



Establishment of a Framework to Measure Disaster Preparedness: Development of Strategies to Enhance Disaster Preparedness Activities

Ronik Ketankumar Patel¹, Sharareh Kermanshachi² and Thahomina Jahan Nipa³

¹ *University of Texas at Arlington, Arlington, USA, ronikketankumar.patel@mavs.uta.edu*

² *University of Texas at Arlington, Arlington, USA, sharareh.kermanshachi@uta.edu*

³ *University of Texas at Arlington, Arlington, USA, thahomina.nipa@mavs.uta.edu*

Abstract

Despite disasters being extremely disruptive to campus life and affecting students both mentally and physically, college students are one of the most overlooked sub-groups in the community following a disaster. It is, therefore, crucial for disaster risk reduction (DRR) to be implemented in universities, where disaster preparedness, response, and mitigation strategies and programs are still lacking even though disaster awareness has increased. This study aims to investigate disaster awareness and preparedness of university students and develop a framework within which to measure the level of their disaster preparedness. To fulfill the objective of this study, a comprehensive literature review was conducted to understand how knowledgeable and prepared students are for disasters. The review provided the basis for the development of a comprehensive survey that was distributed through an online platform. After two follow-ups, 111 survey responses were collected and analyzed, both qualitatively and quantitatively. Based on the analysis, a framework was developed, linking the characteristics of students with different levels of DRR education. It was found that the students' perspectives of the responsibility of friends, parents, and university and/or government agencies to provide for their safety during a disaster are formed by personal characteristics (male or female, graduate or undergraduate, educated or uneducated about disaster preparedness, etc.). It was also observed that graduate and undergraduate students have significantly different opinions about the adequacy of the first aid boxes at their university, and students with prior disaster preparedness education believe that it is important for local communities to help educational systems implement DRR courses. The opinions of students with prior disaster preparedness education differ significantly from those without disaster preparedness education on whether DRR education should be mandatory. The findings of this study will contribute to the US educational system to effectively develop and implement DRR courses and will guide policymakers in their assessment of the universities' emergency preparedness policies.

© 2020 The Authors. Published by Budapest University of Technology and Economics & Diamond Congress Ltd
Peer-review under responsibility of the Scientific Committee of the Creative Construction Conference 2020.

Keywords: disaster-preparedness education, disaster preparedness framework, students' disaster preparedness

1. Introduction

The Federal Emergency Management Agency (FEMA) [1] defines a disaster as an occurrence that has resulted in property damage, deaths, and/or injuries to a community. Every year, US cities are hit by more than 100 disasters that cause extensive deaths, destruction of property [2, 3, 4], and billions of dollars of economic losses [5]. In the period of 25 years from 1990 to 2015, the economic losses from natural disasters totalled approximately 700 trillion dollars [6]. Hurricane Sandy in New York (2012) and Hurricane

Harvey in Houston (2017) are recent examples of natural disasters, each responsible for the loss of approximately 100 lives [5, 7].

Natural disasters are responsible for causing physical damages [8, 9], creating social and psychological disorders in society [10, 11, 12], and damaging the environment [13]. By way of illustration, the 1991 Northridge disaster led to the disruption of critical highways at four different locations in the Los Angeles Metropolitan Area, upsetting the movement of people and causing an estimated economic loss of 1 million dollars per day. The economic losses from Hurricane Katrina in New Orleans and Hurricane Rita in the area surrounding the Gulf of Mexico were \$1845 billion and \$120 billion. Furthermore, the annual frequency of natural disasters has increased significantly worldwide [13, 14]. However, the losses and damages have not increased in proportion as in the period between 1975 to 2009 the losses increased from approximately \$10 billion to \$90 billion.

Disasters such as hurricanes, earthquakes, floods, etc. can disrupt campus life, interrupt classes, damage school buildings, and leave students in an emergency crisis [15]. According to Hoffmann and Muttarak [16], disaster risk reduction (DRR) plays an important role in achieving sustainable development [17]. Universities are beginning to recognize the importance of disaster preparedness and the risks associated with the lack of it, and students are also becoming aware of its importance through experience, the media, and awareness seminars conducted by various organizations [18]. Despite this, however, disaster preparedness, response, and mitigation strategies are still lacking in universities and schools. Tanner and Doberstein [19] stated that students are more vulnerable to a disaster than the general population because of their lack of knowledge, yet few educational institutions recognize the importance of educating their students about proper disaster preparedness [20]. Development of a DRR curriculum for students requires knowing and understanding the factors that affect students' DRR preparation; however, few studies have addressed this issue [21].

This study aims to investigate the disaster awareness and preparedness of university students and develop a framework within which to measure the students' preparedness. To begin this study, a comprehensive literature review was conducted to understand the factors that affect DRR education in universities. Based on the review, a survey was developed and distributed to students to collect their opinions about the identified factors. The findings of this study will assist both faculty members and other academic staff in updating the existing programs, enhancing the disaster preparedness of students, addressing the potential challenges in advancing knowledge, and reducing costly and deadly damages.

2. Literature review

2.1. Impacts of disasters on educational institutions

According to the Centre of Epidemiology of Disasters (CRED) International Disaster Database, the damages caused by natural disasters from 2003 to 2013 added up to 1.5 trillion US dollars. The economic losses from 2016-2017 were approximately 200 billion [22]. These statistics give a cursory view of the monetary damages that are caused by natural disasters overall, but overlook the fact that this includes damages to universities. Loma Prieta Earthquake (1989), Hurricane Andrew (1992), Northridge Earthquake (1992), Colorado State University Flooding (1997), Hurricane Georges (1998), and Hurricane Floyd (1999) are some of the catastrophic events that damaged academic buildings and forced schools to close because of no water and/or electricity [15]. Disasters can affect universities in numerous ways, such as the loss of administrative and research data; damage to libraries; spoiling specimens in laboratories; vitiating computer and communication systems; wrecking buildings; and injuring students, faculty, and staff members; etc. [15].

2.2. Current trends in disaster preparedness education

Tanner and Doberstein, [19] found that students are more vulnerable to disasters than other community groups and are the most ignored in the planning for emergency preparedness. Similar results were found by [23] while assessing tornado preparedness of non-student tenants, student tenants, and non-student homeowners. They learned that students were the least prepared group for disasters due to their lack of

knowledge and low level of disaster preparedness. Research by Tan et al. [24] conducted in China revealed that less than half of the university students had been exposed to disaster rescue skills. A later study in Indonesia by [6] found that the lack of willingness among teachers to motivate students to study resulted in the schools not teaching DRR courses that would stimulate a low level of disaster preparedness. A survey by Tan et al. [24], conducted to assess the knowledge of primary rescue skills used in emergencies, suggested that cardiopulmonary resuscitation (CPR) was the least desired and the most studied and practiced skill.

2.3. Importance of disaster risk reduction education and skills

The risks of disasters can be significantly reduced when students have the appropriate hazard awareness, education, and rescue skills [25, 26] that they can put into practice during an actual disaster [27,28]. Survival techniques should be taught or overseen by experts, as it is the most difficult part of disaster education and involves a certain amount of practical training [24]. Universities that have medical and/or nursing departments have an advantage, as they have professionals and equipment that can train the students and effectively implement disaster-related courses [29]. This preparedness helps the students by i) preparing them mentally for the occurrence of a disaster, ii) encouraging them to collaborate with emergency management practitioners, iii) increasing their confidence in handling emergencies, iv) providing them with an understanding of the physical and psychological consequences of disasters, and v) creating an awareness of the importance of personal safety [30]. The quality of DRR preparedness depends on the will and creativity of the teacher [31], and cooperation and consultation among teachers can help to successfully implement DRR education. Teachers who are more experienced in disaster education should be appreciated and treated as role models to encourage other teachers to follow their examples [32].

2.4. Challenges to developing and delivering disaster preparedness courses

Previous studies have shown that developing comprehensive safety plans and effective communication between the different stakeholders in a university is difficult [33]. Implementation of a disaster preparedness course requires a collaborative effort on the part of all of the stakeholders, and the executive staff of the university should partner up with the local emergency management agencies to improve disaster preparedness for both students and local communities [34]. The government agencies' main course of action is usually to meet with various stakeholder groups and assist them with rehabilitation [6]. They predominantly focus on the community in general, and the university students are not given much consideration. Disaster response and recovery programs have been successful only in agencies and educational institutions that have strengthened their relationships with the community and provided practical training [33].

Developing practical DRR courses also depends on the financial capacity of the schools [6]. Lack of knowledge is not the main problem; knowing how to circumvent the obstacles to teaching and learning the appropriate skills is. According to Amri et al. [31] a large proportion of teachers believe that training will make it easy for them to provide DRR education in the classroom. Furthermore, [6] stated that combining science and technology with practical training will help students learn important disaster-related skills that have the potential to reduce disaster risk-related losses. Spiekermann et al. [35] summed it up well by stating that the two major difficulties that are faced by those dealing with disasters are the lack of resources to put knowledge into practice, and the dearth of a continuous source of knowledge that enables policymakers to make effective decisions.

The literature review revealed how little information is available about students' preparedness and the difficulties they face during disasters. Hence there is a lot of evidence to substantiate the need for including disaster management courses at the university level. As students become acquainted with the dos and don'ts of actions to be taken in the midst of or at the end of a natural calamity, they feel more confident in their own ability to cope and can help prepare their family members and friends address the challenges effectively. It is, therefore, important that the level of awareness among students in university be analyzed and tools be developed to help them plan appropriate post-disaster management activities.

3. Research methodology

The four-step methodology depicted in Figure 1 was undertaken to fulfill the objectives of this research. The first step consisted of an extensive literature review of research papers and journal articles to gain a general idea of the existing knowledge on the following issues: Impacts of disasters on educational institutions, current trends in disaster preparedness education, importance of disaster risk reduction (DRR) education and skills, and challenges to developing and implementing DRR courses. The second step was to develop a survey questionnaire, based on the factors studied in the literature review, to gain knowledge of university students' perceptions of disaster education and university emergency policies. After pilot testing the survey, it was distributed anonymously among students who were above 18 years old. The third step was the analysis of the data. A descriptive analysis of the data, followed by a statistical analysis was conducted. As most of the questions in the survey were 7 point Likert scale type questions, the Kruskal-Wallis test was used to determine and analyze the differences in perception of the students on DRR education and their university's emergency policies, based on their level of education and gender. The same test was used to analyze whether there was a difference in the opinion of students with and without disaster-related education. After all of the input, the results of the statistical test were interpreted.

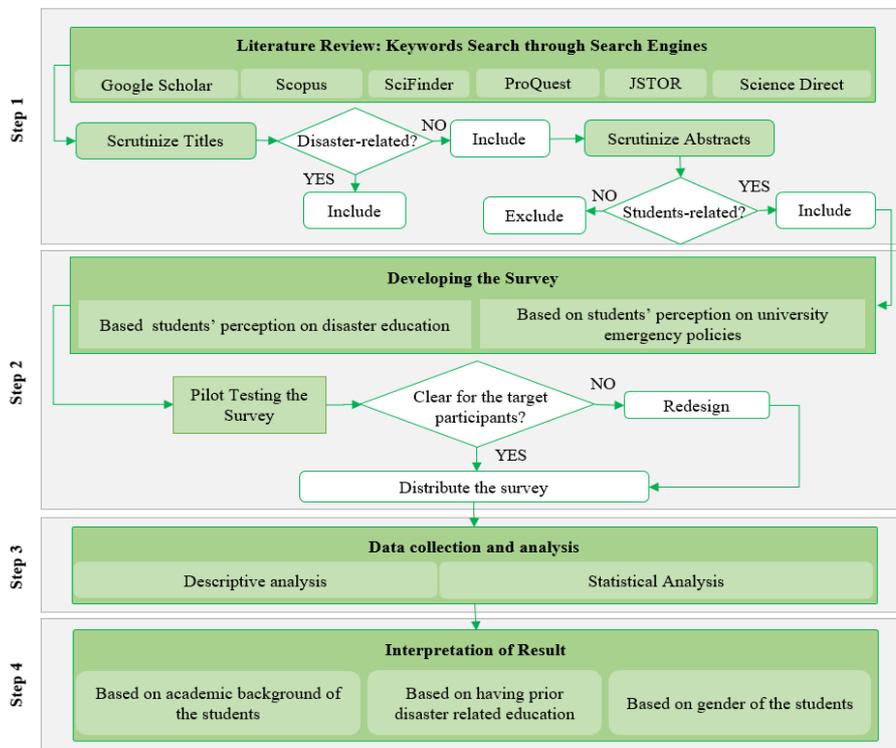


Fig. 1. Research methodology

The Kruskal-Wallis test determines the difference between the actual observed average and the expected average of a data set and is most effective when the data set does not follow a normal distribution. It was selected for this study as it was best suited for the Likert-scale test. The hypothesis developed for this study is shown in Table 1.

Table 1. Hypotheses adopted for this study

Students characteristics	Statistical test	Hypotheses
Graduate and undergraduate students	Kruskal-Wallis test	Null Hypothesis (H ₀): Graduate and undergraduate students have the same perception of DRR education. Alternative Hypothesis (H _a): Graduate and undergraduate students have a different perception of DRR education.
Students with prior DRR education and without prior DRR educations	Kruskal-Wallis test	Null Hypothesis (H ₀): Students with prior DRR education and without prior DRR education have the same perception towards DRR education. Alternative Hypothesis (H _a): Students with prior DRR education and without prior DRR education have different perceptions towards DRR education.
Female students and male students	Kruskal-Wallis test	Null Hypothesis (H ₀): Female and male students have the same perception towards DRR education. Alternative Hypothesis (H _a): Female and male students have different perceptions of DRR education.

The Kruskal-Wallis test uses the equation (1). Here, R represents the rank of the individual group, n_i represents the number of observations in group I, N represent the total number of observations, and a represents the number of groups [36].

$$H = \frac{12}{N(N+1)} \sum_{i=1}^a \frac{R_i^2}{n_i} - 3(N-1) \tag{1}$$

4. Survey development

A structured survey was developed based on the information gained from the literature review about the importance, awareness, and impacts of DRR on students. An online survey was developed, using an online survey assessment tool, "Qualtrics." Figure 2 shows some sample questions that were used in the survey. An invitation email with the details of the study was sent to the students with the help of the faculty, and an electronic informed consent was provided. Students were not compensated for their participation in any way. The survey was developed based on six parameters relating to disaster risk reduction education in universities: (1) demographics, (2) disaster experience, (3) disaster risk reduction education, (4) emergency awareness, (5) emergency drills at universities, and (6) implementation of DRR courses. The survey consisted of 25 multiple choice questions, 19 rating scale questions, and 1 open-ended question.

25) How important is it for the local communities to help universities during emergency situations?							
	Not at all Important	Slightly Important	Somewhat Important	Moderately Important	Very Important	Quite Important	Extremely Important
Importance of local communities to help university	<input type="radio"/>						

43) Do you agree that the education system should make DRR education mandatory?							
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
DRR education should be made mandatory by education system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Fig. 2. Sample questions in the survey

The first section of the survey consisted of demographic questions such as gender, year of birth, major, current year of education, racial or ethnic heritage, mode of transportation for travelling to the university, whether they live off-campus or on-campus, etc. The second section of the survey consisted of questions about the types and number of disasters the participants had been involved in. The third section of the survey was multiple choice questions about the number of disaster-related courses taught in universities and what form of disaster education (practical or theoretical) is better. The fifth section of the survey consisted of rating-scale type questions pertaining to the student's awareness of university procedures and emergency supplies available at the university. The sixth section of the survey consisted of questions about barriers to learning DRR and the importance of local agencies helping universities implement it. All of the rating scale type of questions in the survey were based on the Likert-scale. The population of this study was

students who were older than 18 years. Before the survey was distributed, it was pilot tested to ensure the clarity of the questions.

5. Data collection and analysis

5.1. Descriptive analysis

A total of 111 students from a variety of majors and with different levels of education responded to the survey. Undergraduate students constituted 35 percent of the total, and graduate students constituted 65 percent. The majority of them (74 percent) had not received any education related to disasters, while 26 percent of them had some amount of disaster-related education. A detailed descriptive analysis of the survey participants is shown in Table 2.

Table 2: Descriptive analysis of the student participants in the survey

Demographic Characteristics	Number in Sample	Percentage in Sample	Demographic Characteristics	Number in Sample	Percentage in Sample
Gender			Age Range		
Male	87	78%	Under 25 Years Old	68	61%
Female	24	22%	Between 25 and 29 Years	43	39%
Ethnicity			Above 29Years Old	11	10%
Native American	0	0%	Annual family income		
African American	7	7%	Less than \$15,000	16	16%
American Indian or Alaskan Native	0	0%	\$15,000 to \$30,000	28	28%
Asian	68	65%	\$30,000 to \$60,000	18	18%
Hispanic	12	11%	\$60,000 to \$100,000	28	28%
Native Hawaiian or Pacific Islander	0	0%	More than \$100,000	9	9%
Other	18	17%	Involvement in disaster		
Level of education			Hurricane	6	5%
Freshman	1	1%	Tornadoes	14	13%
Sophomore	6	5%	Flooding	22	20%
Junior	27	24%	Thunderstorm	25	23%
Senior	5	5%	Earthquakes	28	25%
Masters	66	60%	Tsunami	3	3%
Ph.D.	6	5%	None	50	45%
Mode of transportation to university			Involvement in the number of disasters		
Walking	59	53%	0 - 1	69	63%
Personal Vehicle	8	7%	1-2	13	12%
Campus Transit Service	2	2%	2-3	16	15%
Public Transport	42	38%	3-4	3	3%
Time to reach university			4-5	2	2%
Less than 10 Minutes	35	32%	More than 5	7	6%
10 - 20 Minutes	36	32%	Disaster-related courses taken during pre-university education		
20 - 30 Minutes	21	19%	0 - 1	81	74%
30 - 60 Minutes	18	16%	1 – 2	22	20%
More than an Hour	1	1%	2 – 3	4	4%
Student's living in the area			3 – 4	1	1%
Off - Campus	78	70%	4 – 5	0	0%
On - Campus	33	30%	More than 5	1	1%

5.2. Statistical analysis

Table 3 lists the results of the Kruskal Wallis test on the students' perceptions, based on their level of education, disaster-related education, and gender. Based on the P values in Table 3, 5 of the 11 variables were found to be significant for undergraduate and graduate students. For students with and without disaster-related education, 4 variables were found to be significant. Three variables were found to be significant based on gender.

Table 3: P-Values testing the significance of students' perception of the university's emergency policies and disaster risk reduction (DRR) education

#	Variables	P-Values for undergraduate and graduate students	P-Values for students with and without disaster-related education	P-Values for male and female students
1	Curriculum provides psychological first aid training	0.373	0.097**	0.08**
2	University has enough first aid boxes	0.000*	0.710	0.580
3	Importance of local communities to help university	0.344	0.005*	0.173
4	Friends are responsible for students' safety	0.128	0.614	0.062**
5	Parents are responsible for students' safety	0.914	0.053*	0.305
6	University is responsible for students' safety	0.035*	0.677	0.022*
7	Government Agencies are responsible for students' safety	0.003*	0.708	0.120
8	Awareness of the emergency procedures in the university	0.002*	0.532	0.873
9	Awareness of communication system provided by the university during emergency	0.035*	0.905	0.802
10	Importance of local communities on helping the university to implement DRR courses	0.823	0.048*	0.407
11	DRR education should be made mandatory	0.250	0.049*	0.035*

Note: "*" Indicates 95% Level of Confidence and "**" Indicates 90% Level of Confidence

6. Interpretation of the result

6.1. Analysis of undergraduate and graduate students' perception of the university's emergency procedures

From the Kruskal-Wallis test (Table 3) it is evident that graduate students and undergraduate students have different perceptions of the sufficiency of the first aid boxes. They also possess different levels of awareness of the emergency communication and procedures provided by the university. Although they have similar perspectives of the roles of friends and parents in providing safety during a disaster, they have very different perspectives of the roles of universities and government agencies. Both undergraduate and graduate students, however, believe that DRR education should be mandatory in educational institutions.

6.2. Analysis of students' perceptions of disaster-related education: students with and without disaster-related education

The P-values in Table 3 indicate that students who have had DRR education have a different view of adding psychological first aid services to the disaster curriculum than the students who have not had any DRR education. Their perceptions of the roles of their parents in providing safety in the midst of a disaster also differ. All of the students, however, believe that friends, universities, and governmental agencies have similar roles to play in student safety during disasters. Their opinions about the importance of local communities helping universities implement DRR courses also differ according to whether they have had the benefit of prior DRR education, as do their views of mandatory DRR education.

6.3. Analysis of students' perceptions of the disaster-related activities: male and female students

The P-values in Table 3 indicate that male and female students have significantly different opinions about adding psychological first aid to the disaster curriculum. They have similar views of government agencies'

role in their safety during a disaster, but different views of the university's role in their safety and whether DRR education should be mandatory in educational institutions.

7. Proposed framework

Based on the above discussion, a conceptual framework, shown in Figure 3, was developed to understand the characteristics of the students that affect the disaster preparation of an institution. Three characteristics of students were linked with the disaster preparedness factors of an institution: level of education, prior DRR education, and gender. Figure 3 shows that all three characteristics affect their perception of the responsibility of friends, parents, and university and government agencies during a disaster, yet only their level of education affects their awareness of emergency communication and procedures provided by the university while recovering from the disaster. Prior DRR education impacts the perception of the students regarding the importance of local communities helping implement DRR, and both having prior DRR education and the gender of the students affect their opinion as to whether DRR education should be mandatory at educational institutions.

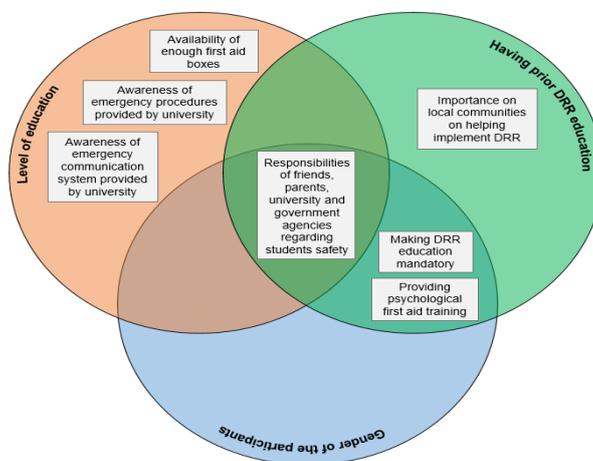


Fig. 3. Conceptual framework linking characteristics of students with factors of DRR education

8. Conclusion

Universities serve as important educational and research centers; hence it is vital that they implement disaster risk reduction education. With that in mind, this research developed a framework to show the relationship of the characteristics of students with different factors of DRR education, and it was found that the characteristics make a notable difference. For example, having had DRR education does not impact the students' awareness of the emergency communication provided by the university, but the level of education does. Irrespective of the level of education, graduate and undergraduate students have similar opinions about whether DRR education should be mandatory; however, students with prior DRR education and male students with or without prior DRR education have a significantly different opinion about mandatory DRR education mandatory than students without DRR education and female students with or without DRR education. The findings of this study will assist both faculty members and other academic staff in updating existing programs, enhancing the disaster preparedness of students based on their characteristics, addressing potentially challenging advancements in knowledge, and reducing costly and deadly damages.

9. References

- [1] Federal Emergency Management Agency. "Guide for developing high-quality emergency operations plans for institutions of higher education". [http://www.fema.gov/media-library-data/20130726-1922-25045-3638/rem_s_ihe_guide. Pdf, 2013.
- [2] Kermanshachi, S., & Rouhanizadeh, B. "Feasibility analysis of post disaster reconstruction alternatives using automated BIM-based construction cost estimation tool". In Proceeding of CSCE 6th International Disaster Mitigation Specialty Conference, Montreal: Canadian Society of Civil Engineering, pp. 13-16. 2018.
- [3] Pamidimukkala A, Kermanshachi S, Safapour E. Challenges in Post-Disaster Housing Reconstruction: Analysis of Urban Vs. Rural Communities". Creative Construction Conference (CCC), 2020
- [4] Nipa T, J., Kermanshachi, S. Identification of the Resilience Dimensions and Determination of their Relationships in Critical Transportation Infrastructures. ASCE Construction Research Congress (CRC), 2019

- [5] L.P. Boustan, M.E. Kahn, P.W. Rhode, M.L. Yanguas. "The effect of natural disasters on economic activity in us counties: A century of data." National Bureau of Economic Research (No. w23410), 2017. <https://doi.org/10.3386/w23410>
- [6] L. Nahayo, L. Li, G. Habiyaemye, M. Richard, V. Mukanyandwi, E. Hakorimana, C. Mupenzi. "Extent of disaster courses delivery for the risk reduction in Rwanda". *International Journal of Disaster Risk Reduction*, 27, pp 127-132, 2018. <https://doi.org/10.1016/j.ijdr.2017.09.046>
- [7] Kermanshachi, S.; Bergstrand, K.; Rouhanizadeh, B. "Identifying, weighting and causality modeling of social and economic barriers to rapid infrastructure recovery from natural disasters: A study of hurricanes Harvey, Irma and Maria". Technical report, 2019.
- [8] Rouhanizadeh, B.; Kermanshachi, S.; Dhamangaonkar, V. "Reconstruction of critical and interdependent infrastructures due to catastrophic natural disasters: lessons learned". ASCE Construction Research Congress, 2019.
- [9] Rouhanizadeh, B.; Kermanshachi, S.; Dhamangaonkar, V. "Identification and categorization of policy and legal barriers to long-term timely post-disaster reconstruction". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, Volume 11 issue 3, 2019. [https://doi.org/10.1061/\(asce\)la.1943-4170.0000307](https://doi.org/10.1061/(asce)la.1943-4170.0000307)
- [10] Rouhanizadeh, B.; Kermanshachi, S. "A Systematic Approach to Analysis and Prioritization of the Socioeconomic Policies and Legal barriers to Rapid Post Disaster Reconstruction". 7th CSE International Construction Specialty Conference (ICSC), 2019
- [11] Rouhanizadeh, B.; Kermanshachi, S. "Gender-based evaluation of physical, social, and economic challenges in natural disasters management". ASCE Construction Research Congress (CRC), 2019
- [12] Rouhanizadeh, B., & Kermanshachi, S. "Investigating the Relationships of Socioeconomic Factors Delaying Post-Disaster Reconstruction". In *Proceedings of ASCE International Conference on Computing in Civil Engineering*, pp. 17-19. 2019. <https://doi.org/10.1061/9780784482445.005>
- [13] Nipa T, J., Kermanshachi, S., Ramaji I, J. Comparative analysis of strengths and limitations of infrastructure resilience measurement methods. 7th CSE International Construction Speciality Conference (ICSC), 2019
- [14] Rouhanizadeh, B.; Kermanshachi, S. "Comparative analysis of public's and decision-maker's perspectives on socioeconomic barriers causing delay in post-disaster recovery processes". ASCE Construction Research Congress (CRC), 2019.
- [15] A. Jaradat, H. Mziu, J. Ibrahim. "Disaster preparedness in universities". *Int J Comput Trends Tech*, 19(1), pp 1-4, 2015.
- [16] R. Hoffmann, R. Muttarak. "Learn from the past, prepare for the future: Impacts of education and experience on disaster preparedness in the Philippines and Thailand". *World Development*, 96, pp 32-51, 2017. <https://doi.org/10.1016/j.worlddev.2017.02.016>
- [17] Nipa T J, Kermanshachi S, Patel R. "Impact of Family Income on Public's Disaster Preparedness and Adoption of DRR Courses". *Creative Construction Conference (CCC)*, 2020
- [18] Patel R, Kermanshachi S, Mostafa N. "A Socioeconomic-based Analysis of Disaster Preparedness, Awareness, and Education". *Creative Construction Conference*, 2020
- [19] A. Tanner, B. Doberstein. "Emergency preparedness amongst university students". *International Journal of Disaster Risk Reduction*, 13, pp 409-413, 2015. <https://doi.org/10.1016/j.ijdr.2015.08.007>
- [20] S. Yusuf, S.S. Susanti. "Disaster preparedness in the red zone schools at 13 years post tsunami 2004". In *IOP Conference Series: Earth and Environmental Science*, Vol. 273, No. 1, p. 012038. IOP Publishing, 2019. <https://doi.org/10.1088/1755-1315/273/1/012038>
- [21] Nipa T J, Kermanshachi S, Patel R, Tafazzoli M. "Disaster Preparedness Education: Construction Curriculum Requirements to Increase Students' Preparedness in Pre-and Post-Disaster Activities". *Associated Schools of Construction (ASC) International Conference*, 2020
- [22] L. Onigbinde, "The impacts of natural disasters on educational attainment: Cross-country evidence from macro data". Master Thesis, College of Arts and Sciences, 2018
- [23] J.P. Mulilis, T.S. Duval, K. Bovalino. "Tornado preparedness of students, nonstudent renters, and nonstudent owners: Issues of PrE theory 1". *Journal of Applied Social Psychology*, 30(6), pp 1310-1329, 2000. <https://doi.org/10.1111/j.1559-1816.2000.tb02522.x>
- [24] Y. Tan, X. Liao, H. Su, C. Li, J. Xiang, Z. Dong. "Disaster preparedness among university students in Guangzhou, China: Assessment of status and demand for disaster education". *Disaster Medicine and Public Health Preparedness*, 11(3), pp 310-317, 2017. <https://doi.org/10.1017/dmp.2016.124>
- [25] Safapour, E., Kermanshachi, S. „Investigation of the Challenges and Their Best Practices for Post-Disaster Reconstruction Safety: Educational Approach for Construction Hazards". *Transportation Research Board 99th Annual Conference*, 2019
- [26] A. Amri. "Challenges in implementing disaster risk reduction education: Views from the frontline in Indonesia". Macquarie University, Sydney, Australia, 2015.
- [27] K. Haynes, T.M. Tanner. "Empowering young people and strengthening resilience: Youth-centred participatory video as a tool for climate change adaptation and disaster risk reduction". *Children's Geographies*, 13(3), pp 357-371, 2015. <https://doi.org/10.1080/14733285.2013.848599>
- [28] J. Whittaker, K. Haynes, J. Handmer, J. McLennan. "Community safety during the 2009 Australian 'Black Saturday' bushfires: an analysis of household preparedness and response". *International Journal of Wildland Fire*, 22(6), pp 841-849, 2013. <https://doi.org/10.1071/WF12010>
- [29] F. Edwards. "Campus roles in emergency management". In: *DRU Workshop 2013 Presentations – Disaster Resistant University Workshop Linking: Mitigation and Resilience*, Paper 6, 2013.
- [30] A. Khorram-Manesh, J. Berlin, L.L. Roseke, J. Aremyr, J. Sörensson, E. Carlström, E.. "Emergency management and preparedness training for youth (EMPTY): the results of the first Swedish pilot study". *Disaster Medicine and Public Health Preparedness*, 12(6), pp 685-688, 2018. <https://doi.org/10.1017.144>
- [31] A. Amri, D. Bird, K. Ronan, K. Haynes, B. Towers, B. "Disaster risk reduction education in Indonesia: challenges and recommendations for scaling up". *Natural Hazards and Earth system sciences*, 2017. <https://doi.org/10.5194/nhess-2015-344>
- [32] V.A. Johnson, K.R. Ronan. "Classroom responses of New Zealand school teachers following the 2011 Christchurch earth- quake". *Nat. Hazards*, 72, pp 1075–1092, 2014. <https://doi.org/10.1007/s11069-014-1053-3>
- [33] M.A. Tkachuck, S.E. Schulenberg, E.C. Lair. "Natural disaster preparedness in college students: Implications for institutions of higher learning". *Journal of American College Health*, 66(4), pp 269-279, 2018. <https://doi.org/10.1080/07448481.2018.1431897>
- [34] S. Goddard, M. Sheppard, K. Thompson, L. Konecny. "Disaster preparedness knowledge". *Beliefs, Risk-Per*, 2018.
- [35] R. Spiekermann, S. Kienberger, J. Norton, F. Briones, J. Weichselgartner. "The Disaster-knowledge matrix–Reframing and evaluating the knowledge challenges in disaster risk reduction". *International Journal of Disaster Risk Reduction*, 13, pp 96-108, 2015. <https://doi.org/10.1016/j.ijdr.2015.05.002>
- [36] D.C. Montgomery, G.C. Runger. "Applied statistics and probability for engineers." (3rd Edition), John Wiley & Sons, 2003.