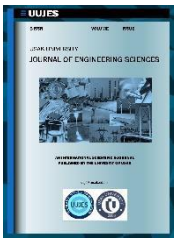

Usak University

Journal of Engineering Sciences

An international e-journal published by the University of Usak

Journal homepage: dergipark.gov.tr/uujes

Review article

EARTHQUAKES AND DISASTER EDUCATION IN OUR COUNTRY AND IN THE WORLD

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Received:26 May 2023 Revised: 22 June 2023 Accepted: 26 June 2023 Online available: 30 June 2022

Abstract

It is known that in almost every period of human history, people have experienced great disasters. Disasters can mostly be of natural origin, earthquakes, floods, landslides, or they can also occur as terrorism, fire, and major accidents caused by humans. The place, time and form of disasters cannot be known beforehand, they can also create different effects in terms of the results they reveal; It can cause economic losses, especially building damages and losses, and social and psychological destructions. Disaster education is very important for creating disaster-resilient communities. The primary goal is to increase people's knowledge, awareness and interest in disasters through disaster education that will be given to all the society. With these educations on disaster, it is certain that people will not only be informed about proactive approaches and measures before a disaster, but will also be more conscious of what to do in the event of a disaster and better prepared to respond to disasters. Thus, people can protect themselves from the disasters that occur.

Keywords: *Earthquakes in the world; earthquakes in Turkey; disaster education.*

1. Introduction

The concept of disaster includes all natural and man-made events that cause significant damage to both the living and non-living environment and cause great loss of life and property. Disasters can be divided into two categories: natural disasters as a result of natural events and man-made disasters caused by various human activities. Man-made disasters primarily include events caused by large-scale accidents, explosions, nuclear disasters, wars, political, economic and social upheavals that lead to property loss. Incidents such as forest fires, nuclear power plant leaks and major accidents are some of the man-made disasters. The second part of this classification is natural disasters. Natural

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DOI: https://doi.org/10.47137/uujes.1302947

disasters are natural events that occur due to natural conditions, negatively affect human life and cause loss of life and property [9].

The history of disasters on earth is older than humanity. Earthquakes, landslides, floods, volcanic eruptions, hurricanes, hurricanes, and repeated disasters since the creation of the Earth about 4.6 billion years ago are actually ordinary events that shape the present face of our planet. In this history, humanity has existed for only a few million years. In pre-human global catastrophes, most of the animal and plant communities that lived in the oceans and on land disappeared from the earth. These extinctions were often overhunting by predators and burning forests. The deterioration of vegetation was accompanied by changes in precipitation and acceleration of soil erosion. The delicate balance between atmospheric and hydrospheric components has been disturbed.

After the industrial revolution, the feedback mechanisms that play a role in the transformation of the global climate system inevitably began to deteriorate. Today, disasters become more severe due to the density of human population, multi-storey buildings in urban settlements, the presence of large industrial establishments that pose a risk to the environment, and cause great loss of life and property [13].

Some concepts are closely related to the concept of disaster and are often used incorrectly instead of the concept of disaster. Emergency is one of these concepts and refers to natural, technological or human-induced abnormal situations that partially or completely interrupt the daily life and activities of a society, require the cooperation of many institutions, organizations and groups, and cause physical, economic and social losses [12].

Hazard, which is another concept related to disasters, is anything that can shake economic and social life or natural and cultural resources and cause loss of life or property. Risk, which is another important concept to be emphasized in the context of disasters , refers to the perceived negative impact of hazards on local community activities, structures and cultural heritage. Another important concept in the context of disasters is vulnerability. Vulnerability refers to the level of material loss, damage or harm caused by a hazard to people, property or the environment [21].

The magnitude of a disaster is determined by the human, property and economic losses it causes. In this context, disaster describes the consequences caused by an event rather than itself [6]. According to the characterization of disasters in this way, not every event leads to a disaster and it is not sufficient to describe natural, technological or human-induced events as disasters. In order for an event to be qualified as a disaster, it must affect people and the living spaces of the society, cause loss of life, and stop or severely interrupt the activities of people . Therefore, an event that occurs in a place not associated with human settlements is not considered a disaster since it does not pose a direct danger to humans [32].

Natural disasters such as earthquakes, volcanoes, tsunamis and typhoons greatly affect human life. Earthquake, which is the most common and destructive among these natural disasters, is the perceptible vibrations that occur in the earth's crust as a result of the sudden release of energy as a result of the breaking of rocks underground and cause seismic waves. Earthquakes have caused a great deal of damage, destruction and loss of human life throughout the world in our recent history, as in every period [11].

Our country is a country where natural disasters are frequently experienced due to its geology, topographic structure and climatic characteristics. Natural disasters cause not only human losses, but also significant economic losses. According to statistics, it is thought that the direct economic losses caused by these natural disasters have an important place in the Gross National Product every year, and these losses reach more

serious dimensions when the economic losses such as market losses, production losses and unemployment are taken into account [25].

2. The Biggest Earthquakes in Turkey in Recent Periods

The geological structure of Turkey has been completely affected by the Alpine orogenic belt. Rocks of almost all ages can be found here, from the Paleozoic to the present. Faulting and tectonic movements that started with the Alpine orogenic belt intensified at the end of the Oligocene and the beginning of the Miocene. In this period, the areas with rigid structures collapsed under the pressure of faulting. While new faults were formed as a result of vertical faulting movements during the Pliocene, the old faults in the region were rejuvenated. In this period, with the onset of stretching (west) and contraction (east) in Anatolia, it started to move westward along the northern and western Anatolian fault lines, and a series of basins were formed throughout this process [5].

2.1. Kocaeli (Türkiye) earthquake (17 August 1999)

On August 17, 1999, at 03:01 local time, a ground shaking of MW 7.6 occurred on the North Anatolian fault in northwest Turkey. It has been reported that the epicenter of the earthquake is located approximately 11 km southwest of the city of Izmit. It has been reported that this earthquake claimed 17,225 lives and injured 44,000 people, with thousands of people missing. Apart from this, some 77,300 buildings were completely destroyed and another 245,000 buildings were damaged. The direct loss is estimated at more than 6 billion US dollars. The shaking time was measured as 37 s with a maximum acceleration of 0.3–0.4 g. Approximately 70% of the buildings in Adapazarı, Gölcük, Yalova, İzmit, Topçular and Kullar cities were either destroyed or damaged during this event and almost all of the deaths were attributed to structural damage during this earthquake [4].

2.2. Kahramanmaraş Earthquake (06 February 2023)

On February 6, 2023, two devastating earthquakes occurred in the Southeastern part of Turkey. The earthquakes occurred in or near a prominent seismic gap known as the Maraş Seismic Gap along the East Anatolian Fault Zone (EAFZ). While the magnitude of the first big and destructive earthquake was M w=7.7, it was calculated as MM w=7.5 between the magnitude of the next one. These devastating earthquakes were accompanied by a large aftershock of w=6.7 and several M>6.0 aftershocks. Numerous aftershocks still continue to shake the earthquake zone [30].

According to Afad data, 'the number of aftershocks between 5 and 6 magnitudes was 47' after the Kahramanmaraş centered 6 February earthquakes . Nearly 15 million citizens living in the region were directly affected by the earthquake, in which more than 50 thousand people lost their lives.

The duration of the first earthquake with a magnitude of 7.7 was 65 seconds, and the second earthquake with a magnitude of 7.6 was measured as 45 seconds. More than 20,000 aftershocks have occurred so far. This figure is equal to our average number of earthquakes recorded in a year. The number of aftershocks between magnitude 5 and 6 alone is 47. As a result of both earthquakes, approximately 400 kilometers of surface rupture occurred, and displacements of up to 7.5 meters occurred in the earth's crust. As a result of the earthquakes in Kahramanmaraş, it was reported that 56 thousand 426 buildings were demolished or needed to be demolished urgently, 206 thousand 452 buildings became heavily damaged, 48 thousand 984 buildings were moderately damaged, and 516 thousand 352 buildings were slightly damaged . Earthquake dated 06 February 2023 is displayed dn the map below.

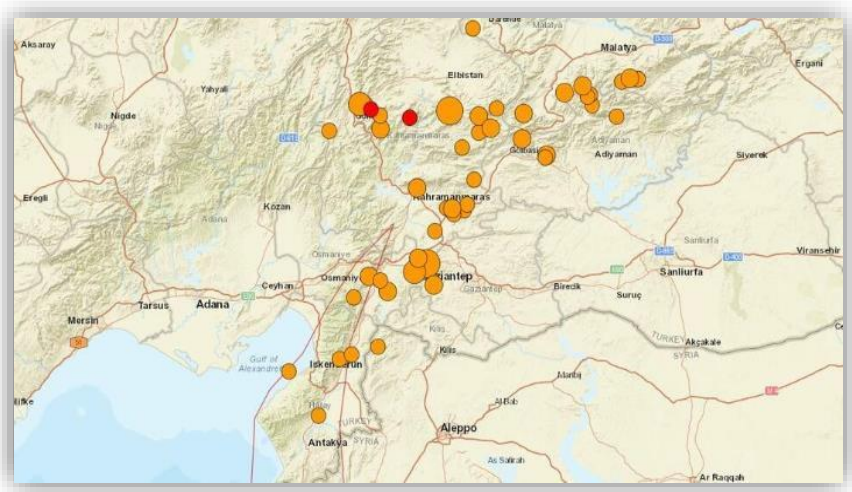

Fig. 1. Earthquakes in Turkey on 06 February 2023 [30]

3. Major Earthquakes in the World in Recent Years

- Iran - December 26, 2003: The 6.6 magnitude earthquake in Kerman province in the southeast of the country destroyed the city of Bam and claimed the lives of 31 thousand people .
- Pakistan - October 8, 2005 : The 7.6 magnitude earthquake that shook the northeast of the capital Islamabad caused the death of 73,000 people in the country. The tremor that also struck Kashmir caused more than 1,200 casualties here as well.
- Asia - December 26, 2004 : The 9.15 magnitude earthquake occurred near the Indonesian island of Sumatra, but the tsunami it caused affected Indonesia, Thailand, India, Sri Lanka and many countries in the region. Villages and tourism centers were devastated in the disaster in which approximately 250 thousand people lost their lives or disappeared
- China - May 12, 2008: 87 thousand 900 people lost their lives in the 7.8 magnitude earthquake that struck the city of Sichuan.
- Haiti - January 13, 2010: At least 316 thousand people died in the 7.0 magnitude earthquake that hit the capital Port-au-Prince.
- Chile - February 27, 2010 : The 8.8 magnitude earthquake and the tsunami it triggered in Chile, a South American country, cost the lives of more than 5 hundred people, hundreds of thousands of houses were damaged, highways and bridges were destroyed.
- New Zealand - February 22, 2011: At least 180 people lost their lives in the 6.3-magnitude earthquake that hit the city of Christchurch.
- Japan - March 11, 2011: As a result of the 9.0 magnitude earthquake that hit the northeast of the country and the tsunami it triggered, 15 thousand 690 people lost their lives and 5 thousand 700 people were injured.
- Iran - August 11, 2012: At least 3 hundred people lost their lives in earthquakes with a magnitude of 6.4 and 6.3, which shook the vicinity of Tabriz city in northwest Iran twice.
- Pakistan - September 24, 2013 : The 7.7 and 7.8 magnitude "twin earthquakes" that shook Pakistan devastated the Balochistan Province in the southwestern part of the country. At least 8 hundred people died in the disaster.
- China - August 2, 2014 : The 6.3 magnitude earthquake in Yunnan province in southwest China killed at least 6 hundred people.

- Nepal - April 25, 2015 : The 7.8 magnitude earthquake, which killed about 9 thousand people, turned the lives of more than eight million people upside down.
- Afghanistan - January 26, 2015 : The 7.8 magnitude earthquake that occurred in the Hindu Kush Mountains in Afghanistan and shook the northeast of the country and the north of its neighbor Pakistan caused at least 400 people to die.
- Ecuador - April 16, 2016 : In 2016, approximately 700 people lost their lives in the 7.8-magnitude earthquake that shook Ecuador, one of the countries on the Pacific coast of South America.
- Italy - August 24, 2016 : The 6.2 magnitude earthquake that struck the central parts of the country in 2016 cost the lives of 3 hundred people. As a result of the disaster in the mountainous region to the east of the capital Rome, it was announced that the soil in and around the city of Accumoli near the epicenter receded by 20 centimeters and there was a slip of 16 centimeters.
- Mexico - September 19, 2017 : The 7.1 magnitude earthquake that hit central Mexico in 2017 reminded us of the trauma of the great earthquake of 1985 that killed thousands of people. The earthquake, in which 396 people lost their lives, caused great destruction in the capital city of Mexico City.
- Iran - November 12, 2017 : An earthquake with a magnitude of 7.3 struck the Kermanshah region of Iran, one of the countries where earthquake disasters are frequently experienced, in 2017. The disaster, in which more than 400 lives were lost, also led to the death of six people in neighboring Iraq.
- Indonesia - September 28, 2018 : Indonesia, which is one of the countries where natural disasters are frequently experienced, is one of the countries where severe earthquakes are experienced. However, the 7.5-magnitude earthquake that struck the island of Sulawesi in 2018 and the 1.5-meter tsunami that followed have been engraved in memories as one of the most painful disasters in recent years . The earthquake and tsunami caused the death of approximately 5 thousand people.
- Haiti - August 14, 2021 : Haiti, located in the Caribbean in the Atlantic Ocean, has been rocked by several severe earthquakes in recent years. More than 2 thousand lives were lost in the 7.2 magnitude earthquake that took place in 2021, and more than 13 thousand houses were either destroyed or damaged [18].

4. Disaster Education and Benefits

Disaster education can be defined as preparing people for the disaster and the aftermath by raising awareness about the risks of the environment they live in, making them aware that they can also be affected, and taking steps to minimize this damage [2].

Disaster education, all hazards/risks education, disaster mitigation and planning are not seen as an integrated whole in education and training programs related to all natural and man-made disaster types, and although there are various issues to be taken into account, it is mistakenly mistaken for only one of many hazards or the disaster management system. focuses on activities at one stage [20].

Thanks to the measures to be taken, the losses caused by disasters, which are unavoidable natural events, can be minimized. When natural disasters are considered as a result, the concept of disaster preparedness can also be considered as a process. Successful progress of the process will not change the outcome of the disaster, but will minimize the losses caused by the disaster. Societies must be conscious in the face of disasters. With the establishment of disaster management systems, the disaster perception of the society can be followed and the perception of disaster management can be improved. In the event of a disaster, controllable variables are few or even nonexistent. Such situations must first be prepared mentally, and then physically prepared. Mental preparation is to bring disaster awareness to individuals. For this, it is necessary to create disaster awareness in the

society. With disaster education, disaster awareness can be developed. Disaster awareness about a disaster can be increased through disaster education that will be held before a disaster occurs.

By increasing the disaster awareness level of people through disaster training, it will be possible to respond to disasters more effectively during disasters, and it will be more successful in minimizing the losses that may occur. Response and recovery activities after disasters are also among the achievements of disaster education. Depending on the content and implementation of these trainings, the interventions will be made in a shorter time and the negative picture created by the disaster will be improved in a shorter time. Especially in these trainings, it is very important for the future of societies to educate children, who are the younger segments of the society, about disasters. In addition, in order for the disaster education vision to be sustainable and successful, disaster education should be planned to include all segments of the society, disaster education should be given by experts and experienced people, and education should be accepted as a part of daily life.

Disaster education should be given great importance in order to raise public awareness about disaster risk reduction. Local governments are more effective than other governments in reaching the public. Resources should be allocated to activities before and after the disaster, and disaster factors in construction and production should be included in planning and costing. In disaster management, besides local organizations and state organizations, voluntary organizations also work. Voluntary resources, which are involved in the recovery phase of the disaster process, can be utilized in the correct use of physical and human resources, which are one of the important factors in the correct planning and successful implementation of the recovery. Because, there is a possibility that the resources of all public and private institutions and organizations will be insufficient in the process after the disaster [10].

The purpose of disaster preparedness is to increase the effectiveness of response and recovery phases by increasing people's resilience and helping them prepare for disasters. Disaster preparedness aims to make people safer in the event of a disaster. The purpose of disaster preparedness is to use one's own capacity to find solutions to the problems faced by society and to be more resilient and strong in the face of disasters. Disaster preparedness keeps individuals, society, institutions, the state and sometimes the world ready for disasters, protects and informs them. The aim of disaster preparedness should be to ensure that all units (persons, institutions, etc.) that may be related to the disaster have the right information before, during and after the disaster and to use this information at the right time and in the most appropriate way [23].

Drills and planned disaster preparedness are important pre-disaster mitigation activities performed before a disaster occurs. At this stage, educational activities are important to minimize disaster damage. Including disaster education issues in education programs aims to make the public more sensitive to natural disasters. Disaster education and disaster management studies can be made more effective by presenting disaster education courses as a part of formal education [23].

5. Disaster Management

Countries in the world that are frequently exposed to natural disasters and suffer great damage have been able to reduce disaster losses to lower levels with some models they have developed. “Disaster Management”, which determines and puts into practice the technical, managerial and legal studies that must be carried out in the “pre-disaster”, “during the disaster” and “post-disaster” periods in order to prevent disasters and reduce damages; It is a management approach that enables effective implementation in the face

of a disaster and improves the existing system in the light of the experiences gained from the events. The Disaster Management Model is also in the form of a model that requires continuity and consists of intertwined phases. Shown below Disaster Management models used in different countries around the world are similar to each other, although there are some minor differences between them.

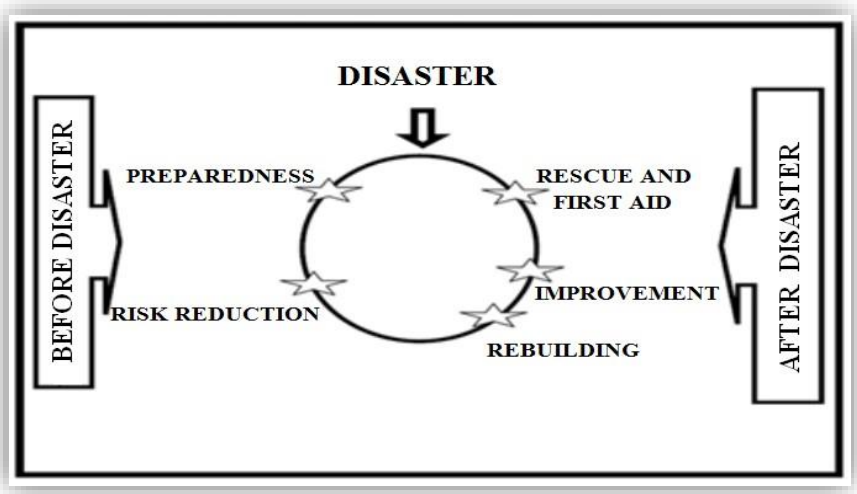

Fig. 2. The Disaster Cycle [1]

There are two main phases in a modern "Disaster Cycle". The first of these is pre-disaster studies, which is called Risk Management. The studies at this stage are “Risk Reduction” and “Be Prepared” activities. According to this model, pre-disaster risk reduction studies are the most important stage of Disaster Management. Due to the "risk reduction" and "preparedness" efforts in developed and disaster-conscious countries, disaster losses remain at very low levels. The work done after a disaster occurs is called Crisis Management. “Rescue and First Aid” activities at this stage are very important. Because, this stage can be successfully overcome with a very good crisis management in an environment of chaos after disasters. In the critical first 72-hour period after disasters, it is aimed to extract as many victims as possible alive from the rubble and to provide first aid to them. In our country, studies and structuring on this subject are carried out very successfully. Crisis Centers established under the chairmanship of the Governor in the provinces and the District Governor in the districts carry out this process well.

The next stage after the "rescue and First Aid" stages in the Crisis Management studies after the disaster is the "Remediation" activities. The society, which has been traumatized socially and economically, should return to its normal life as soon as possible. Establishment of temporary settlement areas, establishment of worship-supply centers, and urgent correction of the infrastructure deteriorated in disasters are carried out at this stage. In line with the experiences gained from the uncertainties and negativities experienced in the 1999 earthquakes, there are now quite advanced organizational and structuring studies in our country, although it is not sufficient. At the end of the Crisis Management period to be carried out after the disaster, the “Reconstruction” phase comes. At this stage, studies are carried out that will erase the traces of the disaster and return to normal life before the disaster. In some “Disaster Management” models, this stage is evaluated together with “Development” [29].

6. Studies on Disaster Education in the World

A three-year disaster education program conducted in schools in China's Sichuan Province was examined. It has been demonstrated that children's perceptions of flood risk, including their awareness and behavior, can be improved through disaster education, which is crucial for improving disaster resilience and adaptation to extreme climatic conditions. However, it was seen that education did not have a significant effect on family and society. Disaster reduction education was explicitly incorporated into China's education system after the Wenchuan earthquake in 2008. More importantly, to increase Sichuan Province's resilience, a disaster education program targeting schoolchildren has been co-funded by the China Central Public Health Emergency Center.

The disaster education program was conducted in three pilot areas, including Shifang City, Yuexi County, and Lu County, as these counties are subject to the frequent risk of flooding, landslides, and landslides caused by heavy rainstorms attributed to their mountainous regions. However, in Sichuan, a large proportion of parents work away from home in major cities, so many children left behind are raised by the elderly. Therefore, this disaster education program in Sichuan province can provide an entry point from which policy makers and education administrators can understand how to reduce disaster risks and increase health resilience for climate [33].

In a study conducted in Japan, the effect of the disaster education program applied to fourth grade students in the primary school affected by the tsunami one year after the Great East Japan Earthquake in 2011 and the subsequent Tsunami disaster was evaluated. The so-called “Reconstruction Mapping Programme” also applied a city monitoring and mapping approach to disaster education during the disaster reconstruction phase. The aim of the program, which emphasized the positive aspects of restructuring by considering the mental health of the children affected by the disaster, was determined as improving the attitudes of children towards contributing to society.

This study investigated a school-based disaster education program called “Reconstruction Mapping Program (RMP)” implemented by disaster-affected schoolchildren in Ishinomaki City, Miyagi Prefecture, for three years starting one year after the 2011 Great East Japan Tsunami. of RPM; It is stated that it aims to develop an attitude where children, as members of the society, can perceive their future hometowns with pride and love, and to find answers to questions such as to what extent the reconstruction mapping program affects the students affected by the disaster and how a disaster education program for these students can contribute to possible future disaster prevention studies. Key questions answered in this study are: To what extent has the Reconstruction Mapping Program affected students affected by the disaster? How can a disaster education program for disaster-affected students contribute to possible future disaster prevention efforts? Overall, the aim of the study was to evaluate the impact of the Reconstruction Mapping Program on students' perceptions and love of their society, their motivation to contribute to reconstruction, and their preparedness for disaster [26].

A Nepali study proposes a change in approach to assessing disaster risk reduction education from short-term knowledge transfer to a long-term action-oriented approach. In addition, the study proposes to introduce a chronological and gradual evaluation method that follows the learners from the beginning in Disaster Risk Reduction (DRC) education, rather than evaluating it retrospectively. Therefore, the study discusses the strong trend and problems for the short-term knowledge transfer assessment paradigm in the literature.

A case study of the long-term action-oriented assessment of Disaster education provided throughout the DRR education exchange programs between Bal Bikash Secondary School in Nepal and Maiko High School in Kobe, Japan is presented. Explaining the chronological development of disaster education and how the attitude of Nepali students has gradually changed. Following the annual (ARA) educational exchange programs from 2001 to 2009 and follow-up interviews with Bal Bikash graduates after the 2015 Gorkha earthquake in Nepal, the participant observation method was applied. With this long-term action-oriented assessment, it confirmed the importance of assessing the actual actions of students as a result of a series of (ARA) educational activities and the impact of actual earthquake risk reduction efforts during the 2015 Gorkha earthquake. More importantly, these results cannot be evaluated with the short-term knowledge transfer paradigm. Finally, the implications of long-term action-oriented evaluation for effective disaster education research continue to be discussed [24].

A study conducted in Indonesia showed that school-based disaster education is a cost-effective approach to facilitating children's attitudes, knowledge and behaviors regarding disaster risk reduction. In addition, effective interventions for adults are not yet fully understood. The aim of this study is to evaluate the spillover effects of a disaster education program for children on their parents. Unique survey data from 539 primary school students and their families in Nias Island, Indonesia. Examining the results , it is seen that the program encourages children to discuss and share their knowledge about disasters with their parents, and it has positive effects on parents' attitudes, knowledge and behaviors. This effect is especially greater for households residing in risky areas. Therefore, the fact that school-based disaster education is effective not only for the participants but also for their parents suggests that it has an important social impact. It is stated that this study is the first to show meticulously the spillover effects of disaster education on parents in a developing country. This study also contributes to the intergenerational value transfer literature by applying an instrumental variable model and providing direct evidence [17].

A study conducted in Iran focused on non-formal disaster education for children in Iran. Previous studies have shown that in addition to non-formal education, there is also formal education in schools and non-formal education in the community. Formal education is provided through the inclusion of disaster information in the formal education curriculum at all levels of education, from the first grade of primary school to the last grade of high school. In addition, informal education is conducted through Iran's national radio and television, as well as online media. The Iranian Red Crescent Society, the Radio and Television of the Islamic Republic of Iran, and official newspapers are among the organizations that provide non-formal education in the field of disasters. In total, children receive a combination of formal, non-formal and non-formal education in the field of disasters. Studies in the field of pedagogy and disaster education have shown that combining educational methods for disaster preparedness is more effective than using a single method. Researchers have emphasized the importance of non-formal education as well as formal education in various fields. However, the importance of non-formal education is even greater than formal education for children in disaster preparedness. Formal education of children takes place in schools and classrooms and is mostly theoretical. Therefore, it only increases awareness and knowledge in this area. But knowledge for disaster preparedness is only one factor among many. Other factors such as risk perception, risk severity perception, self-efficacy are important for disaster preparedness. These factors are hardly developed or not developed through formal education. However, the use of non-formal education in disaster preparedness, such as drills, can increase children's perception of risk and effectiveness. Because, through the designed scenarios, it is possible to create conditions for the child to better understand the

risks and how to evacuate the environment in necessary situations such as earthquakes [27].

Emergency and disaster management departments offered by U.S. universities focus on the study of any risks that may arise in society and the application of practical methods to mitigate the effects of natural or man-made crisis situations. Emergency and disaster management courses train professionals who can adequately prepare the public before a disaster occurs. Educational programs provide information on how to respond to disasters and how to deal effectively with the resulting damage. Disaster management activities aim to reduce vulnerability and strengthen communities across the country by identifying different safety needs. The study of emergency and disaster management enables students to analyze the factors and strategies that play an important role in emergencies and disasters. In Emergency and Disaster Management, students develop the critical thinking and analytical skills necessary to lead in complex and dangerous situations. Students learn to participate in various disaster simulations and to define the different responsibilities of individuals and organizations in emergencies.

Hurricanes and typhoons appear to be the most effective natural disasters in the United States. On the other hand, serious fires have occurred in the USA in the past. For example, on April 17, 2013, ammonium nitrate exploded in a fire at the West Fertiliser factory in Waco, West Texas, about 80 miles south of Dallas , killing 10 emergency workers and the fire got out of control. Significant damage occurred to the wooden building.

One of the incidents reviewed by the Emergency and Disaster Management Program to highlight the importance of good decision making in fire incidents is the Mann Gulch incident. On August 4, 1949, lightning struck a hill in the Missouri National Forest east of the Missouri River and about 20 miles north of Helena; On August 5, 1949, a team sent to fight the fire was involved in a forest fire that killed 13 firefighters. In order to effectively fight such major fire events, undergraduate and graduate programs aiming to train specialists in the field of firefighting have been opened in the USA [31].

A study conducted in the Philippines aimed to explore the disaster risk reduction opportunities offered by the science curriculum of the Philippine basic education program and also to explore how disaster risk reduction education can be used as a platform to develop and promote scientific literacy. This article adds to the existing knowledge on disaster risk reduction education, on the one hand providing the opportunity to use disaster risk reduction-specific non-governmental organizations in the development of scientific literacy, and on the other hand, providing a detailed explanation of disaster risk reduction. A detailed explanation of the disaster risk reduction specific themes in the science curriculum of the Philippine basic education program is presented. These themes are;

(a) natural disasters and early warning systems,
(b) climate change and sustainable development,
(c) first aid and basic safety,
(d) scientific method, scientific process skills and scientific attitude,
It is classified as (e). science-technology-society (STS) and the nature of science (NoS), (f) common natural laws, principles and processes in science, and
(g) healthy habits and lifestyle.

Concepts directly related to disaster risk reduction, such as natural disasters (e.g. typhoons, earthquakes, volcanic eruptions, tsunamis), the nature of disaster risk reduction makes it a rich backdrop for socio-scientific issues. In the context of science teaching, socio-scientific issues refer to controversial real-life problems involving science concepts that require students to learn [8].

7. School Based Disaster Education Project in Turkey

In formal education in our country, courses that include disaster-related issues at primary education level; life studies, science, social studies and an elective course, “Our City”.

Within the scope of the "safe life" unit at the first grade level, the Life Science course provides the learning outcomes of knowing what to do in case of gas leakage in the field and learning emergency phone numbers. Two of these achievements are directly related to disaster prevention and risk reduction in disasters. The unit constitutes approximately 14% of the total duration of the course with 20 hours of class time. At the second grade level, there are two units related to disasters: "safe life" and "life in nature". Within the scope of the safe life unit, the institutions and people who can get help in case of emergency are taught, including the learning outcomes of the relevant phone numbers. The number of achievements of this unit is 6 and the course hour is 20. Within the scope of the unit of life in nature, natural disasters related to the area are emphasized and the measures that can be taken are explained. The number of achievements of this unit is 9, and the course hour is 24. In both units, there are two achievements directly related to disasters. At the third grade level, within the scope of the safe life unit, the importance of using emergency exit doors in emergency situations and getting away from the area are emphasized, completely related to the area .

Within the scope of the safe use of electricity at the third year level of science course, only fire etc. related to the field. hazards are addressed. At the fifth grade level, within the scope of destructive natural events, the causes of destructive natural events and ways of protection are taught, completely related to the field. The recommended time for the subject is only 4 lesson hours.

At the fifth grade level, environmental problems that may occur as a result of human activities related to the field are mentioned within the scope of the subject of human and environment relationship, and the recommended course duration is 10 course hours. At the eighth grade level, within the scope of matter cycles and environmental problems, the ozone layer and the causes and possible consequences of global warming and global climate changes are included. At the fourth grade level of Social Studies course, within the scope of the unit of people, places and environments, the subject of earthquake kit preparation, from areas such as shelters, emergency assembly places, and preparations for natural disasters, is discussed. At the fifth grade level, the causes of disasters and the effects of natural disasters on social life are explained. The elective course "Our City" is offered to students between 5th and 8th grades as an elective. “Life in the city” and “I know my city” units provide information on disasters and how to protect themselves from natural disasters. In addition, natural disasters that may be encountered in the city where he lives are investigated and precautions are given.

At the secondary education level, courses containing related topics; biology and geography courses. Biology course provides environmental awareness by focusing only on current environmental problems, global climate change, erosion, forest fires, within the scope of "Ecosystem Ecology and Current Environmental Problems" at the tenth grade. Within the scope of the "environment and society" unit at the ninth grade level of geography lesson, risks arising from nature-human interaction are included in the field. At the tenth grade level, again with the name of "environment and society" unit; Evaluations were made on different subjects such as the causes of disasters related to the area, practices against disasters in different countries and raising awareness in disasters. At the twelfth grade level, desertification and the necessary precautions to be taken and the Kyoto Protocol are emphasized [19].

In our country, the Ministry of National Education of the Republic of Turkey (MEB); initiated the "School-Based Disaster Education" project, which focuses on training teachers to improve their awareness of disaster preparedness and their teaching skills for disaster education in schools. The first phase of the project was implemented between 2013-2017 with the cooperation of the Japan International Cooperation Agency (JICA). In the first phase, 3600 teachers from the pilot provinces attended the training for 18 hours. However, the lack of collection of data on quality and quantity, reported implementation problems and the inability to reach a large part of the teacher population in Turkey led to the design of the second phase of the project. In order to fulfill our national commitments and to ensure the spread of the program throughout the country, the continuation of this project, "School-Based Disaster Education Project II. Stage" started in 2018. The Teacher Training Program is designed as a hybrid education, which is a more economical learning approach that combines distance education and face-to-face education methods. In the design and development of educational content, materials and tools, the Ministry of National Education collaborated with the Disaster and Emergency Management Presidency, the Turkish Red Crescent and the Turkish Japanese Foundation. The project aims to train trainer teachers and train all teachers (approximately 1 million in 81 provinces). The program started to be implemented by training 567 volunteer trainers in May 2019, and these trainers were trained by 135,375 teachers in 67 provinces as of December 2019, using the gradual education system . Conceptual information is learned practically in the distance education program. In the local, face-to-face education, the information given by the teacher trainers of each province and the teachers in the face-to-face education were trained by active, experiential and inquiry-based group work methods. Teachers also learned how to integrate disaster risk reduction topics into the learning objectives of the curriculum of different disciplines. This study aimed to evaluate the in-service teacher training program in terms of trainers, teacher trainers and local teachers participating in the program [14].

8. Conclusion and Suggestions

While the vast majority of emergencies are unpredictable, their effects can be prevented and mitigated. Indeed, much remains to be done to strengthen the capacity of communities at risk from disasters and emergencies to respond and respond to emergencies. Awareness of emergencies and disasters, step-by-step implementation of emergency plans, and most importantly, joint implementation of programs are of great importance to reduce or prevent the effects of disasters.

The most important aim of disaster education is to bring disaster preparedness culture to all segments of the society, starting from the individual, to be prepared for the first 72 hours of disasters, to raise awareness in individuals, to share basic precautions with individuals that they can take in the places they live, to enable individuals to learn and practice correct behavior in disasters, to ensure that they are prepared for disasters and emergency situations. To share the basic measures that can be taken, to spread the places where individuals can receive disaster education and to establish infrastructures that they can easily access, to standardize the disaster education given through various channels throughout the country, to benefit from the studies carried out by international organizations and to provide accredited education with sufficient knowledge and experience. the creation of roads.

Disasters sometimes cause minor or major damage to the region or country where they occur. Located in the primary seismic belt, Turkey is frequently exposed to earthquakes and various natural and man-made disasters. 93% of Turkey is exposed to seismic risk. In addition, since 98% of industrial establishments are located in regions with high seismic risk, the population in these areas is also exposed to seismic risk. Since the early 1900s,

Türkiye has experienced more than 200 earthquakes. Approximately 86,000 people lost their lives in these earthquakes. In the 20th century, approximately 1,005,480 people lost their lives due to earthquakes around the world. Although we think of physical losses, death and injuries when we think about the damages of natural disasters, their economic, social and psychological effects are also very important [3].

The effects of natural or man-made disasters do not only involve human dimensions, but also encompass environmental effects. Environmental conditions can increase the impact of a disaster, and similarly, disasters can have an impact on the environment. Deforestation, forest management or agricultural practices increase the negative environmental effects of disasters by causing landslides, flooding, soil and water pollution. The increasing frequency and severity of man-made and natural disasters can change the global environment. All of these threats to the environment have become more evident in recent disasters. Disasters affect the environment through their direct or indirect effects on human settlements and ecosystems. Integrating environmental considerations into all phases of disaster management is crucial for sustainable and effective disaster management [15].

Especially considering the impact of earthquakes in our country, buildings should be low-rise and built according to seismic standards. Where additional floors are required, they must be built with specific approvals according to new technical installations (as in Japan). However, it is seen that no lesson has been learned from the earthquakes that took place in our country: In the 1999 earthquake, the standards were stretched in most places after the earthquake, the floors of the buildings were increased and high-rise buildings were built on the filling. In addition, integrated vibration damping systems, which are new technology, are not used in these buildings [28].

Training programs are the cornerstone of disaster-related capacity building activities. Without a trained workforce, existing physical capacity cannot be effectively used to deal with natural and man-made disasters. Infrastructure facilities and technological systems built at great cost can only benefit from disaster prevention and mitigation if a society has an educated workforce and a high level of disaster awareness. Societies that can raise awareness and create a culture of disaster preparedness can cope better with disasters. Awareness can be increased by providing accurate information about disasters to individuals as well as to institutions that make up the society, and by educating them in their own programs. Therefore, disaster preparedness is a key activity for raising disaster awareness and creating a disaster culture in society, and it is a strategic investment that costs little compared to its future benefits. Although disasters cannot be prevented, educational activities such as mitigation and protection from disasters should be carried out continuously [7].

Disaster preparedness informs people about disasters, dangers, risks, living conditions, reliable information sources, institutions and organizations related to disasters. People who have received disaster training are more prepared for disasters and can effectively learn how to respond to disasters, how to protect themselves from disasters and how to recover quickly after disasters. Disaster preparedness strengthens cooperation between people and institutions in society. Disaster drills encourage people to learn more about disasters and raise awareness. For families and children, disaster preparedness is more effective. Education of children, especially at school, is very important for the future of society. A high level of disaster awareness among children will make society more resilient to disasters in the long run. Active participation of the society in disaster planning and research will be more beneficial and rewarding [23].

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