The Position and Importance of Earthquake Education in the World

Deprem Eğitiminin Dünyadaki Yeri ve Önemi

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Özet

Deprem eğitimi, öğrencilerin depremle ilgili farkındalık oluşturması ve bu konuda bilgilerini geliştirmesi açısından önemlidir. Literatüre bakıldığında yüksek farkındalık ve bilgi düzeyine sahip kişilerin depremlerin yıkıcı etkileriyle etkili bir şekilde başa çıkabildiği bulunmuştur. Bu noktada, okullarda uygulanan tatbikat ve teorik dersler gibi geleneksel eğitim yöntemleri yetersiz kalsa da sanal gerçeklik teknolojisi gibi yenilikçi yöntemler daha umut vericidir. Fakat, ideal deprem eğitimi konusunda bir fikir birliğine varılamamıştır. Dünya genelinde deprem eğitimi büyük ölçüde farklılık göstermektedir. Bazı ülkeler deprem bölgesinde olmasına rağmen okullarda deprem eğitimi verilmemektedir. Öte yandan, bazı ülkeler ise deprem eğitimini okul müfredatına dahil etmiştir. Literatürde Meksika ve İsrail gibi bazı ülkelerde verilen deprem eğitiminin yetersiz olduğu görülmektedir. Okullarda her ne kadar deprem eğitimi verilse de çocukların bilgi seviyesi düşük kalmaktadır. Deprem eğitimini uygulayan farklı ülkeleri incelemek ideal bir deprem eğitimi oluşturmak açısından faydalı olacaktır. Sonuç olarak, bu derleme farklı ülkelerde uygulanan deprem eğitimini incelemeyi amaçlamaktadır.

Anahtar Kelimeler: *Deprem, eğitim, afet.*

Abstract

Earthquake education is significant for students to raise awareness and improve knowledge related to earthquakes. Literature on earthquakes emphasizes that people with high awareness and increased knowledge can effectively cope with the devastating effects. At this point, traditional teaching methods, such as drills and theoretical lessons, are inadequate, but innovative methods like virtual reality (VR) technology is more promising. However, there is no consensus on the ideal type of earthquake education. In the world, earthquake education significantly differs. Even though some countries are located in regions that are prone to earthquakes, they do not consider earthquake education in schools. On the other hand, several countries include earthquake education in school curricula. Existing literature demonstrates the insufficiency of current earthquake education in countries like Mexico and Israel. Students have deficiencies in knowledge related to the earthquake in spite of the implementation of earthquake education in schools. Reviewing different countries implementing earthquake education allows us to create an ideal type of earthquake education. Therefore, this review aims to investigate earthquake education in different countries.

Keywords: *Earthquake, education, disaster.*

INTRODUCTION

Natural hazards impact millions of people around the world, with intense disruption of various conditions fundamental to the well-being of people (Ryan et al., 2020). Scientists consider a natural hazard as evolving into a disaster if it results in severe impacts such as loss of life and economic or environmental losses (Moos et al., 2018). In the last decades, the frequency and intensity of natural disasters have been growing at an alarming pace (Iqbal et al., 2021). At this point, education is crucial to minimize or manage those risks through raising awareness and improving decision-making. However, educators have limited time and resources to address all types of disasters. They prioritize the subjects by considering how to best respond to the need of society. Therefore, research on disasters is significant for educators to understand the recent problems and needs.

Earthquake is one of the most devastating natural disasters and often creates massive damage to life and property (Kahandawa et al., 2018). Nowadays, efforts in the prediction and prevention of earthquakes are still tentative because it is a disaster that is unpredictable and unavoidable (Jones, 2020). According to statistics, China has experienced 35% of earthquakes above magnitude 7 (Gong et al., 2015). Nevertheless, numerous countries are located in regions prone to earthquakes. Every year, a substantial number of earthquakes occur at various magnitudes (Çoban & Göktaş, 2023; Yang & Yao, 2021).

Earthquake is a major problem for many countries in the world. At this point, earthquake education is the responsibility of educators and policymakers. Education is an effective tool for the mitigation of earthquakes through the dissemination of information and implementation of measures. Especially formal education is an important opportunity for all students and their parents to get a comprehensive earthquake education (Sözcü, 2021). Countries at risk of the earthquake should consider earthquake data thoroughly. Most importantly, adequate earthquake education should be given in schools. Education is at the heart of preparing earthquake plans, taking measures, and performing drills (Zengin et al., 2015). Education is crucial, but understanding why earthquakes should be seriously considered is more important. At this point, the high number of deaths and countless losses should warn us to give more importance to earthquake education.

Although the date of earthquakes differs, the number of fatalities is constantly high. The 2023 Turkey-Syria earthquake just happened. According to Disaster and Emergency Management Presidency, two earthquakes occurred just a few hours apart,

and the number of fatalities is approximately 40,000 (AFAD, 2023). Earthquakes are likely to happen in the near future. Many countries like Turkey and Syria are at risk of earthquake. The devastating effects of earthquakes will not change, so the position and importance of earthquake education should be changed. For this reason, this study aims to investigate how earthquake education is implemented in different countries. Before presenting findings, the introduction of this study gives the literature on earthquake education.

LITERATURE REVIEW

Earthquakes generally occur without forewarning, so in the event of an earthquake, there is a very short time for people to react (Hua et al., 2020). Hence, people should prepare before happening any earthquake event. Nonetheless, it is challenging to motivate people to earthquake preparedness due to the varying and infrequent nature of earthquakes (Becker et al., 2017). Literature on earthquake preparedness significantly differs. For example, Shaffril et al. (2021) claim that previous earthquake experience is positively related to preparedness. On the other hand, Codreanu et al. (2014) state that no relationship was found between past earthquake experience and preparedness. At this point, research on public awareness is consistent. Numerous studies reveal that people with awareness and knowledge minimize the devastating effects of earthquakes (Ao et al., 2021; Herovic et al., 2020; Soffer et al., 2010). Correspondingly, schools provide lectures and implement drills in order to raise awareness and improve knowledge (Subedi et al., 2020). However, earthquake education in schools is very limited, so students and their parents lack adequate knowledge about earthquakes (Adams et al., 2022). A study by Santos-Reyes et al. (2017) reveals that students mostly reported little fear of earthquakes, while half showed insufficient knowledge. Similarly, Kirikkaya et al. (2011) state that 4th-grade and 5th-grade students in Turkey experience deficiencies in knowledge about what an earthquake is and how an earthquake occurs. Moreover, many students reported weather conditions as a reason for an earthquake. Most importantly, students were unaware that their province has a high risk of earthquakes.

Likewise, students in Israel have inadequate knowledge because earthquake education is the same as a decade ago. Taking part in demonstrations and learning simple theoric information are not effective for earthquake education. At the end of the day, students just know the simple information "go to a safe place and wait" without any idea about what can be a safe place when the building is collapsed (Schmidt, 2018).

The problems related to earthquake education are similar to those in the past. Due to insufficient education, people do not know how to react during an earthquake. For instance, people who experienced the 1985-Mexico earthquake were interviewed. They report that they would immediately leave the building if an earthquake occurs again (Santos-Reyes et al., 2014). Similarly, people who experienced the 2015-Ranau earthquake were mostly puzzled about how to respond (Tongkul, 2021). Subedi and Hetényi (2021) highlight that people in Nepal are motivated to take measures for future earthquakes whenever they experience a large earthquake, but they cannot manage, and their motivation vanishes owing to the lack of earthquake education. Besides, Çoban and Göktaş (2022) emphasize that when schools do not provide earthquake education, the number of deaths and injuries increases because every piece of knowledge related to the earthquake is lifesaving.

In addition to traditional teaching methods such as posters, brochures, and drills, some countries have started to use a virtual reality (VR)-based learning environment (Çoban & Göktaş, 2022). Virtual reality (VR) technology allows users to interact within an immersive computer-generated environment. This environment provides a sensory experience to users by simulating their physical presence in the real world. Because traditional earthquake drills are insufficient to raise awareness, using virtual reality technology in drills can be more beneficial for students (Gong et al., 2015). Furthermore, various models, such as a failure-enhanced evacuation training model, can be used with virtual reality technology for students to enjoy and expand their knowledge related to earthquakes (Mitsuhara et al., 2019). Besides, museum-based education programs provide necessary information on earthquakes for students by creating interactive activities. A positive relationship was found between a museum-based earthquake education program and student knowledge of earthquake preparedness (MacDonal et al., 2017). As a result, various methods for earthquake education exist.

Earthquake education is significant in the preparation of students for any earthquake event (Izadkhah & Gibbs, 2015). Furthermore, many studies recommend that earthquake education be included in the national school curricula for all countries (Gaeta et al., 2014). If earthquake education is insufficient for students, earthquakes can be more destructive (Navakanesh et al., 2019; Sutton et al., 2022). That is why earthquake education should be revised if there is a need for more knowledge and practice. This can only be achieved by reviewing the implementation of earthquake education in different countries. There is no consensus in the literature on the ideal

type of earthquake education (Johnson et al., 2014; Mitsuhara et al., 2019). If different implementations of earthquake education are analyzed, strong aspects can be determined. Analyzing and synthesizing earthquake education in the world can give an opportunity to create an ideal type of earthquake education.

METHOD

This study aimed to carry out a literature review on earthquake education in the world. Firstly, multiple keywords regarding the outcomes of interest were determined. These keywords are listed as follows: "Earthquake Education," "Earthquake Training," "Disaster Education," and "Disaster Training." A comprehensive literature review was conducted by using the given keywords. The literature review was carried out between January 30, 2023, and February 18, 2023. Data were obtained by reviewing available literature in the databases (PubMed, Scopus, ScienceDirect, Web of Science, and Google Scholar). Studies on earthquake education date back a few decades, but the aim of this study is to review the current situation in order to get an idea about an ideal earthquake education. For this reason, the studies in the last 20 years were examined. Additionally, only studies conducted in English were investigated. Studies that included earthquake education directly or as part of disaster education were considered for this study. Moreover, studies that provide information about the content or implementation of earthquake education as country-specific are included, while studies that propose a new education, program, or system are excluded because the focus of this study is the current situation of earthquake education in the world. Fifteen articles were found on earthquake education practices in different countries. These fifteen studies provide information about earthquake education practices implemented in nine countries: Australia, India, Iran, Israel, Japan, Malaysia, Nepal, Romania, and the United States. Finally, the position and importance of earthquake education were discussed according to existing literature.

FINDINGS

The literature search regarding earthquake education in different countries resulted in a small number of articles. This can be explained by the scarcity of earthquake education worldwide. On the other hand, when Boon and Pagliano (2014) give a brief overview of earthquake education in Australia, they highlight that limited information on earthquake education does not mean the absence and insufficiency of earthquake education. Nevertheless, they accept that earthquake education is not the priority of countries, so more research is needed. In this review, eligible studies are presented throughout the findings.

Australia

Australia experiences a considerable number of disasters compared to other countries. At this point, earthquake is not the main concern for Australia. That is why comprehensive disaster education is implemented in schools, but earthquake education is only a part of this disaster education. For example, bushfires are a prevalent problem affecting a substantial proportion of the Australian population. Thus, all governmental organizations demand disaster-based education. Accordingly, The Australian National Curriculum was prepared in order to meet cross-curricular priorities. As a part of disaster education, earthquake education is taught from the 6th to 8th grades. It is also included in secondary school geography lessons. Research on earthquake education in Australia is very scarce. Nonetheless, this does not mean school materials and given education are insufficient. Because Australia faces a high number of disasters, education is shaped according to this need (Boon & Pagliano, 2014).

India

India developed a program for implementing earthquake education in schools. This program is called as School Earthquake Laboratory Program (SELP), and it is applied nationwide. The main objective of SELP is to create awareness among students by providing comprehensive earthquake education. At this point, SELP is considered an opportunity for school children in terms of interactive and participatory learning. Before employing this program, higher secondary school teachers participate in laboratory exercises and workshops in order to learn how to evaluate and analyze earthquake data. After teachers complete their training, SELP focuses on materials essential for earthquake education. Lastly, trained teachers give earthquake education with rich materials in laboratories. In India, specifically, earthquake-prone areas are selected to establish laboratories for implementing SELP. Therefore, earthquake education in India is limited to earthquake-prone areas (Bansal & Verma, 2013).

Iran

In Iran, earthquake education has been implemented within the curriculum framework of different educational levels. Earthquake education started in preschool last until the end of high school. Earthquake education aims to teach how an earthquake occurs and how to make a decision during an earthquake for primary school students, whereas it focuses on emergency response activities for secondary school and high school students. Materials employed during earthquake education generally are textbooks and films. Exhibitions, drills, and drawing competitions are

also included. In Iran, schools conduct an annual national drill every 8 November. After that, annual painting, art, and training exhibition are organized. Schools use earthquake exercises, earthquake songs, drawings, storybooks, and computer games specifically for preschool children (Parsizadeh & Ghafory-Ashtiany, 2010).

Israel

In Israel, the Israeli National Emergency Authority organizes earthquake education by giving lectures and conducting drills. The earthquake education program is carried out yearly. Some students participate in either lectures or drills, while others attend both. The Home Front Command (HFC) gives lectures. One lecture lasts 45 minutes, and educators aim to teach factors affecting an earthquake and how to make the best decision in the event of an earthquake. The National Multi-Age Program for Emergency Education is implemented from 2nd grade to 12th grade by regular school staff. However, HFC personnel, the soldier-instructor gives lectures to students in 5th grade. Thus, the 5th-grade level is a milestone in terms of earthquake education for students in Israel (Schmidt, 2018; Soffer et al., 2010)

Japan

A national curriculum on earthquake education has been planned within disaster education in Japan. Especially in 2017, the curriculum content for disaster education was expanded in subjects such as social sciences and science (Sakurai et al., 2020). The two main areas of focus in earthquake education are providing accurate information to students and providing practical training that will enable them to protect themselves (Shaw et al., 2004). Earthquake education in Japan has undergone significant changes because their experiences have made it necessary to reconsider earthquake education. The content and implementation of earthquake education, which is intertwined with different natural disasters such as tsunamis, has gradually increased. At this point, major earthquakes have a great impact on these changes. For example, in the event known as the "Kamaishi Miracle", after the Great East Japan Earthquake, students who received disaster training before the earthquake survived the disaster and helped those around them to survive thanks to the fact that they applied the training they received fully and without wasting time. Following this incident, disaster education has gradually gained importance and increased in Japan (Katada & Kanai, 2016). With the increasing awareness as a result of the earthquakes in Japan, it is aimed to integrate disaster education into daily school activities and school culture. Considering the possibility of major earthquakes, disaster education has been at the top of the national agenda in Japan since 2011, following devastating

disasters (Kitagawa, 2015). Since Japan is at risk of many different natural disasters, more comprehensive disaster education is provided in schools. In this sense, although disaster education in Japan has common goals, it varies according to the risk situations and different needs of the regions (Suzuki, 2014).

Malaysia

Malaysia is located in an area with low to medium seismic activity levels. Nevertheless, earthquakes frequently happen in the surrounding areas of Malaysia. For example, when Sumatra, an island in Indonesia, experiences huge earthquakes, this also results in affecting Malaysia (Moon et al., 2022; Noh et al., 2021). Although earthquake education in Malaysia is still in its exploratory stage, some districts of Malaysia, which is prone to earthquake, embarked on earthquake-related programs in the schools. For example, the Ministry of Education implemented an earthquake education program from 2017-2019. However, this earthquake education program was limited to Ranau and Lahad Datu districts. Earthquake education is in its infancy, so earthquake risks in Malaysia are poorly understood and discussed (Tongkul, 2021).

Nepal

Nepal is located in the central part of the Himalayas, a highly active seismic zone. People in Nepal experienced many devastating earthquakes. Furthermore, scientists warn people living in this area about the possibility of another large earthquake occurring in the near future (Goda et al., 2015; Sapkota & Neupane, 2021). However, none of the earthquake-related topics is part of the school curriculum. Although some organizations across Nepal have initiated programs meant to raise awareness, the countryside has been neglected. Many people in Nepal have no clear idea about what causes earthquakes and what should be done during an earthquake. Moreover, most of them have mythological perceptions. For this reason, people differ considerably in ways to communicate about earthquakes and related topics in the community. School education in Nepal starts at the age of 5 years. However, attendance is not compulsory in Nepal schools. In terms of earthquake education, school textbooks provide limited information about earthquakes. Moreover, the curriculum in schools does not cover seismology (Subedi et al., 2020).

Romania

Romania is among the countries with high earthquake risk in Europe. For this reason, Romania has a law that came into force in 2006 on providing earthquake education in schools. This law includes informing students about earthquakes by school staff twice in primary school and once in secondary school and high school. However, no specific program and format is planned for earthquake education in Romania. There are serious concerns about earthquake education being shaped according to teachers' preferences. In this regard, most students have deficiencies in their basic knowledge

about earthquakes. Thus, earthquake education in Romania is less developed compared to countries such as Japan (Raluca & Sibișteanu, 2015).

United States

The National Center for Earthquake Engineering Research was the first to initiate a project for schools. Earthquake disaster education started in 1989. Moreover, national and local governments supported earthquake education by funding relevant materials for earthquake education. Efforts to improve earthquake education have been beneficial for the preparedness of people for future earthquakes (Tanaka, 2005).

In the United States, many regions are prone to earthquakes, so over 143 million people are at risk. Earthquake hazard is huge for several states, such as California, Washington, and Oregon. At this point, earthquake displays in free-choice learning environments get attention. Museums, national parks, libraries, and visitor centers have different themes in which people learn in-depth about various aspects of earthquakes. In these places, interest-based learning happens. Thus, theoretical information given by schools and drills can be easily implemented. In addition, these kinds of places enjoy people as well as educate. The number of earthquake displays and exhibits in the United States is over 150. These provide information related to the earthquake. However, only twenty-nine of them give information about earthquake preparedness. On the other hand, twelve displays are located in California, Oregon, and Washington. In earthquake-prone regions of Unites States, displays increasingly get attention (Sumy et al., 2022).

DISCUSSION AND CONCLUSION

Earthquake education is crucial for students to engage with sufficient knowledge and necessary skills of the earthquake before they face any earthquake event. Earthquakes are one of the most common and devastating natural disasters. Data on past earthquake events demonstrate a high number of deaths and countless losses of property in most countries (Kahandawa et al., 2018). At this point, earthquake education is effective in preventing possible loss of life and property damages by teaching how to best respond in the event of an earthquake (Çoban & Göktaş, 2022). Thus, earthquake education is key to the mitigation of earthquakes in all countries.

Even though Nepal and Malaysia are located in an active seismic zone, they do not implement earthquake education in the schools. Nevertheless, the Ministry of Education in Malaysia develops short-time earthquake education programs in order to inform students living in areas at risk of the earthquake (Subedi et al., 2020; Tongkul, 2021). Many studies recommend that earthquake education be implemented nationwide and included in the school curricula for all grade levels (Gaeta et al., 2014). However, Nepal and Malaysia do not prefer to give time and effort to earthquake

education. On the other hand, Australia, India, Iran, Israel, Japan and the United States use earthquake education consistently in schools (Bansal & Verma, 2013; Boon & Pagliano, 2014; Parsizadeh & Ghafory-Ashtiany, 2010; Sakurai et al., 2020; Schmidt, 2018; Soffer et al., 2010; Sumy et al., 2022).

In the majority of countries, earthquake education is given by regular school staff, while Israel gives this responsibility to soldier-instructor (Schmidt, 2018). Identified grade levels for earthquake education significantly differ. In Australia, 6th to 8th-grade students participate in earthquake education (Boon & Pagliano, 2014), whereas, in Israel, soldier instructors give earthquake education to students in 5th grade (Soffer et al., 2010). Moreover, students from all grade levels in Iran and Japan attend earthquake education (Katada & Kanai, 2016; Parsizadeh & Ghafory-Ashtiany, 2010; Sakurai et al., 2020). However, other studies did not report grade levels for given earthquake education.

Most of the countries implementing earthquake education are located in a region prone to earthquakes. Hence, they focus only on earthquakes as significant disasters. In these countries, earthquake education is structured comprehensively. On the other hand, Australia and Japan consider earthquake education as only a part of general disaster education because Australia and Japan experience a substantial number of disasters (Boon & Pagliano, 2014; Kitagawa, 2015; Sakurai et al., 2020). Therefore, every country structures its own system of earthquake education by considering the risks they face.

In the existing literature, virtual reality (VR) technology is recommended instead of traditional teaching methods for earthquake education (Gong et al., 2015; Mitsuhara et al., 2019). However, there is no country reported use of VR technology. The most common teaching methods implemented by almost every country for earthquake education are drills, demonstrations, and theoretical lessons. On the other hand, national parks, museums, visitor centers, and libraries with different themes related to the earthquake are used for earthquake education in the United States (Sumy et al., 2022).

Available literature shows that traditional teaching methods for earthquake education have been insufficient to improve the knowledge of students. Moreover, students are unaware of the high risk of the earthquake (Kirikkaya et al., 2011; Santos-Reyes et al., 2017; Schmidt, 2018). All these reasons put children in danger in the event of an earthquake. If they do not have coping strategies, they are shocked in front of an earthquake. They try to escape from the stairs, so they are injured. If they do not

understand that they experience an earthquake, they cannot respond in the best way. Everything starts with awareness and continues with knowledge. Children aware of earthquakes remember what should be done. Maybe the uncertainty of the experience makes coping with earthquakes harder. That is why existing literature emphasizes raising awareness and improving knowledge minimize the devastating effects of an earthquake (Ao et al., 2021; Herovic et al., 2020; Soffer et al., 2010).

In conclusion, earthquake education is crucial for all grade levels. When students learn the necessary knowledge related to the earthquake at school, they can discuss it with their parents at home. Schools may also invite adults to earthquake education to include every age group. Moreover, policymakers can consider including earthquake education in school curricula. However, if schools continue to implement traditional teaching methods, it can be meaningless to include earthquake education in school curricula because research shows the insufficiency of these methods. Instead, innovative methods like virtual reality (VR) technology can be more beneficial. After implementing earthquake education nationwide, studies examining the effectiveness of the current design of earthquake education are needed. Because earthquakes suddenly happen without forewarning, we should be prepared every time, just like it is about to happen. Thus, earthquake education is an immediate need.

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