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Examination of Fourth-Grade Students' Mental Structures Regarding Natural Disasters

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Abstract

Providing students with knowledge and awareness from an early age in natural disaster education is important. This research examines the mental structures of fourth-grade primary school students about natural disasters. The model of the study is a case study, one of the qualitative research methods. The participants were 14 students studying in the fourth grade at a public school in Terme, Samsun. The study group was determined by convenience sampling. Mind maps and semi-structured interview forms were used as data collection tools. The data were analyzed using the content analysis and descriptive analysis methods. As a result of the research, it was revealed that students' mental structures regarding natural disasters were grouped under 13 themes: earthquakes, floods, erosion, landslides, fire, avalanches, tornadoes, tsunamis, volcanic eruption, hurricanes, storms, lightning, and thunder. In addition, many different codes were obtained under the sub-themes of the causes of the natural disaster, its consequences, precautions, and what to do during a natural disaster. These codes revealed that the students had rich mental structures regarding natural disasters. However, it was also determined that they confused some climate events with natural disasters. The interviews supported the idea that the students had sufficient knowledge about natural disasters and the precautions. Updating textbooks on this subject and including more activities to attract children's attention in lessons will ensure that primary school students receive a better education on natural disasters and become more equipped.

Keywords

Natural disasters, fourth-graders, natural disaster education in primary school.

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INTRODUCTION

Nature, which offers many opportunities for human survival, also contains many risks. Natural disasters are some of these risks. Natural disasters result from climate events and cause significant losses and damage to the environment and all living things. According to the United Nation Statistics Division (UNSD) (2018), a disaster is "*a situation or event which overwhelms local capacity, necessitating a request to the national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering.*" It affects societies by stopping or interrupting social and everyday life, and the affected communities cannot cope using local resources alone (Kadıoğlu, 2011). For a climate event to be considered a disaster, it must seriously affect people's lives. As a result of natural disasters, many deaths, injuries, and economic losses may occur, and these events may have sociological and psychological effects. For example, if people's lives or their houses are damaged in an area where an earthquake or flood occurs, these natural events are considered disasters. However, if no people live in the areas where natural events occur and there are no houses belonging to them, these events are generally not considered disasters (Dölek, 2016). Therefore, disasters usually cause great human suffering and losses, and their effects are felt for many years (Kaymak, 2003).

Natural disasters such as floods, fires, earthquakes, hurricanes, and tsunamis are experienced more frequently and severely in the world nowadays. As a result of human activities, natural resources are depleted, climate change is experienced, and environmental pollution increases. For this reason, many natural disasters occur in Türkiye. Reports even show that Türkiye is in the highest risk group regarding natural disasters and among the countries where the risk tends to increase (Disaster and Emergency Management Presidency, 2018).

Türkiye's geological, meteorological, and tectonic structure causes different types of natural disasters to occur. The history of these natural disasters dates back many years in Türkiye (Karatağ, 2021). Regarding natural disasters, our country is exposed to most of the 31 types of natural disasters seen worldwide, except volcanic eruptions and tropical storms (Dölek, 2016). A remarkable 60 percent of the deaths caused by disasters in Türkiye are caused by earthquakes (Disaster and Emergency Management Presidency, 2018). Türkiye is located in the earthquake zone, with active fault lines such as the Northern Anatolian Fault and the Eastern Anatolian Fault. Due to these active fault lines, earthquakes constantly occur in Türkiye (Atabey, 2000). In addition, storms, floods, landslides, and erosion frequently occur in coastal areas. Natural disasters such as heat waves and drought can also occur in our country during summer.

Natural disaster education is gaining importance since many natural disasters occur constantly in different regions in our country. Disaster education aims to help individuals and societies build confidence during disaster periods, be prepared for disasters, and solve the problems caused by disasters. In line with this, disaster education aims to provide individuals and societies with resilience and empowerment skills against disasters (Çelik & Gündoğdu, 2022). For a community with a disaster culture, disaster education should start at an early age. Children tend to show high sensitivity to learning at certain developmental stages, and in these stages, they are open to learning (Senemoğlu, 2021). These periods, called critical development periods by psychologists, should not be ignored for disaster education. Especially in primary school, children develop rapidly and can quickly learn everything around them. Therefore, disaster education should start in this period and children should

be equipped with concise knowledge to learn what to do in a disaster (Akman & Yıldırım, 2022). A child who receives effective disaster education from an early age will grow up consciously. In this way, the consciousness of individuals in society will increase, and it will be possible to reduce the effects of disasters on society.

Many studies on disaster education have been carried out in the literature. For example, Kısa (2019) suggested activities on natural disasters for 4th, 5th, and 7th grades. Sözcü and Aydınözü (2019) examined the natural disaster literacy levels of pre-service teachers, and Özen (2020) examined the disaster awareness levels of high school students. Disaster education in the preschool period (Akman & Yıldırım, 2022; Sapsağlam, 2019), secondary school students' awareness levels about natural disasters (Adanalı et al., 2022), teachers' opinions on disaster education practices in primary school (Çelik & Gündoğdu, 2022), examining the achievements of the life sciences, social studies, and geography curricula in terms of disaster education (Başıbüyük & Pala, 2023), and the effects of earthquakes on children (Gürbüz & Koyuncu, 2023) constitute some of the recent studies carried out in our country on natural disasters.

Studies about disaster education have also been implemented abroad. The subjects of some of these studies are as follows: an examination of school safety and disaster education in Brazil, Colombia, Cuba, the Dominican Republic, Jamaica, and Puerto Rico (Munoz et al., 2020), the effects of physics learning media based on android integrated earthquake disaster education on the enhancement of problem-solving abilities and natural disaster preparedness (Abdillah et al., 2020), disaster mitigation and disaster learning in Indonesian elementary schools (Suarmika et al., 2022), and using a web geographic information system (Web GIS) in natural disaster education (Li et al., 2022). Review studies have also been conducted about disaster education. For example, Torani et al. (2019) examined the importance of natural disaster education and the effect of different education methods on individuals' disaster risk reduction and preparedness. For this purpose, they examined the results of 31 studies. The results showed that disaster education is a functional, operational, and cost-effective tool for risk management. Based on the results of the studies, it was concluded that training people about disasters is essential. There are also different methods to educate students about disasters. However, it cannot be said that one way is better than others, and it was determined that trained people can better protect themselves from disasters. Hoffmann and Blecha (2020) reviewed the literature on the impact of natural disaster education on vulnerability to disasters in Southeast Asia. Researchers have stated that education and learning enable individuals to prepare for and cope with the consequences of disasters effectively, and that natural disaster education provides individuals access to resources that can help reduce vulnerability to disaster. Alim et al. (2020) examined the effects of disaster mitigation education at universities in the post-COVID-19 period. They determined that students needed to receive sufficient learning of disaster mitigation education, and that 51.9% of the students participated in disaster education. In another study, Zhang and Wang (2022) examined research conducted to identify global disaster education research trends. The results showed that most articles were produced in Europe and focused mainly on education, disaster nursing, disaster risk and reduction, disaster awareness, and earthquakes. However, when the studies were examined, the knowledge and awareness levels of students who graduate from primary school regarding natural disasters needed to be clarified. More studies on this subject are needed. Therefore, in this study, the mental structures of fourth-grade students regarding natural disasters were examined. The sub-problems are as follows:

1- Under which themes and codes are the mental structures of fourth-grade students regarding the concept of "natural disaster" grouped?

2- What are the views of fourth-grade students regarding natural disasters?

METHOD

Model of the Research

The model of the research is a case study. A case study is a qualitative research approach in which the researcher examines one or a few situations in depth with data collection tools (observations, interviews, audio-visuals, documents, reports) containing multiple sources (Creswell, 2007). In case study research, the focus is on "how" and "why" questions; the researcher has little or no control over the events, and the event or phenomenon is studied within its natural context (Yin, 1984). In this research, the mental structures of primary school students regarding natural disasters were examined within the framework of natural life without any intervention, so the research was carried out using a case study model.

Participants

The research participants comprised 14 students (seven girls and seven boys) studying in the fourth grade of a primary school affiliated with the Ministry of National Education in the Terme District of Samsun Province. The participants were determined using the convenience sampling method. The school has a medium socioeconomic level. The research aimed to examine the mental structures of fourth-grade students who were educated on natural disasters in primary school.

Data Collection Tools

The data collection tools of the research are mind maps and semi-structured interview forms. A mind map is a creative drawing in the form of a branched structure in which the main theme of the subject is depicted with a central concept, and the branches emerging from the significant concept contain the key images or keywords evoked by the central idea (Buzan & Buzan, 1996). In the mind map, the individual expresses everything that comes to his/her mind about the given basic concept on paper and relates them to each other. A semi-structured interview form was also used in the research to obtain richer qualitative data. The interview form aimed to examine students' knowledge and perceptions regarding natural disasters in a versatile way, obtain in-depth information, and better explain the concepts in the mind maps. Expert opinions were obtained from one faculty member and three classroom teachers about the interview form.

Data Collection Process

Before the collection of the data, students were informed about mind maps. They created mind maps on different subjects. In this way, they learned better how to draw a mind map. Then, "Natural Disasters" was written in the middle of a blank paper and distributed to the students. They were asked to write down what came to their mind, draw pictures, and thus prepare their mind map regarding natural disasters. Three lesson periods were used for this study. After completing the mind maps, semi-structured interviews were conducted with the students. Questions about natural disasters and how to prevent them were asked. During the data collection process, care was taken to create an environment where students would not be influenced by each other.

Data Analysis

The data were analyzed using the content analysis method. Content analysis involves bringing together similar data around certain concepts or themes and organizing and interpreting them in a way that the reader can understand (Yıldırım & Şimşek, 2011). This analysis method involves a systematic examination of the content of written, visual, or audio materials that describe a specific topic or data set (Büyüköztürk et al., 2021). With content analysis, students' perceptions about natural disasters were presented more concisely and understandably by classifying specific codes and themes. The mind maps were first numbered sequentially in the analyses, considering student gender (e.g., SM1: StudentMale1, SF1: StudentFemale1). Then, the concepts in the mind maps were examined and coded one by one. Codes were created by considering the words and ways of thinking that stand out in the data (Tavşancıl Tarkun, 2000). The sub-themes were obtained by bringing similar codes together. The resulting codes were expressed in separate tables according to the sub-themes they were included in, and their frequency values were calculated. The data obtained from the interviews were analyzed descriptively. After each natural disaster sub-theme, student opinions were summarized descriptively with direct quotes. After the researcher analyzed the data, the results were presented for expert opinion. The expert examined the mind maps, interview data, and coding results, compared them with the original data, and reviewed the analysis results.

Validity and Reliability of the Research

To increase the validity of the research, more than one data collection tool was used, and semi-structured interviews supported the data collected with mind maps. The analysis results were presented for expert opinion to ensure the reliability of the data analysis. During the research, care was taken to ensure that students participated in the research voluntarily, and no intervention was made in student studies

Ethical Principles

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FINDINGS

The sub-themes that emerged from the analysis of the concepts in the mind maps are listed in Table 1.

Table 1

Sub-themes that emerged under the natural disaster theme

Theme	Sub-themes	Students	f
Natural disaster	Earthquakes	SM1, SM2, SM3, SM4, SM5, SM6, SM7, SF1, SF2, SF3, SF4, SF5, SF6, SF7	14
	Floods	SM1, SM2, SM3, SM4, SM5, SM6, SM7, SF1, SF2, SF3, SF4, SF5, SF6, SF7	14
	Erosion	SM1, SM2, SM3, SM4, SM5, SM7, SF1, SF2, SF3, SF4, SF5, SF6, SF7	13
	Landslides	SM1, SM3, SM4, SM5, SM6, SM7, SF1, SF2, SF4, SF5, SF7	11
	Fire	SM1, SM2, SM3, SM4, SM6, SF1, SF2, SF4, SF5, SF6, SF7	11
	Avalanches	SM1, SM2, SM3, SM4, SM6, SF1, SF2, SF4, SF5, SF7	10
	Tornadoes	SM2, SM3, SM4, SM5, SM7, SF1, SF2, SF5, SF7	9
	Tsunamis	SM2, SM5, SM7, SF1, SF2, SF4, SF5, SF7	8
	Volcanic eruption	SM5, SF1, SF2, SF3, SF7	5
	Storms	SM6, SF3, SF4, SF7	4
	Lightning	SM4, SM5, SF7	3
	Hurricanes	SM4, SF7	2
	Thunder	SF7	1

Table 1 shows that students' mental structures regarding natural disasters are grouped in 13 sub-themes. All students (f=14) described earthquakes and floods as natural disasters. Erosion (f=13), landslides (f=11), fire (f=11), avalanches (f=10), tornadoes (f=9), tsunamis (f=8), volcanic eruption (f=5), and hurricanes (f=2) emerged as other types of natural disasters in the students' minds. Four students (f = 4) described storms, three students (f = 3) described lightning, and one student (f = 1) described thunder as a natural disaster. However, these are climate events that we frequently encounter in daily life. The concept of disaster generally reflects more significant amounts of damage and danger. Therefore, it can be seen that some students confused natural disasters with climate events in this regard. Table 2 shows the codes that emerged in the earthquakes sub-theme.

Table 2

Codes of the earthquakes sub-theme

Sub-theme	Codes	Sub-codes	Students		f
Earthquakes	Causes of earthquakes	Fault line	SM1, SM4, SM5, SF1		4
		Ground shaking	SF5, SF7		2
	Consequences of earthquakes	Emotional	Sadness	SM1, SM2, SM3, SM6, SF1, SF2, SF4, SF5, SF6, SF7	10
			Vertigo	SM6	1
			Panic	SM3	1
		Destruction	SM2, SM3, SM5, SM6, SF2, SF4, SF5, SF6		8
		Loss of life	SM3, SM4, SME5, SF1, SF3, SF4, SF6		7
		Loss of property	SM2, SM5, SF1, SF6		4
		Debris	SF1, SF7		2
		News	SM3		1
		Earthquake victim	SM1		1
		It happens a lot in Türkiye	SM1		1
	What to do during an earthquake	Earthquake kit	SM1, SM2, SM3, SM4, SM5, SM7, SF1, SF2, SF5, SF6, SF7		11
		Not approaching the window	SM1, SM2, SM6, SF2, SF6, SF7		6
		Life triangle	SM5, SM6, SF1, SF3, SF6, SF7		6
		Not taking the elevator	SM1, SM2, SM6, SF1		6
		Not approaching the stairs	SM4, SF2, SF6		6
		Shouting	SM4		1
	Precautions against earthquakes	Construction of solid buildings	SM2, SM3, SM4, SM6, SF1, SF3, SF4, SF5, SF6		9
		Column-thick iron	SM1, SF3		2
		Good material	SM2,SM6		2
		Good contractor	SM3		1

In Table 2, it was revealed that the students saw the fault line (f = 4) and ground shaking (f = 2) as the causes of earthquakes. Students emphasized sadness, one of the most emotional consequences of earthquakes (f=10). Additionally, destruction-collapse (f=8) and loss of life (f=7) were the most frequently mentioned results. The earthquake kit (f=11) was the most mentioned thing to do during an earthquake, and they emphasized the construction of solid buildings (f=9) as a precaution against

earthquakes. In the interviews, students expressed how earthquakes occurred: SM2: *"A fault passes under the cities, and when that fault breaks, an earthquake occurs."* SF1: *"When the fault line breaks, everything shakes. Houses are destroyed."* When asked whether earthquakes are preventable, they stated that they cannot be prevented, but it is possible to take precautions: SF3: *"No, they cannot be prevented, but precautions can be taken. For example, we can build solid houses. We can inform people what to do before, during, and after an earthquake. We can make an earthquake bag for earthquakes."* The codes created by the students regarding floods are presented in Table 3.

Table 3

Codes of the floods sub-theme

Sub-theme	Codes	Subcodes	Students	f
Floods	Cause of floods	Rain	SM3, SF1, SF7	3
	Consequences of floods	Overflow	SM1, SM4, SF1, SF2, SF4, SF7	6
		Loss of life	SM2, SM3, SM6, SF4, SF6	5
		Flooding	SM2, SM3, SM4, SF1	4
		Emotional	Fear-anxiety SM2, SF1, SF6	3
			Sadness SM2, SM6, SF6	3
		Injury	SM2, SM6	2
		Destruction	SM3	1
		Loss of money	SF4	1
		The fish are left homeless	SM4	1
	Precautions against floods	Dam	SM1, SM3, SM5, SM6, SF1, SF2, SF5, SF6, SF7	9
		Not building houses on the stream bed	SM4, SF1, SF2, SF3, SF4, SF5, SF6, SF7	8
		Terracing	SM2, SM5, SF1, SF2, SF3, SF6	6
		Planting trees	SM5, SF1, SF2, SF6	4
		Not leaving the water on	SM5	1
		Binding	SM1	1
		Being prepared for it	SF6	1
		Flood bag	SF4	1
	What to do during a flood	Going to higher ground	SM5	1
		Looking for a safe place	SM5	1

Table 3 shows that the students showed rain (f = 3) as the cause of floods in their mind maps. They expressed many consequences of floods, especially overflow (f = 6) and loss of life (f = 5). As a precaution, dams (f = 9) and not building houses on the stream bed (f = 8) were suggested. One student suggested going to higher ground or looking for a safe place in the event of a flood (SM5). In the

interviews, students expressed their opinions about floods: SM3: *"Floods can be prevented. We can increase the number of dams and embankments on streams. We should not establish settlements, building sites, or houses in low places, on the banks of streams."* SF7: *"Yes, it can be prevented by terracing, afforestation, building dams. There is a high risk of flooding in the basements of buildings."* The codes expressed regarding erosion in the mind maps are shown in Table 4.

Table 4

Codes of the erosion sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Erosion	Causes of erosion	Chemical pesticides	SM2, SM3, SM4, SM5, SF5, SF6, SF7	8
		Drought	SM2, SM4, SM7, SF1, SF5, SF6, SF7	7
		Little water	SM1, SM3, SM5, SF3	4
		Waste of water	SM1, SM6	2
	Consequences of erosion	Cracking of the soil	SM1, SM2, SM5, SM7, SF1, SF2, SF3	7
		End of life - death of plants	SM1, SM3, SM4, SF4, SM6, SF7	6
		Seeds do not grow	SM1, SF2, SF4, SF7	4
		Illness	SM3, SM4	2
		Sinking of the water level	SM3	1
		Sadness	SM6	1
	Precautions against erosion	Using animal manure on the soil	SM3, SF5, SF6	3
		Not throwing garbage	SM1, SM2, SF6	3
		Not harming nature	SF3, SF1	2
		Planting trees	SF2, SF5	2
		Conscious water consumption	SM1, SM5	2
		Dam	SF3	1
		Aerating the soil	SF6	1

Table 4 shows that the students mostly cited chemical pesticides (f=8) and drought (f=7) as the causes of erosion. The most common codes for the consequences of erosion were cracking of the soil (f = 7) and the end of life - death of plants (f = 6). Suggestions such as throwing animal manure on the soil (f = 3) and not throwing garbage (f = 3) were expressed as precautions against erosion. In the interviews, students summarized their thoughts about erosion by emphasizing drought and soil cracking: SM2: *"Erosion occurs when dry soil cracks. It occurs if it does not rain as much as it should."* SF4: *"The soil dries out, and no plants are left there. Life gradually ends; erosion occurs over centuries."* SF2: *"If we leave bad pesticides in the soil and there is less rain than necessary, erosion will occur. To prevent it,*

we should not use bad pesticides and should water the soil as much as necessary." The codes related to landslides expressed in the mind maps are shown in Table 5.

Table 5

Codes of the landslides sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Landslides	Causes of landslides	Landslip	SM1, SM4, SM5, SM7, SF1, SF2, SF4	8
		Muddy soil	SM1, SM4, SF7	3
		Slope	SF7	1
	Consequences of landslides	Road closure	SF1, SF2, SF7	3
		Loss of life	SF1, SF2	2
		Loss of property	SF1, SF2	2
		Falling stones	SM4, SM5	2
		Avalanches	SM5, SM7	2
		Destruction	SM3	1
		Infertile soil	SM6	1
		Emotional	Fear SF2, SF4	2
			Distress SM3	1
			Haste SF4	1
	Precautions against landslides	Afforestation	SM1, SM4, SM6, SF1, SF2, SF7	6
		Making a barrier	SM1, SF1	2
		Not building houses or roads on the mountain	SM1, SF5	2
		Construction	SM3	1

According to Table 5, landslip (f=8), muddy soil (f=3), and slope (f=1) were stated by the students as the causes of landslides. As consequences of landslides, road closure (f = 3), loss of life (f = 2), loss of property (f = 2), falling stones (f = 2), avalanches (f = 2), destruction (f = 1), infertile soil (f=2) and some emotional consequences were expressed. Among the precautions, afforestation (f = 6) was the code with the highest frequency. In the interviews, students explained how landslides occur: SM1: *"It occur when the soil becomes heavy due to excessive rain and falls off the ground like a mountain."* SM3: *"A landslide occurs when moist soil slides down from a mountain or a slope."* In addition, 12 students said that landslides could be prevented by taking precautions, while two said that they could not be prevented: SF6: *"We should plant many trees and build embankments in downhill areas."* The codes expressed about fire in the mind maps are in Table 6.

Table 6

Codes of the fire sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Fire	Causes of fire	Lighter	SM6, SF6	2
		Broken glass	SM2	1
		Explosion	SM4	1
	Consequences of fire	Loss of property	SM3, SF1, SF2, SF3	4
		Death	SM6, SF4, SF6	3
		Death of animals	SF1, SF2, SF4	3
		Sadness	SM1, SM6	2
		Injury	SM6	1
		Being stuck at home	SF2	1
		Burns	SM4	1
	What to do during a fire	Extinguishing the fire	SM2, SM3, SM6, SF5, SF6	5
		Calling the fire brigade	SM1, SM4, SF1	3
		Pouring water	SM1	1
	Precautions against fire	Gathering reflective tools	SF6	1
		Not throwing garbage in the forest	SF5	1

When Table 6 is examined, it is seen that students considered the causes of fire as lighter (f = 2), broken glass (f = 1), and explosion (f = 1). The consequences are mostly grouped in the codes of loss of property (f = 4), death (f = 3), and death of animals (f = 3). Students stated the codes of extinguishing the fire (f = 5) and calling the fire brigade (f = 3) regarding what to do in case of fire. Students explained their views on how fire occurs in the interviews: SM2: *"It is an event that occurs when people leave the picnic fire without extinguishing it."* SM2: *"We will put out the picnic fire. We will not throw the glass bottle into the forest."* SF5: *"Yes, if we do not throw glass and unextinguished ashes into the forest, we will protect both the forest and the homes of living things. This way, there will be no forest fires."* All 14 students in the research stated that fire was preventable. The codes in the avalanches sub-theme are presented in Table 7.

Table 7

Codes of the avalanches sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Avalanches	Cause of avalanches	Loud sound	SM1, SM3, SM4, SF1, SF2, SF4, SF5, SF7	8
		Slope	SM1, SM4, SM6, SF7	4
		Snow	SM1, SM3, SF7	3
		Mountain	SM3	1
	Consequences of avalanches	Death	SM6, SF1, SF2	3
		Sadness	SM6, SM4	2
		Loss of property	SF1	1
		Destruction	SM6	1
		Injury	SM6	1
	What to do during an avalanche	Running away	SF4	1
		Warning people	SM3	1
	Precautions against avalanches	Making a barrier	SM1, SM3, SM4, SM6, SF1, SF4	6
		Planting a tree	SM2, SM3, SM4, SM6, SF7	5
		Hanging an avalanche danger sign	SM2, SM3, SF1, SF2	4
		Not building a house on a hillside or mountain	SM6, SF5	2
		Staying away from an avalanche area	SM4, SF5	2
		Ordu	SF4	1

In Table 7, the codes that the students cited as the cause of avalanches are loud sound (f=8), slope (f=4), snow (f=3), and mountain (f=1). Death (f=3) was the most common code expressed as a consequence of avalanches. Regarding what to do in case of an avalanche, only one of two students suggested running away, and the other suggested warning people. However, the suggestions in the code of precautions against avalanches showed that students were conscious about avalanches. In the interviews, students expressed their thoughts about avalanche disasters: SM4: *"It is the sliding of a mass of snow when there is loud noise in the mountains or on places such as slopes."* SM1: *"Yes, it can be prevented by placing barriers in places such as ramps, and by afforestation."* SM2: *"Afforestation, or barriers should be built on the slopes where the avalanche will fall."* As a result of the analysis of mind maps, the codes regarding tornadoes in Table 8 were obtained.

Table 8

Codes of the tornadoes sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Tornadoes	Cause of tornadoes	Wind	SM7	1
	Consequences of tornadoes	Everything flying away	SM4, SM5, SF2	3
		Loss of life	SM2, SF2	2
		Thunder	SM7, SF1	2
		Lightning	SM7, SF1	2
		Damage	SF2	1
		Fear	SM2	1
	What to do during a tornado	Looking for a safe place	SM5	1
		Not going out	SF5	1
	Precautions against tornadoes	Building a strong house	SF5	1

Table 8 shows that only one student cited wind as the cause of tornadoes (f=1). Among the consequences of tornadoes, the codes with the highest frequency were everything flying away (f = 3), loss of life (f = 2), thunder (f = 2), and lightning (f = 2). It can be seen that the sub-codes under the codes of what to do during a tornado and precautions against tornadoes were: looking for a safe place, not going out, and building a solid house. However, unlike the mind maps, students could explain their views about tornadoes in more detail during the interviews. SM3: *"A strong wind revolves around the water or land in the form of a curved tornado."* SF5: *"Winds form a tornado, but it is stronger than a storm."* SF6: *"Stronger winds than the storm wind form a tornado. In addition, the wind rotates and sucks in many things."* Students' mental structures regarding tsunamis were grouped under the codes in Table 9.

Table 9

Codes of the tsunamis sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Tsunamis	Causes of tsunamis	Giant wave	SM5, SF1, SF4, SF5	4
		Ocean	SF7	1
	Consequences of tsunamis	Floods	SM2, SM5, SF1, SF2	4
		Loss of life	SM5, SF2	2
		Damage	SF2	1
		Loss of property	SF4	1
		Emotional	Fear SF4	1
			Unhappiness SF4	1
	What to do during a tsunami	Surfing	SF1, SF2	2
	Precautions against tsunamis	Inflatable boat-vest	SM5	1
		Making a barrier	SF5	1
		Not building a house on a stream bed	SF2	1

According to Table 9, the codes with the highest frequency are giant wave (f = 4) as the cause of tsunamis and floods (f = 4) as a consequence of tsunamis. Furthermore, various codes emerged in different sub-themes. However, two students suggested surfing during a tsunami (f = 2). In the interviews, students' opinions on how tsunamis occurred differed. It was seen that the students gave reasons such as earthquakes, wind, and tidal events as causes of tsunamis. They expressed their opinions as follows: SM4, SM6: *"It happens because of too much wind."* SM3: *"Earthquakes occur underwater, just like on land. Some of these are large. These large earthquakes create giant waves in the water, namely tsunamis."* SF2: *"If a tornado is in the ocean, a tsunami may occur. It may also be due to the ebb and flow event."* SF7: *"It occurs due to an earthquake or volcanic eruption and collapse at the bottom of the ocean or sea."* The codes related to volcanic eruption are presented in Table 10.

Table 10

Codes of the volcanic eruption sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Volcanic eruption	Cause of volcanic eruption	Lava	SF1	1
	Consequences of volcanic eruption	Loss of life	SF1	1
		Loss of property	SF1	1
		Having fertile lands	SF2	1
	Precautions against volcanic eruption	Not approaching the volcano	SF2	1
		Not building a house near a volcano	SF2	1

Table 10 shows that only two students (SF1 and SF2) included sub-codes related to volcanic eruption in their mind maps. SF1 stated that the cause of volcanic eruption was lava and that it had consequences such as loss of life and property. SF2 listed the precautions that can be taken against an explosion as not approaching the volcano and not building a house on a volcano. All students stated that volcanic eruptions cannot be prevented. Students' opinions about this theme are as follows: SM1: *"Lava suddenly begins to gush out from the volcano."* SF4: *"Lava comes out of the volcano and burns everywhere. There is smoke everywhere."* SF2: *"Lava burns us. How can we stop it? We must escape from there as soon as possible. Losing your life is more important than losing your property."* The codes expressed in the storms theme in the mind maps are shown in Table 11.

Table 11

Codes of the storms sub-theme

Sub-theme	Codes	Sub-codes	Students	f
Storms	Cause of storms	Intense wind	SF4	1
	Consequences of storms	Houses flying away	SF4	1
		Lightning strike	SF3	1
		Fear	SF4	1
	What to do during a storm	Not leaving the house	SF3, SF4	2
		Being careful	SF3	1
	Precautions against storms	Keeping nature in balance	SM6	1
		Building solid buildings	SF4	1

The codes in Table 11 show that very few students included storms in their mind maps. These codes are intense wind (f=1), houses flying away (f=1), lightning strike (f=1), fear (f=1), not leaving the house (f=2), being careful (f=1), keeping nature in balance (f=1) and building solid buildings (f=1 Students' opinions about storms are as follows: SM4: *"The blowing of high-intensity wind forms it."* SF3: *"The meeting of different air masses creates a powerful wind."* SF6: *"Storms cannot be prevented, but*

precautions can be taken. For example, solid chicken coops, houses, apartments, barns, and solid places should be built." Table 12 shows the codes of the lightning sub-theme.

Table 12

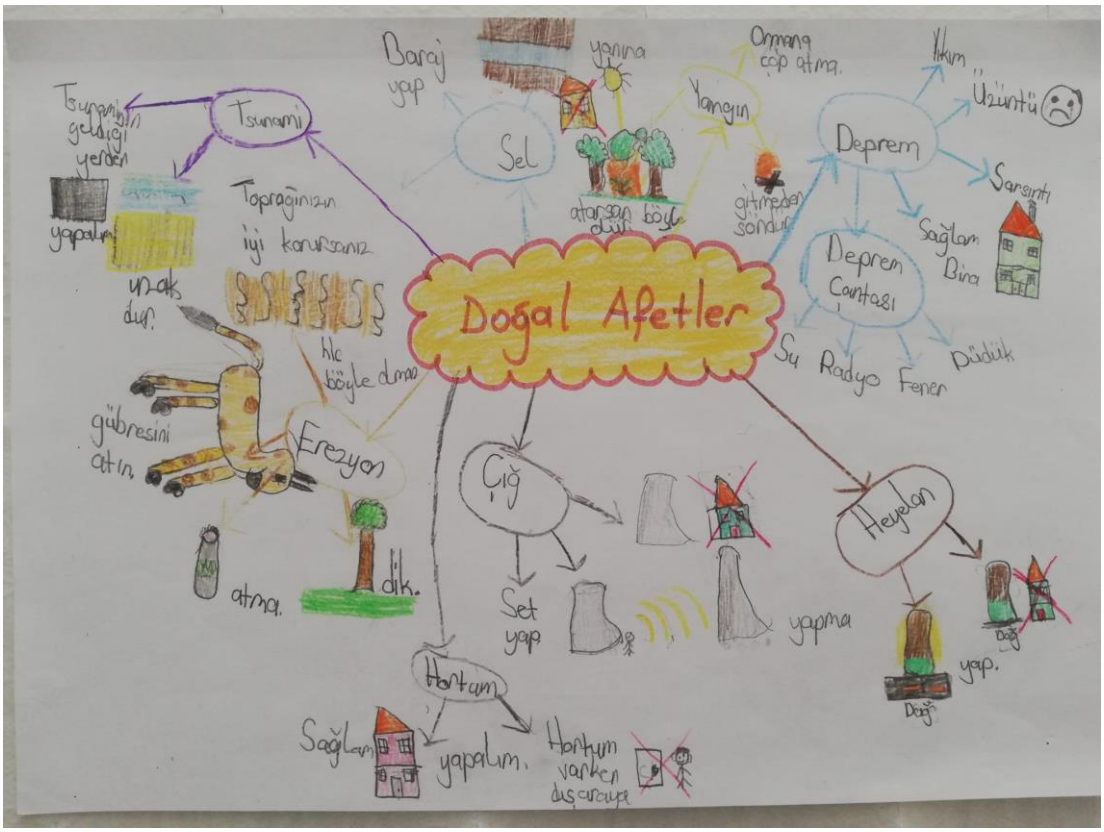
Codes of the lightning sub-theme

Sub-theme	Codes	Students	f
Lightning	Fire	SM4, SM5	2
	Death	SM4	1
	Electric shock	SM5	1

The codes regarding lightning are very limited. As seen in Table 12, fire (f =2), death (f =1) and electric shock (f =1) codes were mentioned. During the interviews, it was understood that some students did not see lightning as a natural event but perceived it as a natural disaster. Figure 1 shows a mind map drawn by students.

Figure 1

An example of a mind map



DISCUSSIONS AND CONCLUSIONS

Natural disasters are natural events that occur frequently in different parts of the world, especially in Türkiye, and negatively affect human life. Reducing the harmful effects of natural disasters is possible with natural disaster education. In Türkiye, natural disaster education begins with formal education in primary school. However, the knowledge and awareness levels of fourth-grade students about this subject are unclear. Especially fourth-grade students who graduated from primary school were selected for this study, because basic education is critical in terms of natural disaster education as well as in many aspects. In this regard, the mental structures of fourth-grade students regarding natural disasters were examined. As a result of the research, it was seen that the mental structures of the students regarding natural disasters were grouped under 13 themes, and all natural disasters emerged as a result of the mind map analysis. The themes of earthquakes, floods, erosion, landslides, fire, avalanches, tornadoes, tsunamis, volcanic eruption, hurricanes, storms, lightning, and thunder showed that the students knew about all natural disasters. In addition, the different sub-codes that emerged in each natural disaster theme and the data obtained from the interviews showed that the students had sufficient knowledge about this subject. The research results can be seen as positive for primary school students. However, the results of studies conducted in the literature on this subject vary. Sözcü and Aydınözü (2019) found that pre-service teachers' natural disaster knowledge and behaviors were at a medium level, while their natural disaster literacy was at a relatively high level. However, the results of studies also show that secondary school students' knowledge and awareness levels about natural disasters are low (Adanalı, Yıyın & Özenel, 2022).

As a result of the study, it was also determined that students confused some natural events with natural disasters. In this regard, students can be given a better education with different methods and techniques. Studies have shown that multiple learning methods are used in disaster learning and that none of these methods is superior to the others (Suarmika et al., 2022; Torani et al., 2019). Research on this subject also shows that the spiral systems in textbooks providing education on natural disasters have deficiencies (Kılıç, 2019). Therefore, it is emphasized that it is essential for training programs to have a holistic approach regarding natural disasters in terms of reducing the impact of disasters and preparing students for disasters. It is also stated that education programs should adopt a holistic approach to disasters and cover topics that will enable students to be prepared for disasters (Tanırcan et al., 2017).

In Türkiye, natural disaster education is included within the scope of the life sciences course curriculum (MoNE, 2018a) and social studies course curriculum (MoNE, 2018b) in primary schools. In the 2nd-grade life sciences course outcomes, natural events (rain, hail, fog, snow, wind) and AFAD are introduced, and the precautions to be taken against natural events are emphasized. In the 3rd-grade life sciences course outcomes, the education is formed in line with the outcome of *"Gives examples of what s/he can do when s/he encounters a situation that threatens his/her security in his/her daily life."* Depending on the outcome, earthquakes and floods are emphasized. In the 4th grade, the program includes the outcome of *"Makes the necessary preparations for natural disasters."* Depending on the outcome, natural disasters likely to be encountered are given priority, and earthquake kit preparation is explained (MoNE, 2018a, 2018b). The results of this research have shown that the natural disaster education given throughout primary school is effective and that students have a rich conceptual structure about how natural disasters occur, how they can be prevented, what to do during natural disasters, and the precautions to be taken. Especially in primary school, children are more careful about the environment and open to learning (Senemoğlu, 2021). Therefore, educators' use of up-to-

date information and data on natural disasters in the lessons of primary school students can help them increase their awareness of this issue. In this regard, planning and designing comprehensive educational programs are necessary for students. Reviewing and updating textbooks regularly is also important. Finally, to raise awareness about natural disasters, it is necessary to provide information to students through the media. The media are important for delivering accurate information about disasters to the public, encouraging disaster preparedness, and supporting post-disaster relief efforts.

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