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Disaster Preparedness Education: Construction Curriculum Requirements to Increase Students' Preparedness in Pre- and Post-Disaster Activities

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Abstract

Students are one of the vulnerable groups of people affected by a disaster, as they suffer both physically and mentally. Concerns are rising, as educational institutions lack adequate emergency programs to prepare students for disasters. Moreover, the integration of disaster preparedness in the coursework is rarely done for students with majors such as construction. This study performs a comprehensive literature review to integrate the research related to students' disaster preparedness and provide strategies to increase students' disaster preparedness. To fulfill this aim, 83 of the most recent scholarly articles were collected and scrutinized. The current trends in disaster preparedness curriculums in construction programs, as well as other majors, were studied, strategies for enhancing these programs espoused by researchers were investigated, and challenges/barriers to providing disaster preparedness education were analyzed. It was concluded that the integration of hands-on practices of rescue activities into construction curriculums, along with theoretical knowledge of disasters, significantly helps students to be prepared for a disaster and for post-disaster mitigation efforts hence should be included in the disaster preparedness curriculum. Lack of resources and trained personnel is one of the major causes of insufficient integration of disaster preparedness materials in the course curriculum. This study will assist in updating the existing programs, enhancing construction students' disaster preparedness, addressing potential challenges to the advancement of knowledge, and reducing damages.

Key Words: Disaster Preparedness, Construction Education, Disaster Preparedness Education, Disaster Preparedness Strategies, Resilience Challenges, Student Vulnerability

1 Introduction

Disasters are phenomena that diminish social stratification due to their unexpectedness and destructive power (Kermanshachi & Rouhanizadeh, Feasibility analysis of post disaster reconstruction alternatives using automated BIM-based construction cost estimation tool, 2018). They cause physical damage to society and the environment, as well as psychological trauma (Rouhanizadeh & Kermanshachi, Investigating the Relationships of Socioeconomic Factors Delaying Post-Disaster REconstruction, 2019). Localities are affected differently by the same type of disaster, based on social vulnerability. Preparedness to face the disaster is one of the measures of social vulnerability. Lack of essential education and information relevant to facing a disaster indicates a poor level of a society's preparedness (Kermanshachi, Berstrand, & Rouhanizadeh, 2019). Disaster awareness has increased recently, but disaster preparedness, response, and mitigation strategies are still lacking in universities and schools (Safapour & Kermanshachi, 2019).

Students, especially if they are in the school when a disaster occurs, are more likely to suffer damage than the general population (Tipler, Tarrant, Johnston, & Tuffin, 2017). Concerns are rising, as schools lack adequate emergency planning to prepare students for disasters, and as a result, students suffer physically, emotionally, and behaviourally (Kruger, et al., 2018). Moreover, construction education rarely includes disaster preparedness materials within the coursework for construction students, this is because the usefulness of including such materials in construction education is poorly acknowledged in the literature. Therefore, this study aims to conduct a comprehensive review of the most recent scholarly articles to integrate the research related to the preparedness of students to face a disaster. The following objectives were formulated to achieve this goal: (1) review existing literature on disaster preparedness of students, (2) investigate the geographical location and trends of studies in these areas, (3) investigate the strategies that help improve students preparedness, and (4) identify challenges/barriers to the institutions making preparedness education available to students, especially construction students. This study will assist both faculty members and other academic staff in updating the existing programs, enhance the disaster preparedness of students, address potential knowledge advancement challenges for construction, and reduce costly and deadly damages.

2 Research Methodology

This research focuses on shedding light on the current state of students' readiness to deal with the pre- and post-disaster phases of a disaster through five basic steps shown in Figure 1. The first step of this study focused on collecting related literature from scholarly journals and conference proceedings. In this process, the keywords "disaster preparedness," "disaster preparedness for students," and others were entered into various search engines like Google Scholar, Science Direct, JASTOR, ProQuest, etc.

In the second step, the titles of each article were scrutinized carefully, and only the articles related to disasters were selected for further analysis. Later, the abstract of each pre-selected article was studied for the purpose of selecting the articles that discussed the readiness of students to face disasters, and 83 articles were finalized. In the fourth step, the collected articles were analyzed based on the continent of origin, disaster type, type of students, and the data collection method. In the final

step, articles were studied to identify strategies that can improve students' disaster preparedness, as well as barriers that would hinder this improvement.

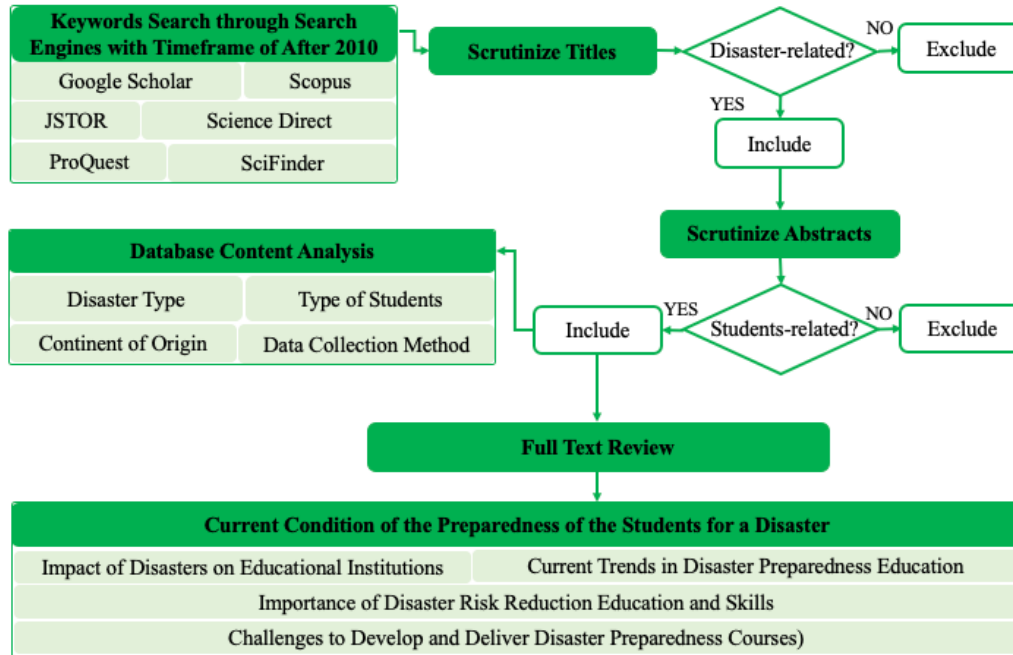


Figure 1: Research methodology and literature search process

3 Database Content Analysis

To understand the current condition of the preparedness of the students to deal with an upcoming disaster, it is important to first analyze the database content. In this study, the collected articles were analyzed based on the type of disaster, type of students, the continent of origin, and the data collection method. As this study collected articles that were mostly published from 2010 to 2019, the analysis based on the publication year was not conducted.

3.1 Type of Disaster

Disasters, irrespective of whether they are natural, man-made, or technological, are increasing worldwide and are causing economic and collateral damages (Rouhanizadeh, Kermanshachi, & Dhamangaonkar, 2019; Nahayo, et al., 2018). Hence, the majority of the collected studies, 42% to be precise, investigate students' preparedness for disastrous events in general including both natural and man-made disasters, as shown in Figure 2. Different geographical locations are susceptible to different types of disasters, and the studies often focus on the type(s) of disasters that occur in that locale. For example, Shah et al. (2018) focused on floods while discussing students' preparedness, as Pakistan is more prone to flooding than to other types of disasters.

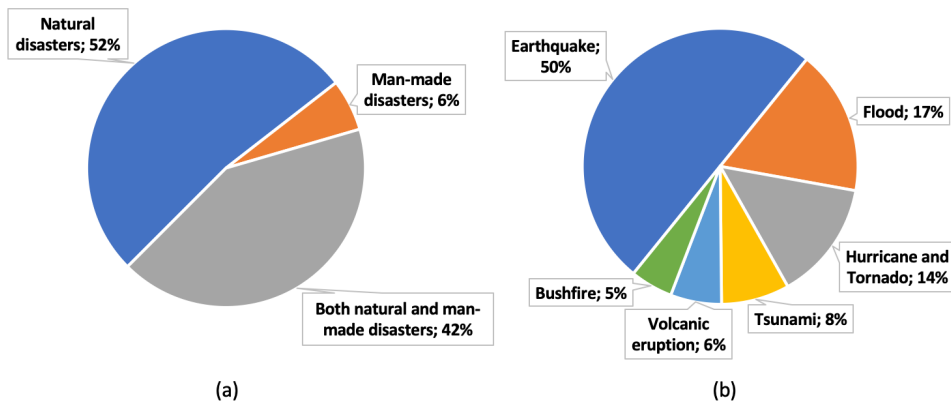


Figure 2: Distribution of the publication based on- (a) disaster type and (b) types of natural disaster

3.2 The Continent of Origin

Developed countries are more cautious about their students' welfare than underdeveloped countries (Amri, Bird, Ronan, Haynes, & Towers, 2017). Figure 3 confirms this fact, as 37% of the collected literature related to disaster studies focused on North American educational institutions. Serbia from Europe, Indonesia from Southeast Asia, and Australia also had a significant number of studies because the territory of Serbia often suffers from floods (Cvetkovic, Lipovac, & Milojkovic, 2016), the geographical location of Indonesia makes it vulnerable to tsunamis (Sujarwo, Noorhamdani, & Fathoni, 2018), and Australia often suffers from natural disasters like bushfires, floods, etc. (Le Brocque, et al., 2017). The low percentage of publications is not an indication of a low number of disasters; rather it is an indication of a dearth of publications from regions that need more studies regarding students' preparedness for disasters. Third world Asian countries are notably behind in this regard. For example, in Pakistan, each school has total authority to decide whether or not to include school safety and disaster preparedness for the students (Shah, et al., 2018).

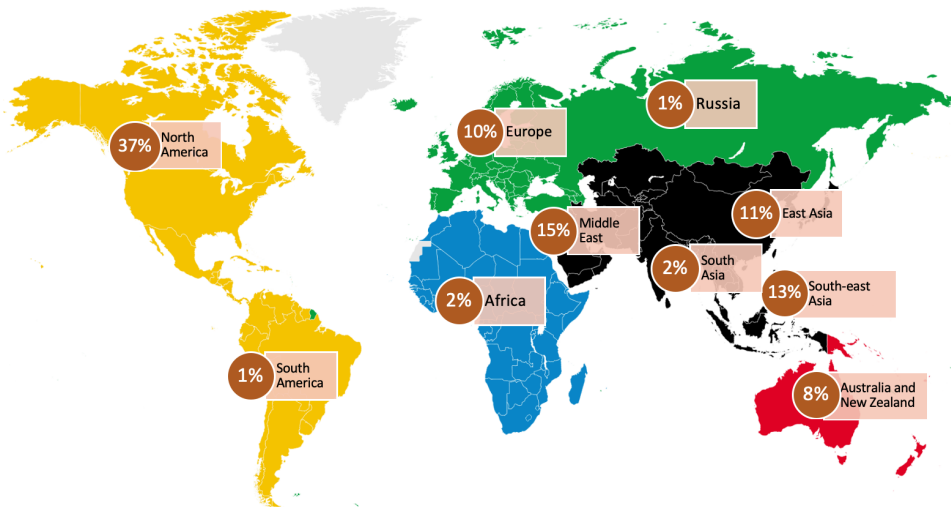


Figure 3: Distribution of disaster publications according to the continent of origin

3.3 Type of Students

Thirty percent (30%) of the studies discussed disaster preparedness of students in general and the rest of the studies focused on students from a particular level. distribution of the publications based on students' level is shown in Figure 4. There was a gradual increase in disaster preparedness studies from elementary students to high school and university students, but these studies should be introduced at a very early age, not be kept for more advanced education. Pre-school students and students with disabilities were the most overlooked group, as they constituted only 4% and 2% of the total students, respectively, and need more attention.



Figure 4: Distribution of the publications based on the type of students

3.4 Data Collection Method

Section Table 1 shows the distribution of the publications based on the data collection method, and it can be seen that 54% of the studies used surveys to investigate the current level of the students' knowledge about disaster preparedness. Simulation of a disaster and observation of the response of the students was another important method of data collection.

Data Collection Method	Percentage
Survey	54%
Literature-based recommendations	13%
Quasi-Experimental Investigation with Pre-test and Post-test Design	8%
Interview	8%
Simulation and Observation	6%
Case Study	5%
Evaluation of Existing Rules and Regulations	4%
Focus Group Question-Answer	2%
Total	100%

Table 1: Distribution of the publication based on the data collection method

4 Impact of Disasters on Educational Institutions

The Centre for Epidemiology of Disaster (CRED) reported that the U.S. experienced approximately \$1.5 trillion in economic losses from 2003 to 2013, and \$92 billion in economic losses from 2015 to 2016 (Onigbinde, 2018). The records suggest that the losses have increased gradually every year. While these statistics provide an overview of the monetary damages that are caused by natural disasters, it should be noted that it includes damages to universities. Hence it is crucial for us

to emphasize implementing disaster risk reduction (DRR) in universities. During disastrous situations or catastrophic events, the level of awareness and preparedness of universities is still uncertain. To find out the efficacy of such awareness, a lot of questions need to be answered, such as: “How ready are the students and faculty members to manage the disaster?” “What strategies will be employed by the university in emergency situations if a disaster occurs?” “If the incident happened during a regular school day, are the staff members well trained to deal with the situation?” (Jaradat, Mziu, & Ibrahim, 2015). Disasters such as the Loma Prieta Earthquake (1989), Hurricane Andrew (1992), Northridge Earthquake (1992), etc. damaged school buildings and compelled schools to close for a month because of lack of water and electricity (Jaradat, Mziu, & Ibrahim, 2015). Universities can be affected in various ways by disasters: damages to the buildings; loss of administrative and research data; destruction of libraries; ruined specimens in laboratories; destroyed or compromised computer and communication systems; injuries to students, faculty and staff members; increased insurance premiums, etc. (Jaradat, Mziu, & Ibrahim, 2015). Disaster resilience education should be given more emphasis, especially in third world countries, as they have limited abilities to adapt to and cope with the new reality brought about by the disaster. The skills and knowledge pertaining to disaster risk reduction are only effective when it is age-appropriate (Nahayo, et al., 2018). It is equally important to provide disaster resilience education in developed countries, as many of their universities are critical research entities as well as educational entities. Many universities hold top secret and highly important information, as they have collaborative projects with governmental organizations such as the Department of Transportation, National Institute of Health, National Security Agency, etc. (Federal Bureau of Investigation, 2013).

5 Current Trends in Disaster Preparedness Education

It is the responsibility of institutions to ensure the safety of the pupils during a disastrous event. Yet, there are schools that do not have safe school facilities, proper disaster management programs, and/or education modules pertaining to risk reduction and resilience (Tipler, Tarrant, Johnston, & Tuffin, 2017). In fact, Tanner and Doberstein (2015) found that even though student groups are the most vulnerable group of all the community groups when it comes to disasters, they are the most disregarded group when considering emergency preparedness. Tan et al. (2017) conducted a study and found that less than 50% of the university students were able to demonstrate the knowledge and rescue skills required during a disaster. Similar results were found by Mulilis and Duval (2000) when they compared student renters with non-student renters and homeowners. They found that student renters were the least prepared group to handle a disaster due to their lack of knowledge regarding disaster preparedness. Nahayo et al. (2018) conducted a study in this area and found that teachers’ lack of willingness to encourage students to study disaster risk reduction fuelled the lower level of students’ disaster preparedness. Tan et al., (2017) conducted a survey to assess the knowledge of primary rescue skills used in emergency situations and found that cardiopulmonary resuscitation (CPR) is the least desired but most practiced skill administered by schools for disaster preparedness. Schools should be innovative while developing disaster-related courses, instead of limiting their curriculum to traditional ideas. However, not many studies focused on disaster preparedness of construction students were found in the literature.

6 Importance of Disaster Risk Reduction Education and Skills for Students/Construction Students

The risks of disasters can be significantly reduced when students have an appropriate education (Amri, 2015). Proper knowledge regarding disaster risks also improves the understanding of the risk and helps in preparedness and adaptation (Spiekermann, Kienberger, Norton, Briones, & Weichselgartner, 2015). It is also important for the students to practice rescue skills that they might need during an actual disaster. Educating children about hazards plays a vital role in preparing them for disasters (Amri, Bird, Ronan, Haynes, & Towers, 2017). Creating an awareness of the dangers does not necessarily indicate a high level of preparation, and book knowledge of a particular procedure that might need to be performed during an emergency does not ensure that the students will be able to do on the spot e.g. (Haynes & Tanner, 2015; Whittaker, Haynes, Handmer, & McLennan, 2013). The most difficult part of the disaster preparedness process is the hands-on practice of the required rescue skills under the supervision of trained personnel (Tan, et al., 2017). In this regard, institutions that have medical schools and/or nursing departments have an advantage, as they can provide professionals and equipment to facilitate training and courses (Edwards, 2013). This preparedness helps the students by preparing them mentally for the disaster, encouraging them to collaborate with emergency management practitioners, increasing their confidence in handling emergency situations, helping them understand the physical and psychological consequences of the disaster and their actions, and making them conscious of individual safety (Khorram-Manesh, Berlin, Roseke, Aremyr, & Sorensson, 2018). Moreover, disaster preparedness of students with a construction background will not only help students but also will be of help to the community. This is because today's construction students are tomorrow's engineers, contractors and construction leaders. If these future engineers and contractors do not have basic knowledge about the importance of disaster preparedness, it might hamper their perception regarding enforcing DRR facilities while designing and constructing infrastructures. Hence, it is high time to include DRR in construction education. Universities should be cognizant of the high-risk factors of their location and formulate relevant disaster preparedness education (Oztekin, Larson, Yuksel, & Ugras, 2015). A few of the strategies presented in Table 2 were provided in previous studies to develop and implement effective disaster risk reduction courses in universities.

7 Challenges to Developing and Delivering Disaster Preparedness Courses for Construction Programs

Implementation of a disaster preparedness course requires a collaborative effort of all of the stakeholders of the locality. Government agencies do not put much focus on students studying in schools and universities let alone students with particular majors like construction engineering and management; they are more concerned about the community as a whole. Moreover, developing practical DRR courses or mixing DRR courses with other courses depends on the financial capacity of the schools (Nahayo, et al., 2018). The majority of the construction major students depend on the student loan for their higher studies; hence, they will lose interest in DRR courses if they require any registration fee. Furthermore, even though it is important to integrate science and technology with practical training to understand the signs of disaster, this process often suffers from a lack of knowledge (Nahayo, et al., 2018). According to Spiekermann et al. (2015), there are two major barriers to effectively handling a disaster: lack of required resources to apply knowledge, and lack of knowledge for making evidence-based decisions when needed. The lack of appropriate teaching materials is another major barrier to students' preparedness (Nahayo, et al., 2018).

#	Suggestion	Reference
1	Incorporate DRR-related sessions into the education curriculum and make concerned parties actively aware.	(Eiser, et al., 2012)
2	Expose students to the theory behind disaster management at an early age, and put the knowledge into action through simulated disaster drills.	(Tan, et al., 2017)
3	Teach techniques for dealing with wounds in simulated disaster situations.	(Tan, et al., 2017)
4	Schools with DRR education programs should team up with local experts at DRR forums, and invite them to provide credible information for students.	(Amri , Bird, Ronan, Haynes, & Towers, 2017)
5	Universities and the local community should devise strategies for using mutual aids when possible.	(Edwards, 2013)
6	A database of related educational resources and proper guidelines should be available online for teachers.	(Amri , Bird, Ronan, Haynes, & Towers, 2017)
7	Students and parents should be involved with the emergency management practitioner of the school to increase the schools' preparedness effort.	(Tipler, Tarrant, Johnston, & Tuffin, 2017)
8	Focus on hands-on interactive activities to engage students in preparedness activities, instead of depending on descriptive handbooks.	(Rafferty-Semon, Jarzembak, & Shanholtzer, 2017)
9	Disaster courses should be offered according to the maturity level of the students, hands-on applications should be under the supervision of trained personnel, and collaboration among all concerned stakeholders is desired.	(Nahayo, et al., 2018; Tan, et al., 2017);
10	An adequate number of grab-and-go kits should be available for the students' personal emergency preparedness.	(Chilton & Alfred, 2017)

Table 2: Strategies for developing and implementing an effective DRR course in universities

8 Conclusion

This study investigated the current trends in the disaster-preparedness of students. Up until now, very little has been known about the barriers students face during a disaster and their level of preparedness for coping with the disaster. Moreover, the long term beneficial effect of integrating DRR in construction education has rarely been studied. Hence, there is a lot of evidence to back up the viability of including disaster management courses at the university level. This study found that third world countries in Asia are especially lagging behind in disaster preparedness. The lack of resources and professionals to provide hands-on practice is a major hindrance to improving the disaster-preparedness of the students. Education will help to spread awareness of the significance of disaster management and preparedness for these catastrophes so that students can help their family members and friends meet the challenges head-on, also, students from construction major will build inherent cautiousness for disaster this way which will help them later as design and construction engineers and construction leaders in their practical field of work. However, to justify the findings of this literature review study, this study recommends conducting a related survey among students from different construction programs.

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