate environmental education by concentrating on a target population and weakness definition.

Researchers in the study conducted by Jarrett & Takacs (2020) share their thoughts with children in grades 9 and 10 on the theories underpinning climate change. Students frequently have misconceptions regarding climate change, which may stem from misunderstandings of related ideas. They created the Climate Change Concept Inventory (CCCI) and tested it on 229 students in order to look into this; focus group interviews were used to confirm the results. They outline their interviewing process and data analysis techniques. The results showed that greenhouse gasses in the atmosphere, sunlight's ultraviolet radiation, and human contributions to atmospheric carbon imports were all overestimated. The fact that CO2 dissolves in water and the part that oceans play in the carbon cycle were not known to the students. Rarely were greenhouse gasses other than CO2 identified. Black body radiation and the energy balance of the Earth were poorly understood.

Climate change can influence every living thing but for future generations, it is more important because they are the future users of the environment. In a study conducted by Lee, et al. (2020), the literature review was examined and reviewed. The researcher’s review was among 8 to 19-year-old participants’ perceptions and understanding levels about climate change. They examined 51 international studies, and the dates were between 1993-2018. The analysis consists of the beliefs and concerns about climate change and perceptions about the causes and consequences of climate change. According to the research, the perception levels increase with age. However, some researches stated that younger ages have more concern and are willing to do something and take precautions.

In a study conducted by Corner et al. (2015), researchers indicated that there is a dearth of information about how young people interact with a topic that will define

and influence their generation, despite decades of study on better ways to communicate climate change to the general public. Researchers use survey data and qualitative research to present an extensive evaluation of studies conducted internationally in this field. There are two primary components to the review. In the first, the involvement of young people with climate change is briefly positioned in relation to other issues, and the awareness, worry, and "scepticism" levels of this age group are examined. In the second, four important factors that determine successful climate change communication are examined, and it is determined whether research on youth differs significantly from results on the broader public. The "psychological distance" of climate change and message framing; the effectiveness of "information-based" interventions; the function of trusted messengers; and the influence of values and worldviews in shaping attitudes on climate change are the four elements. Researchers address the implications for better engaging youth and consider directions for further study in the conclusion section.

2.3. Climate Change Perceptions with psychological distance

Perceptions about the causes, consequences, and reality of climate change have been made in many studies. The psychological variables, like the distance and time of the consequences, are more specific areas. In research conducted by Keller et al. (2022), researchers explained that people have difficulties with faraway places and uncertain futures of climate change. Recent studies explained that there are some inconsistencies in the processes and results of the psychological distance of climate change. This research is a literature review, and its purpose is to build a base line to develop new studies on psychological distance. Researchers discovered that psychological distance is a dynamic, context-specific, multidimensional concept that can be measured and manipulated in a broad range of ways about climate change. It is not possible to adequately capture the diversity and complexity of distance in the context of climate change with current theorizing, which mostly draws on construal-level theory. They provided recommendations for measuring and modifying the construct based on the examined research. Their main

recommendation, though, is to concentrate on certain situations where distance influences how people think about and respond to climate change, such as when it comes to behavior, policy, or affect perception.

In another study conducted by Maiella et al. (2020), psychological distance was defined as the main psychological construct to explain abstract or concrete perceptions and events most accurately. The harmony of the psychological distance with the construal level theory (CLT), hypothetical, social, spatial, and temporal distance are the critical and important dimensions. Any object or event could perceive something as either psychologically close or far away. It is depicted as more tangible when considered to be psychologically close, and more abstract when seen to be psychologically far away (McDonald et al., 2015). Consequently, diverse interpretations of things and events are associated with psychological distance (Trope and Liberman, 2010). More abstract constructions concentrate on the "big picture," whereas concrete constructs are more concerned with the specifics (McDonald et al., 2015). PRISMA procedures were followed in conducting the review, and PubMed, PsycINFO, Web of Science, Cochrane, and Scopus databases were thoroughly searched by the researchers. It has been determined that nineteen articles qualify for the final synthesis of the research. According to the findings, people are generally more likely to engage in resilient and pro-environmental activities in response to climate change when those actions are seen as being closer to home under the psychological distance concept. Not every study, though, demonstrates this outcome. Despite believing that climate change is real and palpable, several research revealed that individuals do not engage in mitigation and adaptation activities. According to other research, people still engage in these activities even when they believe that climate change is distant and abstract.

Spence et al. (2012) conducted a study and according to the study, one of the most pressing social risk concerns of our day is preventing hazardous climate change, and educating the public about associated public perceptions is essential to getting them involved in the significant societal changes needed to battle climate change.

Public perception analyses have shown that people view climate change as remote in a variety of ways. Nevertheless, no thorough investigation of the psychological impact of climate change has been done too far. This study systematically explores and characterizes the four theoretical components of psychological distance—temporal, social, and geographical distance, as well as uncertainty—in connection to climate change using a nationally representative British population. Researchers look at the relationships between these many dimensions of psychological remoteness, worries about climate change, and goals for sustainable action. Based on several characteristics, the results show that climate change is both psychologically far away and close at hand. Higher levels of worry were usually correlated with lower psychological distance, but readiness to take action on climate change was also substantially correlated with perceived consequences on poor nations, a measure of social distance. The results unequivocally demonstrate the value of risk communication strategies intended to address psychological gaps. But drawing attention to the potentially grave long-term effects of climate change can also help encourage sustainable behavior, even among individuals who are already worried.

There is a study conducted by Uzzell, (2000) about psychological distance. According to the researcher, although the differences between the local and global dichotomies have not received much attention, there is every indication that this distinction may be essential to comprehending public attitudes and perceptions regarding environmental issues as well as the behavior that follows. Three questions were the focus of this investigation. Firstly, can individuals only connect with environmental challenges that are tangible, present, and close to home? Second, do individuals view local or global environmental issues as being more serious? Thirdly, how does the public's perception of the severity of environmental issues affect their sense of accountability to take action? In Slovakia, England, Australia, and Ireland, three studies were conducted. Every study's finding consistently show that participants can comprehend issues globally and that there is an inverse distance effect, which makes people regard environmental issues as

being more important the further they are from the perceiver. A negative correlation was also discovered between spatial scale and a sense of accountability for environmental issues, which led to emotions of helplessness on a worldwide scale.

2.4. Review of Literature

In this research, some studies are represented with their purpose, method, and result sections. In the climate change perceptions, most of the research indicated that people have a certain point of awareness, participants mostly realize the weather, climate events, or times are changing. One of the research projects indicates that education is the main point of awareness because the students spend most of their time in schools and they learn or realize daily life actions too. They can easily be affected, and they can have a high level of awareness with education. This can be in schools or any other place where the important thing is education. With this information, the awareness levels of the students are important for this research. In research conducted by Rahman et all (2014), the quality of the schools and students' grade levels affect the awareness levels of the students. Quality of schools may lead to quality education and a quality learning environment, and these can affect awareness levels. Also, in the study conducted by Kuthe, et all, (2019) young students (aged 13 to 16), students have different learning and perception levels about Climate Change and when the lessons about Climate Change increase, these groups can be considered by teachers. On the other hand, psychological distance is a quite new dimension of the perception of climate change. There are some studies about the psychological distance, and on the climate change perceptions. It is also new for the people because studies concluded that people are not completely aware of the distance, location or time distance is not exactly clear for the people.

CHAPTER 3

METHODOLOGY

This study examines students' awareness of Global Climate Change with different dimensions like Reality, Causes, Consequences, and Consequences of Distance. In this chapter, dimensions, design of the study, selection of participants and information about the participants, instruments, procedure, and data collection methods, ethical considerations, and study, limitations are presented. This study focused on descriptive parts. Descriptive reporting requires a precise, quantifiable, and unambiguous characterization of the discussed condition.

3.1. Research Design

It is quantitative research employing a cross-sectional survey. Surveys are a common way to collect data across a wide range of areas and thus are a suitable choice if someone wants to learn more about a group of people's traits, interests, viewpoints, awareness, or beliefs (Fowler, 2013). This method helps researchers obtain data from many groups relatively quickly (Fowler, 2013). If the study focused on a particular area, a printed questionnaire that participants can answer immediately would be convenient. According to Fowler (2013), there are eight steps for applying survey research: defining the purpose of the study, identifying the participants in the survey, selecting the survey's type (mail, online, or in-person), creating the survey's questions and format, applying a pilot study, collecting data process, examine the answers, write up the findings. All of the steps were followed one by one.

3.2. Population and Subjects

The focus of this study is to examine the perceptions of middle school students in Ankara about climate change. The accessible population for this study is public

middle school students in two districts who are in the 5th, 6th, 7th, and 8th grades. Public schools have been chosen as the data collection site, as it is believed that public school administration may be more suitable and understanding in facilitating data collection. The study aims to explore students' perceptions of climate change with respect to various dimensions. The researcher chose five schools based on their accessibility.

The chosen sampling method for the research is non-probability sampling. This is because, the survey relies on accessibility and volunteer participation, making non-probability sampling more appropriate. Non-probability sampling is a sampling strategy where the researcher selects samples based on their own judgment rather than by chance. Volunteer sampling, which is also known as self-selection sampling, is a type of sampling method where individuals voluntarily agree to participate in the study. According to Vehovar et al. (2016), people who are interested in being part of the study are invited to join through advertisements that target qualified individuals. The recruitment process continues until the desired sample size is achieved. There are two steps involved in volunteer sampling or self-selection. The first step is to make your demand for subjects known, determine each subject's appropriateness, and then decide whether to invite or turn them away. The second step is to distribute the volunteer participation papers to the entire school. The researcher explains the study and its requirements to the students. After the volunteer participation papers are distributed, parental approval papers are also given out.

All the papers were distributed to every student in the school, but only those who volunteered participated by filling out the questionnaires.

A total of 1000 5^{th}, 6^{th}, 7^{th}, and 8^{th} grade students participated in the study. Among them 313 students were 5^{th} grade, 303 students were 6^{th} grade, 274 students were 7^{th} grade, and 110 students were 8^{th} grade. Also, there were totally 545 (54.5%) girls and 455 (44.5 %) boys attending to the study. (Table 3.1)

Table 3. 1. General Characteristics of the Sample

	Frequency (f)	Percentages (%)
Gender		
Girl	545	54.5
Boy	455	45.5
Grade level		
5th	313	31.3
6th	303	30.3
7th	274	27.4
8th	110	11.0

Table 3.2 presents information about educational level of the parents. As shown in the table, .5% of mothers and .2 % of the fathers were Illiterate. 4.5 % of the mothers and 1.8 % of the fathers graduated from primary school, while 5.3% of mothers and 6.4 % of fathers graduated from middle school. About 28.6 % of mothers and 28.4 % of the fathers had attained high school education. In addition, 51.7 % of mothers and 50.4 % of fathers reported to have graduated from university and 9.4 % of mothers and 12.8 % of fathers graduated from master/doctorate.

Table 3. 2. Parent' Education Level of the Sample

Education level	Mother		Father	
	F	**%**	***f***	**%**
Illiterate	5	.5	2	.2
Primary School	45	4.5	18	1.8
Middle School	53	5.3	64	6.4
High School	286	28.6	284	28.4
Undergraduate	517	51.7	504	50.4
Graduate	94	9.4	128	12.8

3.3. Data Collection Tools

The study relied on three sources of data: demographics information, including general climate change questions, and the second for instrument types, which are the climate change perceptions scale and bipolar climate change perceptions scale (Van Valkengoed, Steg, & Perlaviciute 2021). All the instruments were applied to the students in their classroom.

3.3.1. The Demographics Information Questionnaire

The first section of the questionnaire aims to gather personal information and general opinions about climate change. This section includes questions related to the respondent's gender, birth date, grade level, family education level, and occupational status. There are eight questions on personal information, requiring specific answers. Additionally, there are four questions related to climate change, asking if the respondent has heard about it, if they believe climate change is happening, how much they know about it, and if they believe anything can be done to mitigate its effects. The respondents are expected to provide clear answers, such as yes, no, little, much, enough, and so on.

3.3.2. The Climate Change Perception Scale

In order to evaluate how student perceive the Reality, causes, consequences, and spatial distance of consequences of climate change, two separate TOOLS were USED (van Valkengoed et al. 2021). SO, the second section of the study comprises two instruments: The perceptions About Climate Change Scale and the bipolar aspect of the perceptions about climate change. Participants were asked to indicate their level of agreement or disagreement with each dimension separately.

3.3.2.1. Perceptions About Climate Change Scale

Perceptions About Climate Change Scale is a self-report instrument developed recently by Van Valkengoed et al. (2021) to identify the adults' perspectives on global climate change across different dimensions, namely Reality, Human and Natural Process Causes, Positive and Negative Consequences, Consequences of Spatial and Temporal Distance, Spatial Proximity. Based on the idea that the perception of climate change is related to two fundamental dimensions of psychological distance (the Construal Level Theory), the authors have proposed that the scale they developed, incorporating the sub-dimensions of Spatial proximity and Temporal distance, distinguishes it from other scales. It consists of 24 items with 8 sub-dimensions. Each dimension has three items. The students

were asked to rate each item on a five-point Likert scale, with 1 (strongly disagree) to 5 (strongly agree). van Valkengoed and his colleagues reported internal consistency reliabilities of each dimension as .98 for reality, .92 for human causes, .92 for natural process causes, and .85 positive and .90 negative consequences, .88 for consequences of spatial distance, .91 for temporal distance, .92 for spatial proximity, and .91 for all items (van Valkengoed et al., 2021). Each dimension has different description and dimension descriptions were represented in table 3.3.

Table 3. 3. Descriptive Information for Eight Dimensions of Climate Change Perception Scale (Developed by Van Valkengoed, Steg, & Perlaviciute, 2021)

Dimension	Dimension Description	Sample Item
Reality	The extent to which students think climate change is real	I believe climate change is real.
Human Causes	The extent to which students think climate change is happening because of the human actions	Human activities are the main cause of climate change.
Natural Process Causes	The extent to which students think climate change is happening because of the natural processes	The main cause of climate change is natural processes.
Positive Consequences	The extent to which students think climate change has positive consequences	Climate change will have significant positive consequences.
Negative Consequences	The extent to which students think climate change has negative consequence	Climate change has too many negative consequences.
Spatial Proximity	The extent to which students think consequences of climate change will be in their local area	Where I live will be affected by climate change.
Spatial Distance	The extent to which students think consequences of climate change will be in the far regions	Climate change will affect places that are far from where I live.
Temporal Distance	The extent to which students think consequences of climate change will be in the distant future	We will feel the consequences of climate change after a long time.

In this study, this questionnaire was translated and adapted to Turkish and middle school students (see Appendix A). Exploratory factor analyses were conducted on the scale. EFA involves three steps. The first step is to ensure that the data is

suitable for analysis in terms of the number of observations. The research data consists of a large sample size of 1000, which is appropriate for analysis. The second step is to use statistical techniques to assess the data's factorability (Shrestha, 2021). The Turkish scale yielded similar eight dimensions to the original scale. Internal consistency estimates ranged from .75 to .91. Particularly, .75 for reality, .79 for human causes, .91 for natural process causes, .88 for positive consequences, and .79 for negative consequences, .89 consequences of spatial distance, .81 for temporal distance, .85 for spatial proximity. The internal consistency of the whole scale was calculated as .86 (Table 3.1).

Table 3. 4. Reliability of each dimension of the Climate Change Perception Scale

Dimension	Cronbach alpha
Reality	.75
Human Causes	79
Natural Process Causes,	.91
Positive Consequences,	88
Negative Consequences,	.79
Spatial Proximity,	.85
Temporal Distance	.89
Spatial Distance	.81
Total Scale	.86

The KMO test is a tool designed to assess if data are suitable for factor analysis. Stated differently, it evaluates the suitability of the sample size. The test assesses the suitability of sampling for each dimension in the model and the model as a whole. This test evaluates the sampling adequacy for each dimension in the model and the entire model. The KMO statistic indicates the proportion of variance among dimensions that could be considered as common variance. A higher proportion and KMO value suggest that the data is more appropriate for factor analysis (Watkins, 2020). The result of the KMO value in this study is .86; this means that the data is suitable for factor analyses (Table 3.2)

Table 3. 5. Factor analyses of the Climate Change Perceptions Scale

	Reality	Natural Processes Causes	Human Causes	Positive Consequences	Negative Consequences	Spatial Proximity	Spatial Distance	Temporal Distance
Reality								
Climate change is not happening. (R)	**.85**	.04	.07	.11	.04	.09	.06	.06
I do not believe that Climate Change is real. (R)	**.82**	.09	.06	.10	.13	.11	.11	.01
I believe that Climate Change is real.	**.69**	.06	.08	.04	.21	.21	-.04	.05
Natural Processes Causes								
Climate Change is mostly caused by natural processes. (R)	.06	**.88**	.15	.23	.10	.07	.02	.03
Natural processes are the main cause of climate change. (R)	.07	**.88**	.17	.22	.07	.04	.02	.03
The main causes of climate change are natural processes. (R)	.08	**.85**	.18	.22	.10	.02	.06	.05
Human Causes								
Human activities are the main cause of climate change.	.11	.16	**.80**	.11	.11	.07	.06	-.02
The main causes of climate change are human activities.	.05	.15	**.79**	.10	.29	.15	.06	-.01
Climate change is mostly caused by human activities.	.07	.18	**.75**	.17	.14	.16	.10	.01

Table 3.5. (continued)

Positive Consequences								
Climate change will have serious positive consequences. (R)	.05	.23	.12	**.85**	.17	.07	-.01	.03
Climate change will have significantly positive consequences. (R)	.08	.23	.13	**.85**	.16	.10	-.03	.05
The consequences of climate change will be positive for the world. (R)	.19	.26	.16	**.77**	.19	.08	.01	.03
Negative Consequences								
The negative consequences of climate change will be very serious.	.12	.08	.19	.15	**.77**	.17	.10	-.01
Climate change will have negative consequences on the Earth.	.21	.08	.21	.22	**.75**	.16	.07	-.04
Climate change has too many negative consequences.	.11	.11	.16	.15	**.74**	.23	.05	.05
Spatial Proximity								
The region where I live will experience the consequences of climate change.	.15	.07	.13	.06	.19	**.83**	.11	.04
My local area will be influenced by climate change.	.14	.06	.11	.07	.24	**.83**	.11	-.01
Climate change will influence the place where I live.	.14	-.00	.12	.09	.09	**.82**	.05	.02
Spatial Distance								
Regions far away from me will experience the consequences of climate change.	.06	.04	.04	.02	.01	.07	**.90**	-.07
Regions far away from me will be influence by climate change	.01	.04	.08	-.00	.09	.07	**.89**	-.02
Climate change will influence regions far away from me.	.05	.01	.07	-.04	.08	.10	**.88**	-.06
Temporal Distance								
The consequences of climate change will only be experienced in the far future. (R)	.07	.05	-.01	.07	.02	-.03	-.06	**.87**
It will be a long time before the consequences of climate change are felt. (R)	.00	.01	-.04	.02	-.08	.03	-.06	**.86**
Climate change will only take place in the long term. (R)	.04	.02	.02	-.01	.05	.05	-.02	**.82**

3.3.2.2. Bipolar Format of the Climate Change Perception Scale

The second part of the Climate Change Perception Scale is prepared in a bipolar format with three dimensions, each of which has two items answered on a seven-point Likert-scale, from 'strongly disagree' (1) to 'strongly agree' (7). It measures students' perspectives among the causes, consequences, spatiality with respect to positive-negative consequences, human-natural process causes, and spatial distance- proximity. Although includes the same dimensions with the Climate Change Perception Scale, bipolar format gives more detailed and comparison inferences. Developers reported internal consistency reliabilities of each dimension as .92 for positive and negative consequences, .96 for human and natural process causes, .83 for spatial distance and proximity, and .85 for all items (van Valkengoed et al. 2021). Dimensions' descriptions were represented in table 3.6.

Table 3. 6. Descriptive Information for Three Dimensions of Bipolar Climate Change Perception Scale (Developed by Van Valkengoed, Steg, & Perlaviciute, 2021)

Dimension	Dimension Description	Sample Item
Human-Natural Process Causes	To extent to which students think the causes of climate change are caused by human actions or natural processes	The cause of climate change is only human activities/ mostly human activities/ equally human activities and natural processes/ mostly natural processes/ only natural processes.
Positive-Negative Consequences	To extent to which students think the consequences of climate change will be positive or negative	The consequences of climate change will be only positive/ mostly positive/ equally positive and negative/ mostly negative/ only negative.
Spatial Proximity-Distance	To extent to which students think the consequences of climate change will be in their local area or far regions	The consequences of climate change will happen only where I live/ mostly where I live/ equally where I live and far away regions/ mostly in faraway regions/ only in faraway regions.

In this study, this questionnaire was translated and adapted to Turkish and middle school students (see Appendix A). Turkish version of bipolar scale was prepared on a five-point format. the bipolar scale assesses the '*endorsement* of each dimension relative to the other dimension' (van Valkengoed et al. 2021, p. "8"). Specifically, the participants were asked to evaluate the perceived causes of climate change on a scale ranging from 'only by natural process' (1) to 'equally natural processes and human activities' (3) to 'only human activities' (5). Similarly, they were asked to evaluate the perceived consequences of climate change on a scale ranging from 'completely negative' (1) to 'equally negative and positive' (3) to 'completely positive'. Lastly, they were asked to evaluate the perceived spatial distance of consequences of climate change on a scale ranging from 'only locations far away' (1), 'equally locations far away and my local region' (3) to 'only my local region' (5).

Internal consistency reliability scores are .91 for Bipolar consequence, .93 for Bipolar Causes, .78 for Bipolar Spatial. The reliability of the scale was calculated to be 0.72, indicating that there may be a small amount of error, but the analyses can be trusted (Table 3.7).

Table 3. 7. Reliability of each dimension in the Bipolar format of Climate Change Perception Scale

	Bipolar consequence (Positive- Negative)	Bipolar Causes (Human-Natural)	Bipolar Spatial	Total
Reliability	.91	.93	.78	.72

The KMO value was found to be 0.56, which suggests that the data is suitable for factor analyses. Factor analyses were performed using EFA. The factor number was not limited in the analyses, and the results indicate that there are three distinct factors that are independent of each other (Table 3.8)

Table 3. 8. Factor analyses of the Bipolar Format of Climate Change Perceptions Scale

	Bipolar Causes	Bipolar consequence	Bipolar Spatial
Human Causes- Natural Process Causes			
Climate change caused by only human activities/ mostly human activities/ equally human and natural activities/mostly natural processes/ only natural processes.	**.95**	.18	.01
Climate change has occurred as a result of only human activities/ mostly human activities/ equally human and natural activities/mostly natural processes/ only natural processes.	**.93**	.24	-.03
Negative Consequences- Positive Consequences			
The consequences of climate change will be only positive/ mostly positive/equally positive and negative/mostly negative/only negative. (R)	.21	**.94**	-.04
Climate change will lead to only positive / mostly positive/equally positive and negative/mostly negative/only negative consequences. (R)	.21	**.94**	.04
Spatial Distance- Spatial Proximity			
Climate change will affect only my local area / mostly my local area/ equally my local area and regions far away from me/ mostly regions far away from me/ only regions far away from me.	.04	.00	**.91**
The consequences of climate change will only my local area / mostly my local area/ equally my local area and regions far away from me/ mostly regions far away from me/ only regions far away from me.	-.06	-.01	**.90**

3.4. Procedure

The researcher analyzed the survey questions, obtained necessary permissions, and translated and adapted them into Turkish for middle school students. The language and sentences were simplified since the original survey was designed for adults.

Once the instruments were completed, the researchers selected accessible schools based on their locations, administrative units, and the number of students in the schools. The schools in the study were chosen through a non-random sampling method due to difficulties in survey implementation and reaching participants. Six schools were initially selected, but only five were used as their student numbers were sufficient for the study. Permissions were obtained from both the Middle East Technical University and the Ministry of National Education. The ethical processes involved writing the schools' names down on a permission paper. After receiving the necessary approvals, researchers visited each school to contact the students. As the students were under 18 years old, parental approval was required for participation in the surveys.

3.5. Data Analysis

The data for this study was collected from the participants by asking survey questions. All the responses were analyzed using the SPSS program. Frequency analyses, descriptive statistic results, factor analyses, and reliability analyses are performed. The results are presented in the result section of the study. The descriptive statistics are further elaborated and discussed in the discussion section of the study.

3.6. Reliability, Validity and Ethics

The two main points to consider in any study are its validity and reliability. Validity refers to whether the survey measures what it aims to measure, while reliability is all about the stability and consistency of the survey. There are various ways to evaluate both validity and reliability, and the approach you take will depend on the nature of your study Cohen et al. (2017). According to Cohen et al.

(2017), it's important to choose the right approach to ensure accurate and trustworthy results. There are various forms of validity, such as face, content, construct, and criterion validity. These ensure that research tools, like questionnaires and exams, are appropriate for the population and objectives of the study. To ensure that research instruments are trustworthy and consistent over time, researchers can perform test-retest and internal consistency reliability tests (King & He, 2005). Furthermore, statistical methods such as factor analysis, and Cronbach's alpha can be used to evaluate the validity and reliability of the data and findings. Reliability tests were conducted using the SPSS program in this study, and the instrument scores were presented in the relevant sections.

The current study did not find any threats to internal validity due to data collection bias, data collector traits, or instrument decay. This was because the researcher was responsible for the majority of data collection.

The instruments used in this study were only used once and simultaneously. The data gathering instrument was comprised of self-report items and was scored entirely by optical mark. Data collector influence occurs when a data collector makes decisions about data collection and scoring procedures, and when data is unintentionally altered to achieve a particular outcome (Fraenkel & Wallen, 2006). It is important to consider ethical issues when conducting research. This includes obtaining participants' consent after providing them with information about the study and ensuring that their confidentiality is guaranteed. Participants must be made aware that they have the right to withdraw from the study at any time and are not obligated to complete the survey. All ethical information was provided to the participants during the data collection process. The study received ethical approval from both Middle East Technical University and the Ministry of Education to ensure that instrumental ethics were met.

CHAPTER 4

RESULT

In this chapter, the results of the study were represented with descriptive statistics. The main point of the study was the examine the perceptions of students about Global Climate Change with different dimensions. To understand of the perceptions, mean, standard deviation, and frequency calculations were made. This study focused on only descriptive parts. Descriptive reporting requires a precise, quantifiable, and clear characterization of the condition being discussed (Grimes & Schulz, 2002).

4.1 Descriptive Statistics

In this part, results regarding mean, standard deviation, variance, and frequency for the Climate Change Questionnaire, Climate Change Perceptions Scale, and Bipolar Climate Change Perception Scale were presented. The results were shown concerning gender because the gender effects can be examined in further research. There is a climate change questionnaire, and it has 4 items. For the options of the items, item 1 has yes (1) and no (2) options, item 2 has yes (1), no (2), do not know (3) options, item 3 has a lot (1), enough (2), some (3), a little (4), no information (5) options, and item 4 has yes (1), no (2), do not know (3) options. The second part includes 8 dimensions and 3 items for each of them. All items have the same 5-point Likert selection with totally agree to totally disagree.

The other part is the bipolar part. The bipolar part has 3 dimensions, and these dimensions have two side options like totally human causes or totally natural process causes. There are 3 dimensions in bipolar format, which include causes, consequences, and spatial distance-proximity parts. All items have 5-point options and some of them are negative. That’s why the negative ones turned into recode

versions for the mean and standard deviation analyses but in the frequency part, all items' answers were in the original numbers. It is believed that descriptive results give some insights into young students' perceptions of climate change by providing important clues about how they respond to climate change (van Valkengoed et al., 2021).

Table 4. 1. Descriptive Statistics of the Climate Change Questionnaire

Items	*Options*	*Frequency*	*Percentage (%)*	*Mean (M)*	*Standard Deviation (SD)*
Have you heard the word climate change before?	Yes	974	97.4	1.03	.16
	No	26	2.6		
Do you think the climate is changing?	Yes	886	88.6	1.21	.59
	No	23	2.3		
	Do not know	91	9.1		
How much do you think you know, in general, about climate change?	A lot	31	3.1	2.69	.80
	Enough	394	39.4		
	Some	453	45.3		
	A little	91	9.1		
	not knowledgeable	30	3.0		
Do you think there is anything that can be done to reduce the effects of climate change?	Yes	722	72.2	1.49	.82
	No	65	6.5		
	Do not know	213	21.3		

In table 4.1, the four questions about the climate change descriptive results were represented. 97.4 % of the students heard the climate change term, but 2.6 % did not hear (M=1.03, SD= .16). The 88.6 % of the students thought the climates are changing, but 2.3 % did not, and 9.1 % did not know (M=1.21, SD= .59). On the other hand, the 45.3 % of the students thought they know the climate change some, 39.4 % enough, 9.1 % a little, 3.1 % a lot, and 3.0 % had no information (M=2.69, SD= .80). In addition to this, 72.2 % of the students thought that there is anything that can be done to reduce the effects of climate change but 21.3 % did not know, and 6.5 % did not think that (M=1.49, SD= .82).

For the other data collection tools, descriptive statistics of the Climate Change Perception Scale, and Bipolar part of the Climate Change Perception Scale, are represented in Table 4.2.

Table 4. 2. Descriptive Statistics of Scales with Respect to Gender

	N	*Climate Change Perception*		*Bipolar Climate Change Perception*	
		M	*SD*	*M*	*SD*
Girl	545	3.91	.45	3.54	.44
Boy	455	3.94	.46	3.57	.47
Total	1000	3.92	.45	3.56	.45

As reported in Table 4.2, the mean scores of the perception scale were higher than the mid-point of 3, indicating that young students possessed relatively high positive perceptions of Climate Change. As far as gender is concerned, boys had slightly higher mean scores on both Climate Change Perception Scales compared to girls on a 5-point scale. Also, the bipolar had similar results and the perception levels were close to the mid-point of 3, indicating that students possessed relatively high positive perceptions but not as high as the Climate Change Perception Scale. Each scale was examined deeply and item-based in the subtitles.

4.1.1. The Climate Change Perceptions Scale

RQ1: What are the profiles of middle school students' perceptions toward global climate change concerning Reality, Human and Natural Process Causes, Positive and Negative Consequences, Consequences of Spatial Distance and Proximity, and Temporal Distance?

The Climate Change questionnaire has 24 items and 8 dimensions. The dimensions are reality, human causes and natural process causes, negative and positive consequences, temporal, spatial distance, and spatial proximity of Climate Change. In the method chapter, the factor analyses of the instrument were represented. Each Dimension has three items about them. In Table 4.3, the dimensions mean, standard deviation, skewness, and kurtosis scores were represented concerning gender.

Table 4. 3. Descriptive Statistics of Climate Change Perception Scale with Respect to Gender

Dimension	*Girls (N=545)*		*Boys (N=455)*		*Total*	
	M	*SD*	*M*	*SD*	*M*	*SD*
Reality	4.57	.51	4.66	.49	4.61	.50
Human Causes	4.11	.78	4.10	.86	4.11	.82
Natural Process Causes,	3.53	1.01	3.57	1.07	3.55	1.04
Positive Consequences,	3.97	.90	4.00	.96	3.98	.92
Negative Consequences,	4.29	.67	4.32	.65	4.30	.66
Spatial Proximity,	4.15	.68	4.19	.72	4.17	.69
Spatial Distance	3.59	.90	3.67	.99	3.62	.94
Temporal Distance	3.03	.81	3.00	.88	3.02	.84
Total Scale	3.91	.45	3.94	.46	3.92	.45

As reported in Table, the mean score of the total perception scale was higher than the mid-point of 3. Mean scores ranged from 3.02 and 4.61 on a 5-point Likert scale for the whole sample. When analysed with respect to gender, mean scores ranged from 3.03 to 4.57 for girls, and 3.00 to 4.66 on a 5-point Likert scale. These results indicated that participants of this study did not have a perception score

under 3 on a 5- 5-point Likert scale. The mean score for the Reality dimension in total (M = 4.61; SD = .50) indicated that students perceived a high level of perceptions about that climate change is happening. The negative consequences had the next highest mean score (M = 4.30; SD = .66), indicating that students had a high perception about that climate change has negative consequences. Also, the spatial proximity (M = 4.17; SD = .69), had a high mean score and this result indicated that students thought that the consequences of climate change were happening in their local areas. Similarly, the human causes had a high mean score (M = 4.11; SD = .82) and it stated that students have a perception that human activities cause climate change. On the other hand, other dimensions which are positive consequences (M = 3.98; SD = .92), the natural process causes (M = 3.55; SD = 1.04), and spatial distance (M = 3.62; SD = .94) had higher than the mid-point of 3. For the temporal distance (M = 3.02; SD = .84) students did not have a strong perception of the time distance of the consequences of climate change, they were undecided about this dimension.

Table 4. 4. Means, Standard Deviations, Skewness and Kurtosis Values for Climate Change Perception Scale Dimensions

Dimensions	*M*	*SD*	*Minimum*	*Maximum*	*Skewness*	*Kurtosis*
Reality	4.57	.51	1.00	5.00	-1.96	6.09
Human Causes	4.11	.78	1.00	5.00	-.92	.68
Natural Process Causes,	3.53	1.01	1.00	5.00	-.59	-.43
Positive Consequences,	3.97	.90	1.00	5.00	-1.06	.53
Negative Consequences,	4.29	.67	1.00	5.00	-1.07	1.26
Spatial Proximity,	4.15	.68	1.00	5.00	-.69	.13
Spatial Distance	3.59	.90	1.00	5.00	-.55	-.07
Temporal Distance	3.03	.81	1.00	5.00	-.07	-.43
Total Scale	3.92	.46	1.00	5.00	-.04	-.36

The minimum and maximum values, means, standard deviations, skewness, and kurtosis values were represented in table 4.4. All of the variables' means, standard deviations, and lowest and maximum values fell within acceptable bounds. The Skewness index ranged from -1.96 to -.07 while the kurtosis index was within the range of -.43 and 6.09. If the kurtosis index is higher than 10 and the skewness index is larger than 3.0, there may be an issue with univariate normalcy. (Kline, 2005). Therefore, it appears that there was not a significant issue with univariate normalcy. A possible range was 1-5 for minimum and maximum values. Actual range was also 1-5. The maximum and minimum scores were equal to the highest and lowest possible scores.

Sub-Question 1: What are the students' perceptions with respect to Reality of Climate Change?

Table 4. 5. Descriptive Statistics of The Climate Change Perceptions Scale Reality Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally agree*
Reality							
I believe that Climate Change is real.	4.55	.65	.4	.7	4.2	32.5	62.2
Climate change is not happening. (R)	4.65	.60	70.7	24.8	3.7	.6	.2
I do not believe that Climate Change is real. (R)	4.63	.60	68.6	26.8	4.1	.3	.2

As reported in Table 4.5, the mean scores of the reality dimension were higher than the 4 in all items, indicating that students had a high perception that Climate change is real and is happening. In this table, some of the items were in recode

versions and it represented with “R” in the table. The mean scores and standard deviation scores were calculated with recode items, but the frequency distributions were calculated with the original version. In the reality dimension, 11 % of the participants did not believe that climate change is real but 94.7 % of them believed that climate change is real. % 4.2 percent of them were undecided about the item. These results showed that participants had a positive perception of climate change’s reality. They thought that climate change is happening. For the opposite idea items in Reality, there were similar results 95.4 % of the participants disagree with the “don’t believe climate change is real” idea. 95.5 % of the participants thought that climate change is happening. This showed that a higher percent of the participants had a strong perception about climate change reality and happening. The reality dimension had a high level of perception among the participants. Participants in both girls (M=4.57, SD=.51), and boys (M=4.66, SD=.49) had high levels of perception.

Regarding Causes Dimensions; Natural Process Causes, Human Causes,

Sub-Question 2: What are the students’ perceptions with respect to Natural and Human Causes of climate change?

Table 4. 6. Descriptive Statistics of The Climate Change Perceptions Scale Natural Process Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Natural Process Causes							
Natural processes are the main cause of climate change. (R)	3.56	1.13	22.5	33.6	26.7	11.5	5.7
Climate Change is mostly caused by natural processes. (R)	3.46	1.14	18.7	35.0	27.0	12.3	7.0
The main causes of climate change are natural processes. (R)	3.63	1.12	25.1	33.2	26.0	10.7	5.0

In the part of the cause, participants had a certain perception that climate change is mostly caused by human activities (M=4.11, SD=.82). On the other hand, participants also thought that natural processes can cause climate change, but they did not have a certain perception, they have been quite undecided about the natural processes (M=3.55, SD=1.04). Items' mean scores were slightly higher than the mid-point of 3 for the natural causes, but for the human causes, items' mean scores were higher than 4, and 4 means that they agreed that climate change is caused by human activities or natural process causes. For the frequency analyses, in the human causes, three items were similar to each other, and an average of 6.3 % of the participants did not agree with the idea that the main or mostly cause of climate change is human activity. On the other hand, 77.8 % of the participants thought the other way. The undecided part for human activity was quite low ranging between 14.3-17 % of the participants. These results showed that most of the participants thought that human activity is an important and mostly or main cause of climate

change. In the other cause type, which is natural process causes, the results were close to each other. An average of 56.0 % of the participants disagreed with the idea that natural causes are mostly or main causes of climate change. 26% of the participants were undecided, and 17.4 % of the participants agreed with the idea. Results were likely to be opposite of the human causes, but the undecided part was higher in the natural processes.

Table 4. 7. Descriptive Statistics of The Climate Change Perceptions Scale Human Causes Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Human Causes							
Human activities are the main cause of climate change.	4.13	.96	2.1	4.2	15.2	35.4	43.1
Climate change is mostly caused by human activities.	4.07	1.01	2.8	4.7	17.0	33.6	41.9
The main causes of climate change are human activities.	4.11	.94	2.0	4.3	14.3	39.3	40.1

Sub-Question 3: What are the students' perceptions with respect to Positive and Negative Consequences of climate change?

Table 4. 8. Descriptive Statistics of The Climate Change Perceptions Scale Positive Consequences Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Positive Consequences							
The consequences of climate change will be positive for the world. (R)	4.16	.99	47.8	28.9	17.4	3.5	2.4
Climate change will have serious positive consequences. (R)	3.85	1.06	30.6	38.1	21.1	5.8	4.4
Climate change will have significantly positive consequences. (R)	3.95	1.03	34.6	38.1	18.0	5.8	3.5

For the consequences, participants' opinions about positive consequences were mostly negative, they did not think that the consequences of climate change will be positive, this dimension item recoded so, higher mean scores meant that students did not think climate change has positive consequences (M =4.16, SD=.99). For the negative consequences, students thought that the consequences will be negative (M =4.44, SD=.73). For the consequences part, negative consequences had the next highest mean after the reality in total (M= 4.30, SD=.66). The negative consequences about the climate change mean scores were high and this indicated that the high number of the participants had a high perception. Besides that, students also had a high mean score about the positive consequences. They concluded that there could be some positive consequences or not, the students were undecided about positive consequences. It was slightly closed to the statement that climate change consequences will not be positive because of the recode items. With

the frequency results, 72.4 % of the participants thought that the consequences of climate change will not be positive. An average of 8.4% of the participants agreed with the positive consequences. On the other hand, the negative consequences were the opposite of the positive consequences' results. 18.4 % for positive, 13.6 % for negative consequences were undecided. Some of the participants did not have a certain idea about the consequences. They thought that climate change is real according to the reality dimension, but the consequences are not certain. The majority of the participants thought that the consequences will be negative for the world.

Table 4. 9. Descriptive Statistics of The Climate Change Perceptions Scale Negative Consequences Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Negative Consequences							
Climate change will have negative consequences on the Earth.	4.44	.73	.3	1.2	9.2	32.8	56.5
Climate change has too many negative consequences.	4.25	.80	.6	1.5	14.4	38.9	44.6
The negative consequences of climate change will be very serious.	4.21	.83	.4	2.0	17.4	36.3	43.9

Sub-Question 4: What are the students' perceptions with respect to Spatial Distance and Proximity of climate change?

Table 4. 10. Descriptive Statistics of The Climate Change Perceptions Scale Spatial Proximity Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Spatial Proximity							
My local area will be influenced by climate change.	4.14	.81	.4	1.7	18.8	41.4	37.7
The region where I live will experience the consequences of climate change	4.17	.78	.2	1.7	17.4	42.8	37.9
Climate change will influence the place where I live.	4.19	.80	.5	1.3	17.0	41.0	40.2

The scale also has items with detail information about consequences like the distance. These dimensions are spatial proximity and spatial distance. In the spatial proximity, items about the participants' local area' experiences about the consequences of climate change. Participants 41.4 % of them agreed with the idea that their local area will be influenced by climate change, and 2.8 % of them agreed that the regions where they live experience the consequences of climate change. Also, 81.2 % of them agreed that climate change influences their living places.

For the spatial distance, items about the regions far away from them. 34.6 % of the participants agreed that regions far away from them will be influenced by climate change but 30.1 % of them were undecided about the item. The other two of the items about spatial distance had quite similar results.

Participants both undecided and agreed but there was not a clear inference about that participants thought that climate change will influence regions far from them.

The mean scores supported the frequency results, for the spatial proximity, participants' opinions about their local area, and influenced of the consequences of climate change on there is positive and they thought that their local area will be influenced by climate change (M =4.14, SD=.81). They were not quite sure about the regions far away from them because they were undecided about experiencing the consequences of climate change in the regions far away from them (M =3.52, SD=1.08).

Table 4. 11. Descriptive Statistics of The Climate Change Perceptions Scale Spatial Distance Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Spatial Distance							
Regions far away from me will be influence by climate change.	3.71	1.03	3.7	6.5	30.1	34.6	25.1
Regions far away from me will experience the consequences of climate change.	3.52	1.08	5.7	9.3	32.1	33.4	19.5
Climate change will influence regions far away from me.	3.65	1.02	3.6	7.1	33.2	33.2	22.9

Sub-Question 5: What are the students' perceptions with respect to Temporal Distance of climate change?

Table 4. 12. Descriptive Statistics of The Climate Change Perceptions Scale Temporal Distance Dimension

	Mean (M)	*Standard Deviation (SD)*	*Frequency(f)*				
			Totally disagree	*Disagree*	*Uncertain*	*Agree*	*Totally disagree*
Temporal Distance							
It will be a long time before the consequences of climate change are felt. (R)	2.85	1.09	5.4	22.7	37.4	20.3	14.2
The consequences of climate change will only be experienced in the far future. (R)	3.06	1.00	8.6	20.2	48.0	15.4	7.8
Climate change will only take place in the long term. (R)	3.15	.89	8.6	17.4	58.7	10.6	4.7

For the temporal distance part, items about the happening timeline of the climate change and consequences of them. Students were undecided about the time of experiencing the consequences of climate change, they were not sure if they will experience the consequences in the far future or not (M =3.06, SD=1.00). For the frequency analyses, the first item, 37.4 %, the second item 48.0 %, and the third item 58.7 % of the students were undecided. The last item's undecided ratio is higher than others because the item indicated that climate change will only take place in the long term and the only word can confuse the students.

The profiles of students Climate Change Perceptions with 8 dimensions were depicted in figure 4.1.

Y: Mean x: gender bars: dimensions

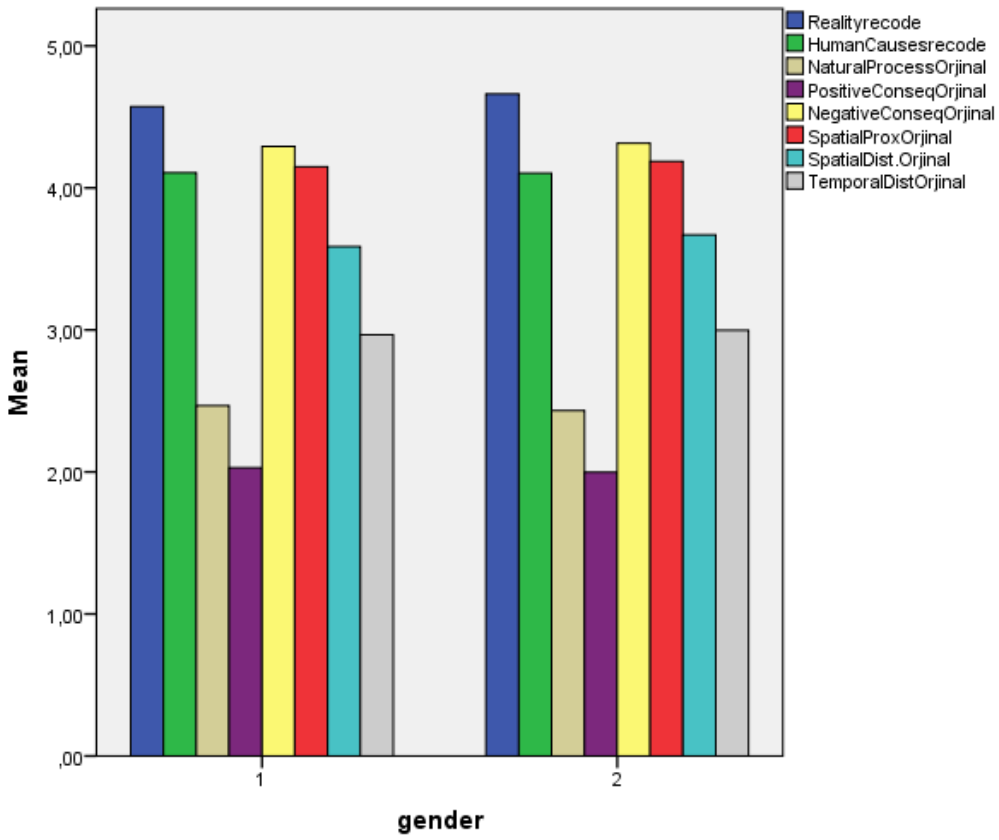

Figure 4. 1. Dimension Mean of Climate Change Perception Scale

4.1.2. Bipolar Format of The Climate Change Perceptions Scale

The bipolar part of The Climate Change questionnaire has 6 items and 3 dimensions. Each dimension provided specific information about the perception of the students. The dimensions are Human Causes- Natural Process Causes, Negative Consequences Positive Consequences, and Spatial Distance- Spatial Proximity. Dimensions have two items about them, but each item has 5 different statements, and participants selected the most suitable one for their perceptions. Each item has two versions of the opinions, and 3 represent equal opinions.

Sub-Question 2: What are the students' perceptions with respect to Natural and Human Causes of climate change?

Table 4. 13. Frequency percentage of Bipolar Climate Change Perception Scale

	only natural processes	*mostly natural processes*	*equally natural and human activities*	*mostly human activities*	*only human activities*
Human Causes- Natural Process Causes					
Climate change caused by ……..	1.8	5.0	24.2	53.8	15.2
Climate change has occurred as a result of……..	1.4	5.5	26.4	52.4	14.3

In the frequency tables, numbers 1 to 5 represent different statements. For the human causes- natural process causes items, there are two of them and infer similar things. 53.8 % of the participants agreed with the idea that climate change is caused by mostly human activities, and 52.4 % of participants thought that climate change has occurred as a result of mostly human activities.

Sub-Question (SQ) 3: What are the students' perceptions with respect to Positive and Negative Consequences of climate change?

Table 4. 14. Frequency percentage of Bipolar Climate Change Perception Scale

	only negative consequence	*mostly negative consequence*	*equally negative and positive consequence*	*mostly positive consequence*	*only positive consequence*
Negative Consequences-Positive Consequences					
The consequences of climate change will be …	24.8	50.2	21.7	2.3	1.0
Climate change will lead to … consequences.	24.0	52.0	21.4	1.6	1.0

For the consequences, 50.2 %of the participants agreed on the idea that the consequences of climate change will be mostly negative, and 52.0 % of the participants thought that climate change will lead to mostly negative consequences.

Sub-Question 4: What are the students' perceptions with respect to Spatial Distance and Proximity of climate change?

Table 4. 15. Frequency percentage of Bipolar Climate Change Perception Scale

	only regions far away from me	*mostly regions far away from me*	*equally regions far away from me and my local area*	*mostly my local area*	*only my local area*
Spatial Distance- Spatial Proximity					
Climate change will affect ……..	1.0	5.8	89.3	3.2	.7
The consequences of climate change will happen in……..	1.0	6.0	88.7	3.3	1.0

For spatial distance and spatial proximity, 89.3 % of the participants thought that climate change will affect equally regions far away from them and their local areas. Also, 88.7 % of the participants thought that the consequences of climate change will happen in regions far away from me and my local area.

For the descriptive statistics, participants 'perceptions about the causes of climate change were mostly equally human activities and natural processes, but it quite closes to the human activities (M= 3.76, SD=.84). Participants thought that the consequences of climate change will be equal but close to the negative (M =3.96, SD=.81). students, Also, tended to believe that climate change will affect their local areas and regions far away from them equally (M=2.97, SD=.40).

Table 4. 16. Descriptive Statistics of Bipolar Part of the Climate Change Perception Scale

	Mean (M)	*Standard Deviation (SD)*
Human Causes- Natural Process Causes		
Climate change caused by only human activities/ mostly human activities/ equally human and natural activities/mostly natural processes/ only natural processes.	3.76	.84
Climate change has occurred as a result of only human activities/ mostly human activities/ equally human and natural activities/mostly natural processes/ only natural processes.	3.73	.83
Negative Consequences- Positive Consequences		
The consequences of climate change will be only positive/ mostly positive/equally positive and negative/mostly negative/only negative. (R)	3.96	.81
Climate change will lead to only positive / mostly positive/equally positive and negative/mostly negative/only negative consequences. (R)	3.96	.78
Spatial Distance- Spatial Proximity		
Climate change will affect only my local area / mostly my local area/ equally my local area and regions far away from me/ mostly regions far away from me/ only regions far away from me.	2.97	.40
The consequences of climate change will happen in only my local area / mostly my local area/ equally my local area and regions far away from me/ mostly regions far away from me/ only regions far away from me.	2.97	.42

The profiles of students Bipolar Climate Change Perception Scale were depicted in figure 4.2.

Y: Mean x: gender bars: dimensions

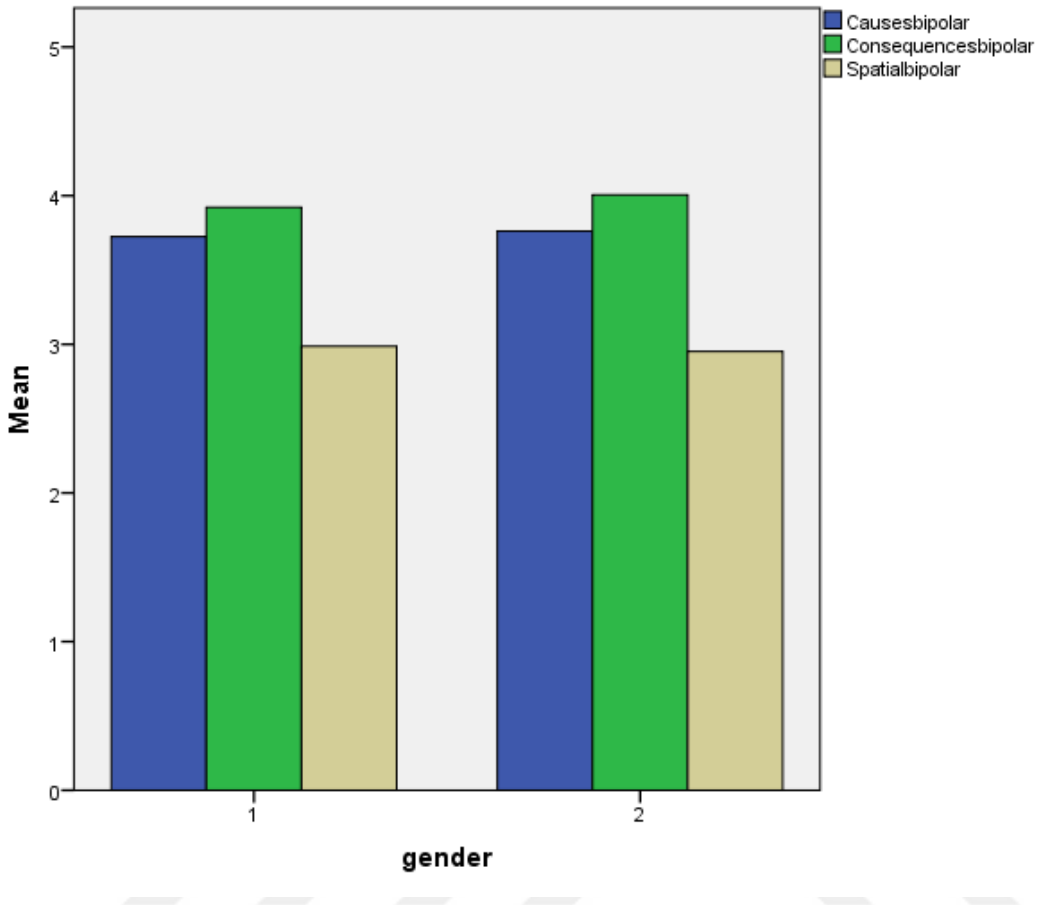

Figure 4. 2. Dimension Mean of Bipolar Climate Change Perception Scale

4.2. Summary of Results

The purpose of the study was to identify the profiles of middle school students' perceptions toward global climate change from different perspectives, such as the reality of climate change, the human and natural process causes of climate change, positive and negative consequences of climate change, consequences of spatial distance and proximity, and temporal distance. In the study, descriptive analyses were made, and the results were examined to identify the profiles of middle school students' perceptions of global climate change. There were 3 different parts of the instrument, the first part includes 4 climate change questions. These questions examined the general opinions about climate change. 97.4 % of the students heard the climate change term. The curriculum of the middle school students has climate

change topics, they are not deep, but they have the climate change term in general. This could affect the results. Also, 88.6% of the students thought that climates are changing. It is a high score but not similar to the first one. A small amount of the students knew the term climate change but did not believe the climates are changing. 9.1 % of the students did not know whether the climates are changing or not. They knew the term and believed the climates are changing, also they mostly thought they knew climate change 45.3%, and 39.4% had enough information, but a little, a lot, and no options' frequencies are lower than the others. After the knowledge part, their actions are important for reducing the effects of climate change. 72.2 % of the students thought that they could do something to reduce the effects but 21.3% did not know and 6.5 % did not think that there was anything for reducing the effects.

The second part of the instrument is the Climate Change Perception Scale. There are eight dimensions of the scale, and the purpose of the scale is the examine the participants' perception levels with respect to Reality, Human and Natural Process Causes, Positive and Negative Consequences, Consequences of Spatial Distance and Proximity, and Temporal Distance dimensions. In general, students had a high perception of the climate change reality. They mostly thought that climate change was real, and it was happening (M=4.61). For the part of the cause, human and natural processes can cause climate change. Students had high mean scores on human causes (M=4.11) and it indicated that students thought that human actions cause climate change. On the other hand, the natural processes cause scores were in the midpoint of 3. This indicated that they were undecided about the effect of natural processes. They thought that human actions have an effect, but natural processes were not clear. For the consequences of climate change, they thought that the consequences would be negative(M=4.30). The results indicated that students thought climate change consequences affected them negatively. However, for the positive consequences, the items were recoded, so the 3.97 mean score means that students had a negative perception about the positive consequences. They thought that climate change would not have positive consequences.

The developers of the scale included the Spatial Distance, Proximity, and Temporal Distance terms because the perception of consequences of the time and distance of climate change is important and gives a more detailed perception level.

They are more certain about their areas. For these reasons, they were mostly undecided about the far regions which is the Spatial Distance part. Temporal distance means that climate change will happen at which time. It could be in a very long time. They were mostly undecided about the time because they observed some of the results of climate change, but they were not sure about the time distance. It could be happening more deeply, or the effects could be more crucial for everyone in a long time. From a different perspective, they cannot see the consequences, and think that there is no effect of climate change and have no idea about the future. The time is quite unknown for the participants.

The Climate Perception Scale gave the perception levels with eight different dimensions. The students gave similar or close ideas in some dimensions, but the dimensions' meanings were opposite to each other in general. For example, there are causes of climate change, the students can think that human actions cause climate change and natural processes can cause a little too. For a deeper look and information, a bipolar format of the scale was developed. The 3 dimensions are opposite to each other like Human Causes- Natural Process Causes, Negative Consequences-Positive Consequences, and Spatial Distance- Spatial Proximity. Students can think that both options can cause or both consequences can happen and choose both of them to agree on the Climate Change Perception Scale. However, in bipolar format, they choose the closer option. The results of the bipolar format indicated that students mostly thought that climate change was caused by human actions. After this option, equally natural processes and human actions had the highest scores. This showed that students did not think that only one of them caused climate change, mostly human activities but natural processes can have an effect. This result is also similar to the consequences part, students mostly thought that the consequences of climate change would be mostly negative. The only negative and equally negative and positive scores are close to each other

but the most and only positive options' scores were low. This indicated that students did not think that there would be positive consequences but there will be mostly negative consequences of climate change. The consequences could be negative or positive but also the consequences could be happening in the local areas or far regions. For the spatial proximity and distance dimensions, students thought that climate change consequences would affect equally their local areas and far regions. They can observe the consequences, but they cannot make certain inferences about far regions.

The Climate Change Perception scores and local area results were high but the far regions' results were close to the undecided part. However, in the bipolar part, they choose equal options. In general, the students have a perception about climate change positively in reality, human causes, negative consequences, and spatial proximity. They had not certain perception about the natural process causes, spatial distance and temporal distance because their scores were close to the undecided parts. Last one is for the positive consequences, students had negative perception about the positive consequences. They did not think that climate change will have positive consequences.

CHAPTER 5

DISCUSSION AND LIMITATIONS

In this chapter, the discussion of the results, and the limitations of the study were represented.

5.1. Discussion of the Results

The purpose of the study was to identify the profiles of middle school students' perceptions toward global climate change. Students' perceptions of global climate change included the reality of climate change, the human and natural process causes of climate change, positive and negative consequences of climate change, consequences of spatial distance and proximity, and temporal distance. In the study, descriptive analyses were conducted, and the results were examined to identify the profiles of middle school students' perceptions of global climate change.

Students' responses to the items, which examined their background on climate change on a self-reported basis, showed that they have a high level of awareness about climate change. For example, a great majority claimed that they had heard about the term 'climate change, thought that climates are changing (88.6%), and believed that their actions are important for reducing the effects of climate change. These findings are not surprising mainly due to climate change being included in the middle school science curriculum. Also, climate change is one of the frequently mentioned terms both in our daily lives and in media. 9.1 % of the students did not know whether the climates were changing or not. slightly less than half (45.3%), claimed that they were knowledgeable not only about climate change and believed the climates are changing 39.4% had enough information, but a little, a lot, and no options' frequencies are lower than the others.

This study aimed to have a closer look into Turkish pre-service science teachers' awareness, interests, values, and behaviors about climate change. The findings demonstrated that majority of the participants have heard about climate change and have expressed positive views on ways to tackle climate change. The pre-service science is certain that climate change is indeed happening and considers it a serious issue.

Regarding their level of Climate Change Perception, overall results revealed that students have a perception that climate change is real, and it is happening. They can observe the climate change effects or actions and the perception levels can be affected by them. They thought that climate change was happening, and it was an expected result in the light of the literature.

The climate change's causes are also clear to the students because the results indicated that there is a perception about the human action causes. Students concluded that human actions cause climate change. They see on social media and science lessons the human effects on the environment. The effects of humans like car gasses, fabric gasses, oils that spoil the oceans, or the simple harms to the environment can cause bigger problems like climate change. They learned these in school and also see them on media. They combined the information and as the literature review mentioned, students have a certain perception about human actions' causes of climate change. On the other hand, for the natural processes, students did not have certain perceptions. They thought that natural processes could cause climate change but not so sure. A high number of students were undecided about this dimension. The natural processes are not so clear. Students cannot know the answer to the "What kind of natural processes and how do they affect climate change?" question. The natural processes could be volcanic eruptions, but students cannot know this information. The student's natural process cause results indicated that they thought natural processes could cause or not climate change.

In addition to the causes, consequences of the climate change are an important and popular dimension. The conclusion about the reality of climate change is related to

the consequences of climate change because the student' can make conclusions about the climate change is happening or not by looking at the consequences of it. students saw the effects and consequences of the climate and believed that climate change is real. That's why if the students think that climate change is happening, then the consequences perception levels should be high. Like the expectancy, students have a high perception level about the negative consequences of climate change. The results indicated that students thought that climate change has negative consequences, and they had a high perception about it. for the positive consequences, students did not think that climate change has or will have positive consequences. there are no certain positive consequences of climate change, and this perception level is expected and related to the literature. All the reality causes and consequences of climate change are related to each other, and the results indicated that students have an expected perception level. The level of perceptions could be higher but for the level of science education, we concluded that this level is enough but needs to be improved. The results also similar to the research of the Kuthe, et al. (2019), students have a high level of perception, but the dimensions and location of the study conducted is different.

The results indicated the consequences of climate change perceptions are high and the time and location of the consequences are the other part of the climate change. There are consequences and students have a perception about it, but also the time and location of the consequences are not so certain for the students. most of the students thought that the consequences of climate change felt and will be felt in their local areas. these local areas could be their cities, countries, or regions. They can conclude these areas because they can observe them and hear from other people. However, for the distance areas, they cannot conclude. The results indicated that there was not a perception about the consequences of the distance. The proximity is a more suitable option, but the distance is not sure for the students. high number of students were undecided about the regions far away from them. The study conducted by Maiella et al. (2020), the people' perception levels low about the far away distances. The level of perception increases with the

distance decrease. They thought that the consequences of climate change could be in the faraway regions too, but they may not see or hear, so they cannot make conclusions. The other research about the distance of climate change concluded the similar results. Most people do not have a perception of the spatial distance and proximity level of climate change. The result of the study is expected and similar to the literature. The spatial distance and time related with the psychological distance, and it is easily combined with the environmental topics especially climate change. (Trope & Liberman, 2010). Also, the time distance is not so accurate for the students. the statements about the happening time of consequences of climate change are not certain. They observe them in this time and make conclusions about the recent time, but they cannot make it to the long-time distances. In the future, the new generations could be more conscious about the environment and take some precautions, and students can think like that. The results about the time distance of consequences of climate change agreed with the idea that students did not have a perception of it. They are mostly uncertain about the time.

In all results about the climate change perceptions, students had some perceptions in different dimensions. For comparing the dimensions, the bipolar part of the study was examined. The human activities and natural processes are compared to each other, and students choose one of them or both of them options. A high number of students concluded that climate change is mostly caused by human actions. There were only human actions and equally human and natural processes options, but a small amount of the students chose these because, in the previous part, they were sure about human actions but undecided about the natural processes. That's why students thought that climate change is caused by human actions more than natural processes, but the natural processes could have some effect on it. the similar results examined in the consequences part. Most of the students agreed that the consequences of climate change are and will be negative but there could be some positive consequences too. In the previous part of the instrument, students concluded that there are and will be negative but there are not and won't be positive consequences. However, in the bipolar part, they could not choose only the

negative consequences part, they thought there could be (maybe a small amount of) positive consequences. the bipolar gave us these results and helped to observe the students' perceptions more deeply. Also, for the consequences of distance. There were statements about the climate change consequences will be in our local area or far away regions. Most of the students agreed that the consequences would be felt equally in their local area and far away regions. They concluded that their local areas face the consequences of climate change, but they were not sure about far away regions. However, in choosing one or both of their section, they concluded that the consequences could be equally in local areas and far away regions. This result was the expected result. The conclusion about the faraway regions was understandable but also the equal option was more accurate and correct. For the bipolar part, the study indicated that students had more specific and detailed information about the dimensions of climate change and had a high level of perception in all bipolar parts.

In the original scale developed by (van Valkengoed et al., 2021), the results were similar to this study. the reality of the climate change, causes and consequences have a certain perception but for the spatial and temporal parts, most of the participants were undecided. Original study conducted with adults, but this study conducted with middle school students. the time gap is big, but the results are quite close to each other. Also, in the study conducted by Spence et al. (2012), the findings show that, with regard to several characteristics, climate change is both psychologically far and close at different dimensions. Although perceived consequences on poor nations, as a social distance measure, was also strongly correlated with preparation to act on climate change, lower psychological distance was often linked with higher levels of worry in that study.

5.2. Implication of the Study

This study contributed to the expanding body of research on young pupils' perceptions of climate change from a distinct cultural setting, such as Turkey. Consequently, we thought that the hints revealed by the study regarding students'

views of climate change could help create climate-literate people who “know how to evaluate scientifically reliable climate information, communicate about climate and climate change in a meaningful way, and can make informed and responsible decisions about actions that may affect climate” (NOAA, 2009, p.2). These people also “understand the essential principles of Earth's climate system including the natural and human-caused factors that affect it, are aware of the fundamental relationship between climate and human life. "System thinking and teaching in the context of the climate system and climate change" is the title of their study. "From a climate system perspective, climate change is the result of a modification of the system's components leading to the change in the long-term climate due to the nonlinear feedback among the components," according to Roychoudhury, Shepardson, and Hirsch (2017, p. 29). The overall findings offer suggestions to researchers, curriculum designers, textbook writers, educators, and parents who want to start or at least enhance climate education in Turkey.

First, the current study offers a valid and reliable tool to researchers interested in the topic of climate change for evaluating the perceptions of young students (in grades 5–8) regarding eight dimensions: the reality of climate change, the causes of climate change resulting from human and natural processes, the positive and negative consequences of climate change, the consequences of proximity and spatial distance, and the temporal distance. By translating and modifying the Climate Change Perception Scale from the international literature, the study also adds to the relevant body of knowledge by making it accessible to Turkish academics. In light of this, the study is thought to provide a valuable contribution to the literature on scientific education generally and environmental and climate education specifically.

To raise the awareness level of the younger generation, particularly about the time and location distance of the consequences of climate change—a point that many students find unclear—the findings are also helpful to curriculum developers, textbook authors, teacher educators, and teachers in countries where there has been an initial attempt to integrate climate change education into their curricula. The fact

that climate change is global, not local and that different regions may be affected differently from one another should be emphasized. Despite this, the issue of climate change affects the whole planet. Therefore, it is recommended that future scientific curricula that are in line with science textbooks include temporal and spatial views in addition to other aspects. Although mentioned in the curriculum, in grades 5 and 7, time dimensions should be given more emphasis. (Karaarslan Semiz & Teksöz 2023). One promising approach is adopting a Systems perspective. Stated differently, there is a need for incorporating a holistic framework into the curricula. According to Karaarslan Semiz & Teksöz 2023, system thinking should be incorporated into climate change education, as noted by NGSS (2013), Orion & Libarkin (2014), and Roychoudhury et al. (2017).

Future educators should be confidently able to teach concepts related to climate change with the necessary preparation in this area. In a similar vein, educators must understand the multidisciplinary nature and complexity of the climate system to produce generations of climate-literate problem solvers who can offer viable solutions to pressing climate change-related concerns. As a result, it is essential to incorporate ideas about climate and climate change into education at all educational levels.

5.3. Limitations and Recommendation of the study

The study is the first effort to look at how young Turkish students perceive climate change. However, there are many limitations to this study, each of which suggests a direction for future investigation. Using descriptive statistics, the current study illustrated how Turkish middle school children now perceive climate change. Mean scores, standard deviations, lowest and highest values, skewness and kurtosis values, and frequency tests were all assessed in the descriptive analyses. While it may provide researchers with some understanding of how pupils perceive climate change, we consider this to be a significant research constraint. Therefore, inferential research should be the focus of future studies to shed light on current findings and offer more specific information on how people perceive climate

change. Such research ought to look at how different cognitive and emotional factors, including climate change, influence how people perceive climate change. Information, enthusiasm, plans for action, conduct, disposition, and attitudes toward values. The demographic factors and student characteristics—such as residence (rural vs. urban), school type (private vs. public), class levels, gender, parents' educational attainment, and socioeconomic status—that may affect how people perceive climate change were not examined in this study. Furthermore, reactions to the items from different geographical locations might differ in pupils. Thus, geographical variations are considered in future studies.

Students in the fifth, sixth, seventh, and eighth grades who attend public schools in two Ankara districts are the only participants in this study. As a result, it appears that the participants are by no means typical of all Turkish middle school pupils. To this aim, a nationwide study is required to determine the characteristics of young pupils' perceptions of climate change to make these findings more broadly applicable.

Due to its dependence on self-reported data, the study was constrained (self-reported perception). Participants in this kind of questioning are constrained in the responses they may provide and are unable to fully express themselves Rosenman et al. (2011). To confirm the correctness and consistency of the current findings using a variety of techniques and metrics, more study is required. Future studies that gather qualitative data may be able to provide a completer and more wide-ranging picture of how young kids see climate change.

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APPENDICES

A. Climate Change Perception Scale

Sevgili öğrenci,

Bu araştırmada iklim değişikliğine yönelik görüşleriniz alınacaktır. Doğru ya da yanlış yanıt yoktur, size en uygun seçeneği işaretleyiniz. Anketteki bazı sorular diğerlerine benzemektedir, bu konuda endişelenmeyiniz. Araştırmaya katılmanız ve ifadeleri eksizsiz doldurmanız büyük önem taşımaktadır. Çalışmaya katılım gönüllülük esasına dayanmaktadır. Cevaplarınız gizli tutulacak, sadece araştırmacılar tarafından değerlendirilecektir. Elde edilecek bilgiler bilimsel amaçlı kullanılacaktır. Çalışmaya katıldığınız için şimdiden teşekkür ederiz.

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Orta Doğu Teknik Üniversitesi-Yüksek Lisans Öğrencisi

Kişisel Bilgiler:

Cinsiyetiniz: ❑ Kız ❑Erkek

Doğum Yılınız: ……..

Sınıfınız: ❑5 ❑6 ❑7 ❑8

Geçen Dönemki Fen Bilimleri Dersi Not Ortalamanız: ……..

Annenizin Eğitim Durumu

❑Okuryazar değil ❑İlkokul ❑Ortaokul ❑Lise ❑Üniversite ❑Yüksek lisans/Doktora

Babanızın Eğitim Durumu

❑Okuryazar değil ❑İlkokul ❑Ortaokul ❑Lise ❑Üniversite ❑Yüksek lisans/Doktora

Annenizin mesleği (emekli ise emekli olmadan önceki mesleğini yazınız):

……

Babanızın mesleği (emekli ise emekli olmadan önceki mesleğini yazınız):

……

İklim değişikliği kelimesini daha önce duydunuz mu? ☐ Evet ☐ Hayır

İklimlerin değiştiğini düşünüyor musunuz? ☐ Evet ☐ Hayır ☐ Bilmiyorum

İklim değişikliği ile ilgili, genel olarak, ne kadar bilginiz olduğunu düşünüyorsunuz?

☐ Çok fazla ☐ Yeteri kadar ☐ Biraz ☐ Çok az ☐ Bilgim yok

İklim değişikliğinin etkilerini azaltmak için sizce yapılabilecek bir şey olduğunu düşünüyor musunuz? ☐ Evet ☐ Hayır ☐ Bilmiyorum

BÖLÜM 1: Aşağıda iklim değişikliği hakkında belirtilen genel ifadelere ne derece katıldığınızı belirtiniz ve sizin düşüncenize en yakın olan numarayı işaretleyiniz.

Bir ifadeye;

Kesinlikle Katılıyorsanız 5 sayısını,

Kesinlikle Katılmıyorsanız 1 sayısını işaretleyiniz.

Eğer bir ifadeye daha fazla veya daha az katılıyorsanız, 1 ile 5 arasında sizin düşüncenizi en iyi ifade eden sayıyı işaretleyiniz. Unutmayın doğru ya da yanlış cevap yoktur, yapmanız gereken sizi en iyi tanımlayacak numaranın bulunduğu bölümde yer alan kutuyu işaretlemenizdir.

	Kesinlikle Katılıyorum	**Katılıyorum**	**Kararsızım**	**Katılmıyorum**	**Kesinlikle Katılmıyorum**
	5	**4**	**3**	**2**	**1**
İklim değişikliğinin gerçek olduğuna inanıyorum.					
İklim değişikliği, büyük oranda doğal olaylardan kaynaklanmaktadır.					
İklim değişikliğinin sonuçları, Dünya için olumlu olacaktır.					
İnsan faaliyetleri, iklim değişikliğinin başlıca nedenidir.					
İklim değişikliği, yaşadığım yeri etkileyecektir.					
İklim değişikliğinin çok fazla olumsuz sonuçları vardır.					
Doğal olaylar, iklim değişikliğinin temel nedenidir.					
İklim değişikliği **gerçekleşmemektedir.**					
İklim değişikliğinin sonuçlarını, uzun zaman sonra hissedeceğiz.					

İklim değişikliğinin Dünya'ya olumsuz etkileri olacaktır.					
İklim değişikliğinin başlıca nedeni insan faaliyetleridir.					
Yaşadığım yer, iklim değişikliğinin sonuçlarını yaşayacaktır.					
İklim değişikliğinin gerçek olduğuna **inanmıyorum.**					
İklim değişikliğinin, önemli olumlu sonuçları olacaktır.					
İklim değişikliğinin başlıca nedeni doğal faktörlerdir.					
Yaşadığım yer, iklim değişikliğinden etkilenecektir.					
İklim değişikliğinin olumsuz sonuçları oldukça ciddi olacaktır.					
İklim değişikliği, büyük oranda insan faaliyetlerinden kaynaklanmaktadır.					
Yaşadığım yerden uzak yerler, iklim değişikliğinden etkilenecektir.					
İklim değişikliği, sadece uzun dönemde gerçekleşecektir.					
İklim değişikliği, yaşadığım yerden uzak olan yerleri etkileyecektir.					
İklim değişikliğinin önemli ölçüde olumlu sonuçları olacaktır.					
İklim değişikliğinin sonuçları, uzak gelecekte yaşanacaktır.					
Yaşadığım yerden uzak olan yerler, iklim değişikliğinin sonuçlarını yaşayacaklardır.					

BÖLÜM 2: Verilen ifadeleri okuduktan sonra sizin görüşünüzü en iyi tanımlayacak numaranın bulunduğu kutuyu işaretleyiniz.

İklim değişikliğinin nedeni **sadece insan faaliyetleridir.**	İklim değişikliğinin nedeni **çoğunlukla insan faaliyetleridir.**	İklim değişikliğinin nedeni **eşit derecede insan faaliyetleri ve doğal süreçlerdir.**	İklim değişikliğinin nedeni **çoğunlukla doğal süreçlerdir.**	İklim değişikliğinin nedeni **sadece doğal süreçlerdir.**
5	4	3	2	1

İklim değişikliği sadece **olumlu sonuçlara** neden olacaktır.	İklim değişikliği **çoğunlukla olumlu** sonuçlara neden olacaktır.	İklim değişikliği **eşit derecede olumlu ve olumsuz** sonuçlara neden olacaktır.	İklim değişikliği **çoğunlukla olumsuz** sonuçlara neden olacaktır.	İklim değişikliği **sadece olumsuz** sonuçlara neden olacaktır.
5	4	3	2	1

İklim değişikliği **sadece benim yaşadığım yeri** etkileyecektir.	İklim değişikliği **çoğunlukla benim yaşadığım yeri** etkileyecektir.	İklim değişikliği **eşit derecede benim yaşadığım yeri ve uzakta olan yerleri** etkileyecektir.	İklim değişikliği **çoğunlukla uzakta olan yerleri** etkileyecektir.	İklim değişikliği **sadece uzakta olan yerleri** etkileyecektir.
5	4	3	2	1

İklim değişikliğinin sonuçları **sadece olumlu** olacaktır.	İklim değişikliğinin sonuçları **çoğunlukla olumlu** olacaktır.	İklim değişikliğinin sonuçları **eşit derecede olumlu ve olumsuz** olacaktır.	İklim değişikliğinin sonuçları **çoğunlukla olumsuz** olacaktır.	İklim değişikliğinin sonuçları **sadece olumsuz** olacaktır.
5	4	3	2	1

İklim değişikliğinin sonuçları **sadece benim yaşadığım yerde** gerçekleşecektir	İklim değişikliğinin sonuçları **çoğunlukla benim yaşadığım yerde** gerçekleşecektir	İklim değişikliğinin sonuçları **eşit derecede benim yaşadığım yerde ve uzakta olan yerlerde** gerçekleşecektir	İklim değişikliğinin sonuçları **çoğunlukla uzakta olan yerlerde** gerçekleşecektir	İklim değişikliğinin sonuçları **sadece uzakta olan yerlerde** gerçekleşecektir
5	4	3	2	1

İklim değişikliği **sadece insan faaliyetleri** sonucunda oluştu.	İklim değişikliği **çoğunlukla insan faaliyetleri** sonucunda oluştu.	İklim değişikliği **eşit derecede insan faaliyetleri ve doğal süreçler** sonucunda oluştu.	İklim değişikliği **çoğunlukla doğal süreçler** sonucunda oluştu.	İklim değişikliği **sadece doğal süreçler** sonucunda oluştu.
5	4	3	2	1