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DETERMINATION OF UNIVERSITY STUDENTS' METAPHORICAL PERCEPTIONS ABOUT THE CONCEPT OF CLIMATE CHANGE

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Abstract:
This study aims to reveal the metaphor that Turkish university students have about the concept of "climate change". The research was carried out with the students at Necmettin Erbakan University, Ahmet Keleşoğlu Faculty of Education (Geography 17, Biology 26, History 47) and Faculty of Health Sciences (Nutrition and Dietetics Department 74) in the spring term of 2021-2022 academic year. The research group consisted of a total of 164 students (124 female, 40 male). The data of the research were collected by qualitative research method and the research was organized in a phenomenological design. To determine the perceptions of the students about the concept of climate change, a semi-structured form containing the expression "climate change is like.....because....." was prepared and the students were asked to complete the sentence given in the form. The data obtained were subjected to content analysis. Tables were created by calculating the number of metaphors in each category, how many students repeated the metaphor (frequency), and percentage values. When the findings of the research are evaluated, it is seen that a total of 96 valid metaphors were produced by the students. These metaphors were coded by considering their common features and 8 different conceptual categories were formed. Some of these categories are *"Climate change leading to uncertainty"*, "*Climate change as a symptom of danger/worry"*, "*Climate change as the beginning of change*", "*Climate change as the work of insensitivity"*, *"Climate change as a factor forcing to get used to the new situation"*, *"Climate change with a disruptive effect"*, *"Climate change as a cause of despair"*, *"Climate change as a source of different thoughts"*, and the number of metaphor and frequencies of these categories are calculated and given in tables. When the findings obtained are analyzed, it is seen that the most recurrent metaphor for climate change includes concepts such as *human (f=5), mental state (f=4), life (f=3), a sick body (f=3), disappointment (f=3), cancer (f=3), extinction (f=4), moving (f=4), disaster (f=3), end of the world (f=3), and chaos (f=2).* When the metaphor produced by the students in this study are analyzed, it is seen that the perceptions of university students about the concept of climate change are diverse and rich.

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1. Introduction

Today, rapidly increasing world population, rapid industrialisation, and unhealthy urbanisation, nuclear tests, chemicals such as pesticides, artificial fertilisers, and detergents have started to pollute the environment, and as a result, polluted air, water, and soil have reached dimensions that may be harmful to living things. This pollution can be considered as an environmental problem (Çokada, Türkoğlu and Gezer, 2006). Some of the human-induced environmental problems turn into major problems, if necessary, measures are not taken. In recent years, global warming is one of the leading environmental problems (Kaya, Ateş, and Kılıç, 2019). The average weather conditions that do not change within a large region and for many years are called climate. The climate also shows deviations around its averages. In many parts of the world, weather conditions show great changes not only during the year but also from one year to the next (Karaoğlu, 2013). Climate characterises the comparable atmospheric conditions on Earth. In other words, the climate is all meteorological events that characterise the average of the atmosphere at any point in the world (Akman, 1990). Climate is the average weather conditions in large regions over a very long time. While climate also includes extreme weather events; it also determines the character of a region in terms of weather events and vegetation cover (Akçakaya et al., 2015).

The increase in the average surface temperature, which is called global warming, causes climate change on the one hand, and on the other hand, the global warming process continues to increase due to the changing climate. In addition, a number of climatic feedback mechanisms activated by external forcings such as solar activities, volcanic activities, and changes in the earth's orbit also exacerbate the warming process. In addition to the climate variability experienced in its natural course due to the external forces mentioned above, global warming as a result of human activities has prepared the ground for the global climate change, we face today (Başoğlu, 2014). Global warming, which has become a frequently used term in recent years, poses a serious threat to the world. According to scientists, global warming will lead to deforestation, sea level rise, and major climate changes (Özey, 2011). Global warming is not only an increase in temperature in every region of the world. Global warming is the rapid spread of forest fires with the onset of scorching heat in one part of the world, the increase in desertification, and even reaching a level that endangers human life; on the other hand, it is the phenomenon of natural disasters such as floods, flood disasters, and excessive erosion in another part of the world at the same time (Akın, 2009). Global warming can be defined as "*the temperature increase detected on the earth and in the lower layers of the atmosphere (lower and middle troposphere) as a result of the strengthening of the natural greenhouse effect with the effect of urbanisation due to the rapid increase in the accumulation of greenhouse gases released into the atmosphere by various human activities such as burning fossil*

fuels, deforestation, agricultural activities, and industrial processes since the industrial revolution" (Türkeş, 2008).

Global warming is a term that expresses only one of the potential effects of increasing greenhouse gases in the atmosphere. In other words, one of the most obvious symptoms of the current artificial climate change is "warming" (Kadıoğlu, 2007). Global warming is the increase in the average or temperature of the earth in the parts of the atmosphere close to the earth (in the lower stratosphere) either naturally or by human influence (anthropogenic) (Akman, Ketenoğlu, Kurt and Yiğit, 2012). The average temperature of the Earth is close to 15^{o} C. Without some greenhouse gases, the average temperature of the earth would be -18^{0} C. These gases also help to maintain a habitable climate on Earth. However, the excessive release of these gases causes the temperature to rise dangerously. This is called global warming (Özey, 2011). Global warming can lead to significant global climate changes. The potential impacts of global warming can be grouped as water resources, health, agriculture and forestry, energy, and transport. Global warming caused by the increase in greenhouse gases and the accompanying climate change is expected to directly or indirectly affect human life, environment, and ecological systems such as severe weather events, floods, floodings, drought, desertification and agricultural pests (Karaoğlu, 2013). However, there is great confusion in the perception and correct understanding of global climate change. Global warming is not, as is widely believed, a continuous warming of all parts of the world. On the contrary, it is a continuous increase in the average temperature of the earth. As a result, climatic balances in various parts of the world are disturbed and abnormalized. This deterioration manifests itself in the form of deterioration in the precipitation regime, as well as overheating, cooling, floods, floodings, etc. (Özdemir, 2017). Today, it is accepted by almost all climate scientists that there is a deterioration in the world climate system. It is stated with certainty that if the various activities of human beings, which cause the deterioration of the natural balance, continue without taking the necessary precautions, these deteriorations in the climate will increase and climate changes due to global warming, which may have very unfavourable consequences, will be experienced. Because of the increase in the accumulation of greenhouse gases and particles in the atmosphere due to human causes, the destruction of the natural environment and the thinning of the ozone layer will cause a global increase in temperature (Öztürk, 2002). Based on the definitions, it can be said that the source of the changes seen in the climate in the past was natural factors, while the changes experienced today are human (anthropogenic) activities (Başoğlu, 2014). Climate change is defined as "changes in the average state or variability of the climate for decades or longer, regardless of the cause" (Akçakaya et al., 2015).

Knowing how such an important and current environmental problem is shaped in people's thoughts and how this problem is perceived will be the key to the cause and solution of the problem. The use of metaphor techniques in determining what students understand from climate change will reveal the quality of their knowledge on this subject. With the metaphors produced, it is possible to have information about whether a subject

is understood or not. In this respect, metaphors can be used to reveal the level of students' thoughts about climate change.

Metaphors first emerged from a perspective called "mental metaphor theory" developed by Lakoff and Johnson in the 1980s. According to this theory, "*If our conceptual system is largely metaphorical, our way of thinking and every phenomenon we experience is metaphorical in some way*". Metaphors are very effective in learning abstract concepts that can be learnt indirectly (cited in Şahin & Baturay, 2013). According to Levine (2005), "Metaphor" is derived from the Greek word "Metapherein" and is formed by combining the words meta (to change) and pherein (to carry).

The word metaphor is etymologically based on the compound word "metaphora" (meta + phora). "Meta" means "beyond" and "phora" is a Greek word meaning "to carry". Latin writers used the concept of metaphor as "translatio" (transfer, carrying) or "smilitudo" (simile) (Tepebaşılı, 2013). Metaphor is used when one wants to explore and understand something esoteric, abstract, novel or speculative. As a general rule, the more abstract or speculative it is, the greater the variety of metaphors needed to deal with it (Yob, 2003). Metaphor draws attention as a powerful mental mapping and modelling mechanism for individuals to understand and construct their own world (Arslan & Bayrakçı, 2006). Metaphorical and real are not a simple binary, but two poles connected by a continuum. Something can be more or less metaphorical, more or less literal. Metaphors can die, freeze or stagnate as they are used. They may eventually become literal terms, just as the "skirt" of a mountain, the "arm" of a chair, and the "virus" in a computer become literal terms with predetermined dictionary definitions (Yob, 2003). According to Shuell (1990), "*If a picture is worth 1000 words, a metaphor is worth 1000 pictures. This is because, while a picture provides only a static image, a metaphor provides a mental framework for thinking about a phenomenon*." According to Draaisma (2007), metaphor allows the memory to hunt with many fishing rods at the same time.

Metaphors are creative because they direct our minds beyond existing and obvious similarities, relationships, and views to new similarities and views of their own creation. Metaphor is a discovery; because a dimension of meaning that the word alone would not have carried before is discovered and thus the horizon of both the word and the thought expands (Lakoff & Johnson, 2015:10). Metaphors, just like attitudes, are formed as a result of experience and provide information about the individual's behaviour on the subject (Göğebakan Yıldız, 2017). A metaphor is a label, meaning or conceptual expression created by a concept in an individual. It is a process of seeing and understanding. It is a more important and powerful mental production than simply explaining a concept with another concept because it expresses the depth and experiences of the related concept (Eraslan, 2011). Metaphors have consequences. They reflect and shape our attitudes and therefore determine our behaviours. Those closest to home and heart are often the most invisible ones because we only recognise them as the reality they represent (Strenski, 1989). The metaphor we use to describe our daily actions, emotions and experiences can influence our behaviour (Nikitina and Furuoka, 2014). Metaphors take words from their usual context and transfer their meaning to a new context

(Draaisma, 2007). The differences in interpreting the events and situations experienced by human beings represent the essence of metaphor. Revealing the image formed in the mind for a concept will make the existing perception of that concept available (Mete and Ayrancı, 2016).

According to Tutar (2015), perception is the state of being aware of the events and things around people. Individuals produce a product by processing what they receive from the outside world through their senses. This process is called perception and the resulting product is called perception. If the messages have a meaning for the individual, if the messages can be made sense of, perception occurs and perception is realised consciously. Commenting, evaluation, interpretation, and meaning of perceptions and consciously forming mental integrity is called perception. At the same time, for perception to occur, the stimulus must be at or above the absolute perception threshold, which is the lowest level that directs the person to react (cited in Arğın, 2021).

1.1. Objective

This study aims to reveal the mental images of prospective teachers about the concept of climate change and how they perceive climate change through metaphors. In addition, it is to determine under which conceptual categories the metaphors created by the students can be grouped according to their common features and semantic relations. When considered in this context, it can be thought that such studies will contribute to raising awareness in people about climate change.

2. Method

2.1. Research Design

The research is qualitative in nature and the research design is designed as phenomenology. The basis of effective educational activities is to attract and maintain students' interest. In order to keep students' interest in the learning situation alive, it is necessary to develop the logic of phenomenology in order to make the best use of innovation, diversity, and risk situations (Durmuş & Baş, 2016). In this context, the phenomenon focused on in the research process is the students' thoughts about the concept of climate change with the help of metaphors and how they organise and conceptualise the concept of climate change in their minds. Tekindal and Arsu (2021) state that researchers who want to investigate a phenomenon or concept can develop an in-depth understanding of the phenomena and concepts in question by using a phenomenological approach in their research.

Phenomenology as a philosophy and research method is not limited to an approach to knowing; rather, it is an intellectual preoccupation with interpretation and meaning-giving used to understand the lived world of human beings on a conscious level (Qutoshi, 2018).

2.2. Working Group

This study was carried out with the students of Necmettin Erbakan University, Ahmet Keleşoğlu Faculty of Education (Geography 17, Biology 26, History 47) and Faculty of Health Sciences (Department of Nutrition and Dietetics 74) in the autumn term of 2021-2022 academic year. The research group consisted of 164 students (124 female, 40 male) (Table 1). The students participating in the study were determined on the basis of volunteerism. In addition, the students participating in the study were selected from the non-random sampling method by the appropriate sampling method. According to Büyüköztürk et al. (2017: 95), convenience sampling is a method that aims to prevent loss of time, money, and labour. Convenient sampling method is expressed as collecting data from a sample that the researcher can easily reach.

It is seen that the most preferred sample size in the studies is between "101-200" in article studies and between "201-400" in thesis studies. The fact that sample sizes are not too large can also be explained by the fact that metaphorical studies do not aim to generalise to the universe (Gezer, 2020, 1523).

Table 1: Gender distribution of participants

Gender	**N**	**%**
Female	124	76
Male	40	24
Total	**164**	**100**

2.3. Data Collection

The students participating in the study were given a form consisting of an open-ended question in the form of "Climate change is like .....; because....." and asked to write their opinions. At the beginning of the research, information about metaphor was given to the students, and examples related to metaphor were shown. Then, the prospective teachers were asked to fill in these incomplete forms within 20 minutes.

2.4. Analysing the Data

The data obtained in this study were analysed by content analysis approach. Content analysis is a technique used to reveal the concepts and relationships necessary to explain the data obtained.

The common denominator of content analysis techniques is based on inference. All of them aim to bring an interpretation based on the elements observed and described in the messages (Bilgin, 2014). The main purpose of content analysis is to reach concepts and relationships that can explain the collected data. The data summarised and interpreted in the descriptive analysis are subjected to a deeper processing in content analysis, and concepts and themes that are not noticed with a descriptive approach can be discovered as a result of this analysis (Yıldırım & Şimşek, 2008). The metaphor developed by the participants about the questions in the interview form and their responses were analysed in five stages.

These stages are (1) coding the data, (2) creating categories, (3) organising the data according to the codes and categories (4) ensuring validity and reliability (5) defining and interpreting the findings (Altun & Apaydın, 2013; Yıldırım & Şimşek, 2016).

2.5. Coding of Data

Before analysing the data, the answer sheets of the students were coded by giving numbers from 1 to 164. The answers given by the students to the first and second questions in the answer sheets were collected under the headings of "metaphor" and "explanation". The metaphors identified from the data were classified by using the content analysis technique based on their similarity aspects. In addition, the explanations written by each student for the metaphor they developed were analysed and classified. At the end of each student's statements in the papers numbered from 1 to 164, the section, and answer sheet number were added in capital letters, and the relevant paper number was written together and given in brackets. For example, the letters and numbers in the code (SK98) can be explained as follows. The capital letter S stands for the answer sheet number K98, that is, the 98th paper among the answer sheets numbered from 1 to 164.

2.6. Creating Categories

The metaphor produced by each student for the open-ended questions in the answer sheet about the phenomenon of climate change was coded and those with semantic closeness were brought together and a total of 8 different conceptual categories were formed. Tables were created by calculating the number of metaphors in each category, how many students repeated the metaphor (frequency), and percentage values. In addition, a separate table was created for the reasons why students preferred the metaphor used for each open-ended question.

2.7. Organising the Data According to Codes and Categories

At this stage, the data were organised according to the codes and categories. After the detailed coding done in the first stage and the determination of the categories that can bring together the codes that are related to each other, the researcher created a system to organise the collected data and carried out the organisation process according to this system.

2.8. Ensuring Validity and Reliability

The validity of this research (according to Yıldırım and Şimşek, 2011) was made according to the expert review criterion. Validity was tried to be ensured by comparing the classification study of the expert with the classification study of the researcher. The reliability of the research was ensured by comparing the compatibility of the codings made by two researchers to confirm whether the codes under the conceptual categories based on the research data represent the conceptual categories in question. The reliability of the data analysis conducted in this way was calculated using the formula [Agreement / (Agreement + Disagreement) x 100] (Miles & Huberman, 1994). The average reliability

between the coders was found to be 93% and consensus was achieved. According to Saban (2009), in qualitative studies, a desired level of reliability is achieved when the agreement between expert and researcher evaluations is 90% and above.

2.9. Defining and Interpreting the Findings

The interpretation of the information is defined and presented in detail by the researcher and conclusions are made in this last stage. At this last stage, the researcher has to give meaning to the data collected and explain the relationships between the findings, establish cause and effect relationships, draw some conclusions from the findings, and make explanations about the importance of the results obtained (Yıldırım & Şimşek, 2016). In this context, metaphors related to climate change were categorised based on their similarities and semantic expressions in the justifications. Similar metaphors were combined under the same named category and their frequencies and percentages were calculated. The tabulated categories were explained and interpreted, and a word cloud was created from the prominent metaphor. The metaphor that defines climate change from different perspectives and is considered important are also given under each category as examples of their justifications.

3. Findings and Interpretation

The findings obtained regarding the metaphor developed by the participants for the concept of "climate change" were tabulated and analysed within the framework of the research questions. The participants presented a total of 96 valid metaphors about the concept of "climate change" (Table 2). 21 of these metaphors were developed by 2 or more participants. The number of students representing these 21 valid metaphors varied between 2 and 5. The most commonly used metaphors related to the concept of "climate change" by the students are *human* (5), *extinction* (4), *mental state* (4), and *moving* (4).

Table 2: Valid metaphor put forward by the participants towards the concept of "*climate change*"

Met. Seq.	Name of Metaphor	f	%	Met. Seq.	Name of Metaphor	f	%
1	Human	5	3,70	49	Extinction	4	2,96
2	Mental state	4	2,96	50	Moving out	4	2,96
3	Life	3	2,22	51	Disaster	3	2,22
4	Smoking	3	2,22	52	End of the world	3	2,22
5	A sick body	3	2,22	53	Food that has started to spoil	3	2,22
6	Disappointment	3	2,22	54	Chameleon	3	2,22
7	Cancer	3	2,22	55	Chaos	2	1,48
8	Growing old	2	1,48	56	Seasons	2	1,48
9	Horror film	2	1,48	57	Hidden illness	2	1,48
10	Disaster	2	1,48	58	Emotion	2	1,48
11	Broken clock	2	1,48	59	Changing dormitory	1	0,74
12	Demolition	1	0,74	60	The weariness of the world	1	0,74
13	Failure to realise	1	0,74	61	A piece that doesn't belong to the puzzle	1	0,74
14	Memory loss	1	0,74	62	Expatriation	1	0,74
15	Not knowing what to wear	1	0,74	63	Flavour change	1	0,74
16	Death	1	0,74	63	Changing department	1	0,74
17	Car with a flat brake	1	0,74	65	Alienation	1	0,74
18	Incident	1	0,74	66	Encountering a polar bear in the desert	1	0,74
19	Gemini	1	0,74	67	Fox without fur	1	0,74
20	Chaos	1	0,74	68	Broken machine	1	0,74
21	Debris	1	0,74	69	Muddy water	1	0,74
22	Flood	1	0,74	70	World virus	1	0,74
23	Earthquake	1	0,74	71	Time slippage	1	0,74
24	Insulin	1	0,74	72	Order shift	1	0,74
25	Aging	1	0,74	73	Broken refrigerator	1	0,74
26	Desertification	1	0,74	74	Loss of hope	1	0,74
27	Changing minds	1	0,74	75	Radiation	1	0,74
28	Inability to adapt to conditions	1	0,74	76	Greenhouse tomato	1	0,74
29	A ripped sweater	1	0,74	77	A child who can't play with snowballs	1	0,74

30	Tree	1	0,74	78	Covid patient in intensive care	1	0,74
31	Mind	1	0,74	79	Self-poisoning	1	0,74
32	Hair greying	1	0,74	80	Paralysis	1	0,74
33	My dreams	1	0,74	81	Turkish education system	1	0,74
34	Slow death	1	0,74	82	Clock	1	0,74
35	Breathlessness	1	0,74	83	School	1	0,74
36	Coming to an end	1	0,74	84	Polar bear	1	0,74
37	Metamorphosis of nature	1	0,74	85	Global warming	1	0,74
38	Destruction	1	0,74	86	Weather forecast	1	0,74
39	Irresponsibility	1	0,74	87	Global challenge	1	0,74
40	Suicide	1	0,74	88	Reaction	1	0,74
41	Drinking alcohol	1	0,74	89	Fire	1	0,74
42	Harmful habit	1	0,74	90	A bottle with a hole	1	0,74
43	Punishment	1	0,74	91	Water	1	0,74
44	Failure to seize the opportunity	1	0,74	92	Day cycle	1	0,74
45	Putting petrol in a diesel car	1	0,74	93	Sick old man	1	0,74
46	Man's domination of nature	1	0,74	94	Trip	1	0,74
47	Bad habits	1	0,74	95	Air conditioning	1	0,74
48	Moving towards the abyss	1	0,74	96	The beginning of a new era	1	0,74
			Total			**135**	**100**

The conceptual categories formed from the metaphor that prospective geography teachers have for the concept of geography were grouped under 8 categories. These categories are *"Climate change leading to uncertainty"*, "*Climate change as a symptom of danger/worry"*, "*Climate change as the beginning of change*", "*Climate change as a result of insensitivity"*, *"Climate change as a factor forcing to get used to a new situation"*, *"Climate change with a disruptive effect"*, *"Climate change as a cause leading to despair"*, *"Climate change as a source of different thoughts"*. The categories, frequency, and percentage distributions of the metaphor developed by the students for the key concept of climate change according to their common characteristics are as follows.

Table 3: Categorical distribution of metaphor produced by participants

Seq. No	Categories	Metaphor names	Number of Metaphors	f	%
1	Climate change leading to uncertainty	*Loss of hope (1), destruction (1), extinction (4), not realising (1), memory loss (1), not knowing what to wear (1), death (1), car with a flat brake (1), incident (1), gemini (1).*	10	13	10.42
2	Climate change as a symptom of danger/worry	*Chaos (1), disaster (2), wreckage flood (1), earthquake (1), disaster (3), insulin (1), old age (1), desertification (1), change of mind (1), inability to adapt to circumstances (1), confusion (2), horror film (3).*	13	19	13.54
3	Climate change as the beginning of change	*Food that has started to spoil (3), life (3), a ripped sweater (1), tree (1), time shift (1), mind (1) hair greying (1), my dreams (1), slow death (1), end of the world (3), smoking (3), emotion (2), breathlessness (1), the end (1), transformation of nature (1).*	15	24	15.63
4	Climate change as a result of insensitivity	*Destruction (1), irresponsibility (1), suicide (1), drinking alcohol (1), harmful habit (1), punishment (1), missing an opportunity (1), putting petrol in a diesel car (1), man dominating nature (1), bad habit (1), moving towards the abyss (1), beginning of a new era (1).*	12	12	12.50
5	Climate change as a forcing factor for people to get used to a new situation	*Change of residence (1), moving (4), seasons (2), human (5), tiredness of the world (1), a piece that does not belong to the puzzle (1), expatriation (1), change of taste (1), change of department (1), alienation (1), polar bear in the desert (1), fox without fur (1)*	12	19	12.50
6	Climate change as a disruptive effect	*Broken machine (1), muddy water (1), broken clock (2), aging (2), world virus (1), mental state (4), order shift (1), broken refrigerator (1), radiation (1), greenhouse tomatoes (1), child unable to play snowballs (1).*	11	16	11.46
7	Climate change as a cause for despair	*Covid patient in intensive care (1), a sick body (3), cancer (3), self-poisoning (1), paralysis (1), Turkish education system (1), hidden illness (2), disappointment (3).*	8	15	8.33
8	Climate change as a source of different thoughts	*Clock (1), school (1), polar bear (1), global warming (1), weather (1), global problem (1), reaction (1), fire (1), a bottle with a hole (1), water (1), day cycle (1), chameleon (3), old sick man (1), trip (1), air conditioner (1).*	15	17	15.63

Category 1: Climate change leading to uncertainty.

There are 10 different metaphors belonging to 13 students in this category (Table 3). The percentage of these metaphors was 10.42 and the most repeated *extinction* metaphor was written by 4 students. With this metaphor, it is seen that there is a perception that the world and living things will disappear with climate change. The other 9 metaphors were written once by the students. When the metaphor in this category and their justifications are analysed, we can say that students have uncertainty about climate change and its effects, and the results of this uncertainty are perceived as negative. The justifications written by the students for the metaphor in this category are given below.

- Loss of hope: *"It is not clear what will happen, how it will happen. Uncertainty leads to despair."* (CK1)
- Extinction: *"The changes that occur bring about the end of our world and living creatures."* (SK 158)
- Not realising: *"Changing climates are known but not recognised."* (CK8)
- Memory loss: *"When a person loses his memory, a new life begins, but it is not known whether the end is good or bad. As a result of climate change, nature enters a new order. However, it is not clear whether the outcome will be good or bad."* (TK80)
- Not knowing what to wear: *"Experiencing several different climates on the same day*." (SK138)
- Death: *"It happens quietly and slowly. We cannot easily recognise that climate change is happening*." (SK160)
- A car with a flat brake: *"Climate change is like a car with a flat brake, you don't know what will happen and you regret not taking precautions*." (SK161)
- Incident: *"We are experiencing a different climate when you don't expect it."* (SK98)
- Gemini: *"Climate change is like Gemini, you never know when it's going to happen*." (BK40)

Category 2: Climate change as a symptom of danger/worry

The reason for the formation of this category is that the perception that the information conceptualised by the students in their thoughts about climate change evokes as a metaphor is based on danger and worry. This category consists of 13 metaphors inferred by 19 students. The percentage of metaphors was calculated as 12.4 (Table 3). The most repeated metaphors were *disaster, catastrophe,* and *chaos*. The metaphor justifications in this category, which mostly reflect negative thoughts, consist of statements that the consequences of climate change will be severe.

- Chaos: *"Climate change has the power to change everything about a region. Everything we can think of such as living conditions, natural conditions, crops, etc. are extremely affected by this change*." (CK15)
- Calamity: *"Climates are beautiful as they are, the slightest change affects the world negatively, so climate change is a bad thing*." (CK16)
- Flooding: *"Deteriorating climate characteristics cause many unfavourable weather conditions. One of them is floods."* (TK90)

- Earthquake: *"Climate change, like earthquake, causes disruption of the established order*." (SK150)
- Desertification: *"Climate change is like desertification, it happens gradually, but the consequences are very severe.* (CK2)
- Disaster: *"The end is a disaster, there is no salvation."* (BK20)
- Insulin: *"When insulin changes, it starts to affect the body negatively, and when the climate starts to change, it affects the world negatively*." (BK21)
- Changing opinions: *"People can suffer great harm as a result of changing ideas. As a result of climate change, nature may suffer great damage*." (TK54)
- The metamorphosis of nature: *"We cannot experience the incidents we need to experience in our seasons, it disrupts the balance of people, animals, and plants. This turns into a complex order."* (SK130)
- Horror film: *"Climate change changes the way people live, species begin to disappear, floods and disasters occur*." (BK26)

Category 3: Climate change as the beginning of change

The 24 students who perceived climate change as a change in the negative direction and tried to create the similarities they associated with it mostly through human beings produced 15 different metaphors. The metaphor with a frequency of 3 was *food that started to spoil, life, a ripped sweater, the end of the world,* and *smoking*. The rate of metaphor in this category was 15.6% (Table 3). It is understood from the justifications that the students wrote for the metaphor that they have an idea that many positive situations have started to change in a way that cannot be recovered with climate change.

- Food that has started to spoil: *"As climate change occurs, it becomes harmful, such as spoilt food."* (SK126)
- Life: *"Unwanted changes occur in the climate just like in our lives."* (CK5)
- A ripped sweater: *"Climate change is like a ripped sweater, once it's broken, it's hard to fix*." (CK10)
- Tree: *"Climate is a long-term formation like a tree. It changes and differentiates."* (CK11)
- The greying of hair: *"Changing climate over time is as irreversible as greying hair."* (TK55)
- Slow death: *"Although it is not very noticeable at first, the world becomes bad over time. The reason is that people perform all kinds of actions that can harm the world and never hesitate to do so."* (SK103)
- Smoking: *"Just as human life is slowly disappearing, the world is slowly disappearing."* (TK71)
- Breathlessness: *"Weather changes adversely affect many living things."* (SK147)
- The coming of the end: *"The world's own order is slowly changing in ways that it should not be, and this change is harming the world and those in it."* (SK144)
- "The metamorphosis of nature: *We can call it as not being able to experience the seasons on time. The absence of rain and snow in winter."* (SK116)

Category 4: Climate change as a result of insensitivity

This category was formed with the metaphor produced by students who thought that humans were insensitive to climate change. The students wrote the statements emphasising that human beings are at the centre of this fundamental environmental problem, that they are insensitive to its prevention, that they do not make an effort to take the necessary precautions, and that they have to bear the consequences as justification. This category consisted of 12 metaphors and was written by one student. The ratio of the number of metaphors to total metaphors was found to be 12.5% (Table 3).

- Destruction: *"Destruction of the earth by humans causes climate change*." (CK14)
- Irresponsibility: *"It is the problem of changing one's place of residence as a result of insensitivity, laziness, and unreasonable morality*." (TK51)
- Suicide: *"In suicide, man chooses his own death, and climate change is a kind of suicide by man's own hand*." (TK67)
- Harmful habits: *"We are aware of most of our harmful habits, but we cannot give them up. We are also aware of climate change, we know what causes it, but most of us are still unconscious or careless, we do not give up our habits*." (TK74)
- Punishment: *"People are punished for destroying the natural balance with their own hands*." (SK101)
- Failing the opportunity: *"Climate change is the failure to adequately protect the nature and climate we have been given."* (SK110)
- Putting petrol in a diesel car: *"This action spoils the vehicle. By disturbing the balance of the earth's temperature, population, etc., we are causing the current climate to change and permanent deterioration in the world."* (TK60)
- Moving towards the abyss: *"We are all aware of climate change, but we are doing very little about it."* (SK96)

Category 5: Climate change as a forcing factor for people to get used to a new situation.

There were 12 metaphors in this category and the frequency of 12 metaphors was calculated as 19 (Table 3). The prominent metaphors were human, moving, and horror film, and the other metaphors were repeated once. The ratio of the number of metaphors in this category to total metaphor is 12.5%. Students have an opinion that the current environmental conditions will deteriorate with climate change, the habitat characteristics of living things will change, and that we are likely to encounter new situations that we are not used to.

- Moving: *"Just like when we move to a new place, everything changes and a new life begins with climate change."* (TK81)
- Human: *"A change occurs as a result of bad factors affecting the climate (air pollution, industrialisation, etc.). Humans are the cause of these."* (TK46)
- A piece that doesn't belong to the puzzle: *"It's not really there, there is a certain time and place to live in the seasons, but if you go beyond this time, climate change occurs."* (BK42)

- Alienation: *"We see that the climates we are used to, know and experience are now looking at us from another window, this is alienation."* (SK136)
- Coming across a polar bear in the desert: *"In the degraded ecosystem, which is deteriorating and increasingly ruined, living things are now losing their natural environment one by one."* SK121)
- A fox without fur: *"It loses its usual standard of living."* (SK162)

Category 6: Climate change as a disruptive effect

In this category, a total of 11 metaphors and the number of repetitions of these metaphors was calculated as 16. Among the metaphors, *mental state* was repeated 4 times, and the metaphor of *broken clock* and *aging* was written 2 times. The percentage of metaphors was calculated as 11.6 (Table 3).

- Broken machine: *"Climate change is like a broken machine, its flow and time are disrupted. The system is changing."* (BK32)
- A broken clock: *"It shows the time incorrectly. Climate change also disrupts the usual order*." (BK37)
- Aging: *"Nature has lost its former strength and energy as a result of climate change."* (TK84)
- Mental state: *"The damage we cause to the earth, the universe, and the natural environment causes climate change as a return to us. Climate change also affects our mood*." (SK109)
- Order shift: *"There is an order in the world with climates. Therefore, climate change disrupts this order."* (SK128)
- Broken refrigerator: *"When the refrigerator breaks down, it does not cool, it cools too much or too little. In climate change, the seasons are disrupted and the balance between cold and hot is disturbed*." (SK140)
- Radiation: *"Human beings know the sources of radiation, its damages, how it should be protected, and how to be less affected, but they do not take precautions and are affected by it blatantly. Even though they know how bad climate change is, they do not take precautions, contribute more to it, and are affected by its consequences. Both have serious effects on our health*." (SK94)

Category 7: Climate change as a cause for despair

There are 8 different metaphors in this category and the number of repetitions of metaphors by students is 15. The metaphor repeated 3 times is *a sick body, cancer and disappointment, and the* metaphor repeated 2 times is *a hidden illness*. The ratio of metaphor to total metaphor is 8,33% (Table 3).

- Covid patient in intensive care: *"When necessary, measures are not taken, the sick body becomes unable to support life and eventually dies. Climate change is just like this, if necessary, measures are not taken, the world will become unable to support life*." (TK62)

- A sick body: *"The ozone depletion and the long-term changes in harmful gases that occur in industrialised society are at the root of climate change. The human body is also affected by harmful substances for a long time."* (TK65)
- Cancer: *"Because people do not see the consequences of climate change in the immediate neighbourhood and in a short period of time, they pretend it does not exist. This is like a smoker not realising that smoking is harmful until they get cancer."* (TK50)
- Paralysis: *"I liken it to a stroke, just as a person cannot do anything when they have a stroke, climate change is paralysing the world."* (TK63)
- Hidden illness: *"Climate change is like a hidden illness, it progresses day by day, it gets worse and worse and we hardly notice it."* (SK104)
- Disappointment: *"Climate change is the absence of the weather that should be in the expected season. This is a kind of disappointment."* (SK137)

Category 8: Climate change as a source for different thoughts

A separate category was not created from these metaphors that do not have relational properties and all of them were collectively given under the same category with the same category name. Because it was not possible to create a separate category from each of these metaphors that do not have semantic closeness, it was preferred to give them together in the same category. In this category, the *chameleon* metaphor was written by 3 students (Table 3). The others were metaphor written once. The number of metaphors was 15 and the metaphor percentage was 15,63.

- School: *"If you use nature well, there will be no climate change; if you use it badly, there will be climate change. If you learn in a school, the result will be good, if not, it will be bad."* (BK38)
- A polar bear: *"When we talk about climate change and its damages, everyone talks about the damage to polar bears. I think climate change affects them the most."* (SK99)
- Global problem: *"As a result of climate change, many problems will arise, affecting living things all over the world."* (SK134)
- Reaction: *"Climate change is a reaction of the climate as a result of changing events in the air*." (SK143)
- A bottle with a hole in it: *"The water sources that we fill with rainfall begin to dry up as the weather gets warmer."* (BK36)
- Water: *"Climate is a sensitive issue like water."* (BK41)
- Chameleon: *"Chameleons constantly change colour. In climates, it constantly changes the temperature without us noticing*." (SK163)
- Sick old man: *"The world seems to be struggling to survive despite all kinds of climate adversities."* (TK44)
- Trip: *"The world reacts to what we do to it. It trips us because we treat the world badly."* (TK69)
- Air conditioning: *"Sudden changes in weather conditions can make a person as sick as being hit by an air conditioner."* (SK142)

The distribution of the prominent metaphor is shown in the word cloud visual, which was created by considering the frequency values of the metaphors developed by the participants related to the key concept of climate change (Figure 2). As can be seen in the visual, the most common metaphor are *Human 5*, *Mental state 4*, *Extinction 4*, *Moving 4*, *Smoking 3*, *Life 3*, *A sick body 3*, *Disappointment 3*, *Cancer 3*, *Disaster 3*, *End of the world 3*, *Food that has started to spoil 3*, *Chameleon 3*, *Aging 2*, *Horror film 2*, *Catastrophe 2*, *Confusion 2*, *Seasons 2*, *Hidden illness 2*, *Emotion 2*, were repeated. The metaphor in the word cloud visual was formed from a metaphor repeating between 2 and 5.

Figure 2: Word Cloud Image Created According to Frequency Values of Metaphor (prepared with wordart.com)

4. Conclusion and Discussion

It is accepted by almost everyone that global warming is one of the most important environmental problems of today. Global warming, which has become such an important problem, is seen as the root cause of many environmental problems. Along with the problems caused by global warming, the negative effects on living life are multifaceted, and perhaps most of them will not be possible to compensate. Global climate change is one of the leading environmental problems caused by global warming. The effects of

climate change have started to be felt in many different ways today. It is also curious how people perceive this problem and what they think about it. In this respect, it is important to determine what university students' thoughts on climate change consist of and to reveal their attitudes and behaviours towards environmental problems.

The conceptual categories formed by the metaphor that emerged with the perceptions of university students about the concept of "climate change" contain some important information. First of all, it is understood from the metaphor they produced that university students have an awareness of the concept of "climate change" and that they have certain ideas about what climate change is and what its consequences will be. A total of 96 valid metaphors were created by establishing similarities between many different concepts related to the key concept of climate change. The frequency of these metaphors was calculated as 135. The richness of the metaphor inferred by the students with the concept of climate change shows that their perceptions of the concept are quite different, diverse, and valid.

The most repeated metaphors were formed with expressions such as *human* (f=5), *mental state* (f=4), *life* (f=3), *a sick body* (f=3), *disappointment* (f=3), *cancer* (f=3), *extinction* (f=4), *moving* (f=4), *disaster* (f=3), *end of the world* (f=3), and *chaos* (f=2). As can be seen in these metaphors, both the concept of humans as a similarity to climate change was used more in the metaphor created by the students and human characteristics came to the fore in the justifications of the metaphor. In addition, expressions such as *loss of hope*, *not realising*, *not knowing what to wear*, *death*, *insulin*, *aging*, *change of thoughts* are other examples of metaphors for associating climate change with human beings. Human beings have been in constant interaction with the environment since the moment they started to live on earth. For this reason, human beings were frequently mentioned by the students both as a metaphor and in their justifications. This situation reveals that the perception that human beings are at the centre of climate change is dominant in students' thoughts. Because one of the main causes of today's environmental problems is the damage caused by human beings to the environment and their irresponsible behaviours. For this reason, while the similarity to human beings is at the forefront in terms of the number of metaphors, the concept of human beings is also found in the justification of almost every metaphor.

In addition, a significant number of the examples given are also related to human characteristics. Özdemir and Babaoğlan (2022) stated in their study that the most frequently expressed metaphor related to the concept of climate change was *human* (f=16). When the sentences written about the *human* metaphor are examined, it is seen that *"A change occurs as a result of bad factors affecting the climate (air pollution, industrialisation, etc.). It is human beings who cause these (TK46)*", and regarding the extinction metaphor, *"As all living things, we are very badly affected by the change in climate. Everything we do consciously or unconsciously in this way leads us to extinction (SK148)"*. The beginning of a new era "*Every climate change is the price of the evils done by human beings and that is why the climate is changing (TK76)*", punishment "*People are punished for disrupting the natural balance with their own hands (SK101*)", cancer *"Since people do not see the consequences of climate change in*

the immediate environment and in a short time, they pretend that it does not exist. Many expressions such as "*A smoker does not realise that smoking is harmful until he/she gets cancer (TK50)"* have emerged in relation to the concept of human and in the examples, they are mostly associated with *human*. *In addition,* we can say that expressions such as *loss of hope*, *not realising*, not knowing *what to wear*, *death*, *insulin*, *aging, change of thoughts, life* are other examples of metaphors for associating climate change with people.

As can be understood from the category names, it is noteworthy that metaphors for expressions such as *uncertainty, anxiety, danger, change*, *bad things that may happen, disruptive effect, hopelessness,* and *negativity* are produced a lot when climate change is mentioned. In addition, it is also seen that metaphors were written about getting used to the *new situation*, albeit to a lesser extent. Some of the metaphors are related to insensitivity and consist of expressions such as *destruction*, *irresponsibility, harmful habit*, *wasting opportunity*, *human domination of nature*, *moving towards an abyss*, which emphasise that human insensitivity towards the environment is effective in the realisation of climate change. Some examples of metaphors reflecting this feature are given below.

- ***Chaos*** *"Climate change has the power to change everything about that region. Everything we can think of such as living conditions, natural conditions, crops, etc. are extremely affected by this change".* (CK15)
- ***Disaster*** *"Climates are beautiful as they are, the slightest change affects the world negatively, so it is a bad thing".* (CK16)
- ***Wreckage*** *"As a result of globalisation and carbon emission, the ecosystem change in the world has resulted in wreckage".* (TK45)
- ***Flood*** *"The same weather conditions experienced in a row with deteriorating climatic characteristics cause negativities. One of these is floods".* (TK90)
- ***Desertification*** *"Occurs gradually, but the consequences are very severe".* (CK2)
- ***Paralysis*** *"I liken it to a stroke, just as a person cannot do anything when they have a stroke, climate change is paralysing the world".* (TK63)
- ***Breathlessness*** *"Weather changes negatively affect many living things".* (SK147)
- ***A ripped sweater****: "When it gets damaged in the climate like a ripped sweater, it's hard to fix it later".* (CK10)
- ***The greying of hair*** *"Changing climate over time is irreversible like the greying of hair".* (TK55)
- ***Coming to the end*** *"There is a world that is slowly being depleted by climate change".* (SK157)
- ***Failing the opportunity*** *"It is not being able to adequately protect the nature and climate that we are given".* (SK110)
- ***A sick body*** *"gets sick as a result of global warming in our world and leads to many bad consequences".* (TK68)

It is seen that students did not produce metaphors about the sources showing climate change (geological records, melting of glaciers, rising seas, etc.), possible effects of climate change (health, biodiversity, drought, famine, etc.), defining climate change, and preventing climate change. Kaya, Ateş, and Kılıç (2019) reported that students did

not express any opinions about the prevention of global warming and the measures to be taken.

This result shows that students' knowledge about climate change is mostly superficial and acquired from different sources, but it is seen that it consists of accurate information. It is seen that students have a negative perception that climate change is mostly human-induced and dangerous. According to Özdemir and Babaoğlan (2022), the sharing of information about the concepts of climate change, the greenhouse effect, and global warming in media such as visual and written media may have raised awareness in students and affected student views.

When the words produced as a result of the research are examined, it is seen that the results of climate change are generally emphasised. As a matter of fact, when the words produced were ranked according to their frequencies, the words "drought, famine, flood, melting of glaciers" were expressed the most. The common feature of these words is that they are situations that may arise as a result of climate change (Yel, 2022). It is seen that the participants' statements draw attention to the negative effects of climate change (Özdemir & Babaoğlan, 2022). Aydın (2017) stated in his study that most students think that the amount of fresh water available will decrease with global warming, climate changes will occur, the lives of living things will be negatively affected, human health will be negatively affected, and disease-carrying organisms will spread to wider areas.

Climate change tends to turn into a dimension that threatens every segment of society and all living life. As seen in this study, climate change was perceived by university students in very different ways by expressing it with various metaphors. However, in all of these perceptions, it is seen that students have a negative attitude towards climate change. Arğın (2021) states that for the perception of a situation to be formed in a person, the person must know that thing or have encountered and experienced that situation before. When a familiar or experienced situation is encountered again, the individual's interest will increase. According to Tunç and Atılgan (2017), in the general definitions of the concept of perception, in addition to the argument that perception is realised through the sense organs, issues such as desire, expectation, knowledge, and culture at that moment occupy an important place in terms of perception. According to Kahraman and Şenol (2018), it is widely accepted that global climate change causes risks and losses beyond the limits of acceptability and threatens all living and non-living things.

As a result, in this study, what students understand from the concept of climate change and how they associate the key concept of climate change with other concepts were determined through their metaphorical perceptions. A significant number of students were able to write many valid metaphors related to the key concept of climate change. This result shows that students have a certain level of knowledge about climate change. However, this knowledge needs to be utilised in practice. The high number of metaphors produced about the consequences of climate change is a remarkable and important situation. These answers can be considered as expressions that show how climate change is really understood in a scientific sense. For this reason, environmental

education courses should be made compulsory in almost every discipline by using appropriate methods and techniques in order to raise awareness in students about climate change, to ensure that they are sensitive to environmental problems, to develop their ability to propose solutions to environmental problems and to raise environmentally literate individuals. In addition, it can be said that metaphor can be used at all levels of education and can be a good data collection tool for determining what is in students' minds about different concepts. According to Eraslan (2011), metaphor can be used to determine students' prior knowledge about the subject. Students' readiness for a new subject can be determined with the help of metaphors they can produce. Saban (2008) states that metaphor can be used as a powerful "pedagogical tool" in revealing, understanding and (perhaps) changing the mental images that prospective teachers have about certain phenomena during teacher education.

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