Volunteering in earthquake disaster programs: Engineering students' perceptions and motivations

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Abstract: A major devastating earthquake is predicted to shake Lebanon in the near future leading to extensive damage and national tragedy. To effectively mitigate the cataclysmic effects of such disaster, effective mitigation and response strategies relying on government resources, community engagement and volunteering programs are essential. The objective of this study is to assess the willingness of engineering college students to serve as volunteers in earthquake volunteer programs initiated and led by universities and to determine their motives behind such engagement. Lebanese senior and graduate engineering students ($n = 332$) were surveyed. The findings revealed a strong tendency of Lebanese engineering students to participate in such volunteer programs, and that learning and altruistic factors are the leading predictors behind participants' motivation. This study emphasizes the role of universities and engineering community in earthquake risk mitigation and response operations in future earthquake disasters.

Keywords: Volunteer programs, Engineering students, Lebanon, Earthquake, Disaster risk mitigation

Introduction

It has been shown from recent earthquake devastations that loss of lives and long term effects can only be effectively reduced through planned response action programs that engage community trained volunteers led by credible organizations. A case study in the Nishi Suma area (Japan) by R. Shaw and K. Goda [1] pointed out that 60 percent of residents were evacuated by their own efforts, and approximately 20 per cent were rescued by neighbor volunteers. This data signifies the importance of community volunteer in the immediate rescue operation. Similar observations were also found after the Marmara earthquake of 1999 in Turkey and the Gujarat earthquake of 2001 in India [2,3]. Moreover, recent natural disasters have confirmed the limits of immediate governmental response and the critical needs of community volunteers to respond quickly until official emergency systems are organized, mobilized and functional [4]. While the government's response to the basic needs of victims is characterized by limited personnel, volunteers are capable of flexibly responding, in large numbers, to the different needs of victims and their involvement becomes an absolute necessity [5].

Disaster volunteers are generally classified according to their expertise, as either specialist disaster volunteers who possess professional skills, or non-professional disaster volunteers who are average citizens with no particular professional skills and who implement support activities in the disaster areas. The majority of non-professional earthquake disaster volunteers have not participated in organized disaster prevention drills, received education during the pre-disaster stage, or have previous experience of volunteering in disaster areas [6].

This study intends to identify the motives behind the willingness of engineering students to participate in earthquake volunteer programs. It also calls for the need to transform capable and motivated Lebanese students into semi professional volunteers through the implementation of specialized volunteering programs led by universities across the country.

Purpose of the study

Due to the innovative role of engineering students in the society, and their future leadership positions in advancing policies and implementing strategies, this study seeks to investigate the predictor factors for their willingness to assume responsibilities during earthquake disasters. Moreover, this research explores these students' incentives for serving as volunteers to mitigate earthquake risk and to engage in immediate response action considering Lebanon as a case study.

Very little has been written on the motivations of engineering college students to volunteer for earthquake disaster risk reduction programs. Although volunteering for such a cause seems appealing and beneficial to students' learning, no attempt has been made to assess the Lebanese college students' willingness to participate and their readiness to engage in volunteering programs for mitigation of earthquake disaster. Using a case study method, this research will assess the influential factors that motivate senior and graduate engineering students in Lebanon to engage in such a mission during Spring 2013. This investigation brings insights into the current situation as well as contributes to the literature by providing a deeper understanding of how and why engineering students develop an interest or a lack of interest in natural disaster volunteerism. Also, the findings of this research will act as a foundation for the development of future student volunteering program in Lebanon. This research attempts to answer the following question: What are the motives behind the willingness of engineering students' participation in earthquake disaster risk reduction volunteering programs?

Earthquake Hazard in Lebanon

The seismic activity in Lebanon has been observed and documented for more than 2000 years where strong earthquakes have ruined many cities and towns transforming thousands of buildings into rubbles while leaving hundreds of thousands of casualties in the Eastern Mediterranean region. The seismic activities in Lebanon have triggered many earthquakes during the past 2000 years. However, the most notable and prominent ones were the earthquakes of 551 A.D., 1202 A.D and 1759 A.D. The moment magnitudes of these earthquakes have been estimated to reach 7.5 while causing tremendous destruction in the coastal cities of Beirut, Tripoli, Jubail, Saida, and Tyre as well as in the ancient and the city of Baalbek.

Geologists have shown that Lebanon is covered by seismic fault systems; the Dead Sea Transform (DST) is extremely important since it has been responsible for the bulk of seismic activity in the Eastern Mediterranean. It has been originated from the interactions and collisions of the African and the Arabian plates. It is the deepest and most deadly fault system in the Eastern Mediterranean region, stretching from Ethiopia through Aqaba, Jordan, Lebanon, and Syria to continue north to join the East Anatolian fault in Turkey. Such fault system and its ramifications has proven to be the origin of several catastrophic and deadly earthquakes throughout the history of Lebanon [7].

The Mount Lebanon Thrust (MLT) is another active major fault recently discovered along the coast between Beirut and Enfeh [8]. The disastrous 7.5 moment magnitude earthquake occurred on July 9, 551 AD that destroyed most of the coastal cities of Lebanon occurred on this fault. Scientists have suggested that the return period for similar earthquakes on the same fault is

between 1500 and 1750 years. The earthquake of 20 May 1202 AD which caused severe destruction in Beirut and Damascus was estimated to have an equivalent moment magnitude of around 7.5 [8, 9]. The year 1759 AD witnessed two significant seismic events on 30 October and 25 November. The equivalent moment magnitudes of these events were approximately 6.7 and 7.4 respectively [9].

The seismic hazard evaluation of Lebanon has been established taking in consideration seismic activity within the country and contributing seismic sources in Israel, Syria and Cyprus. It has previously been estimated that peak ground acceleration (PGA) of the Lebanese territories varies between 0.2 g in the eastern part of the country to 0.30 g in the western part near the coastal areas [10]. However, due to the recently discovered offshore MLT fault system, it is recommended that a PGA of 0.25 g to be used for most of Lebanon except for the coastal area, where most of Lebanon's population, infrastructure, lifeline facilities and capital investments are located, and the area around the central part of the DST fault, where a PGA of 0.3 g is recommended [10]. This increase in seismic hazard implies that essential facilities such as hospitals, schools, transportation systems and lifeline facilities located in major cities along the coastal region should take precautionary measures by adopting disaster risk reduction strategies that include the development and implementation of a mitigation plan that prioritises the retrofitting of essential facilities to avoid a future disaster. With all the documented evidence, Lebanon still lacks the needed infrastructure to resist such a disaster, and there is limited disaster planning at both the government and local community levels. In fact, the country lacks policies and institutions for earthquake disaster prevention and mitigation [11].

Theoretical framework

Researchers have investigated the factors that investigate the relationship between attitudes and behavior that may lead to engage in volunteer work [12, 13]. Because volunteering is a personal decision that involves a particular attitude toward the interaction with the community, the Theory of Reasoned Action (TRA) was chosen for this study in order to understand how participants perceive volunteering in an earthquake disaster program. TRA helps characterizing human behavior as intentional and rational. This model provides a social psychological framework proved to be useful in explaining several types of behavior [14, 15]. It suggests that someone's Behavioral Intention depends on Attitude and Subjective Norm as shown in figure 1.
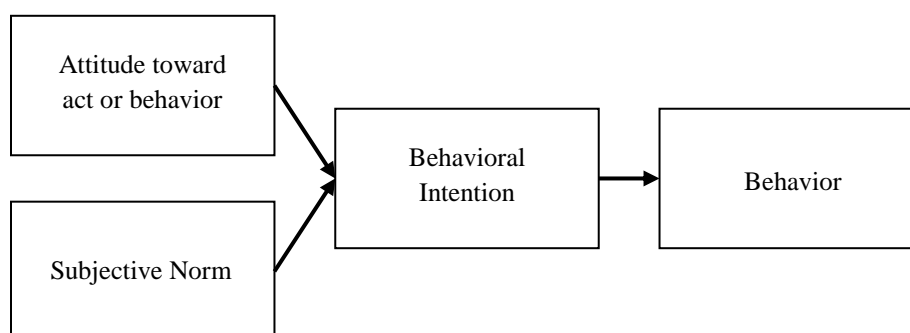
Figure 1: The Theory of Reasoned Action,

The attitude toward the behavior is someone's overall evaluation of the behavior including the beliefs about the consequences of this behavior and the corresponding positive/negative judgment about each feature of this behavior. The subjective norm is the individual's own estimate of the social pressure to perform/not perform this behavior, or in other words the influence of people in one's social environment. This framework will help predicting the intention for joining earthquake volunteering program. Constructs of the TRA model have been already measured and validated in several previous studies related to volunteering activities [16].

Because choosing to volunteer in earthquake disaster rescue programs represents a great deal of challenge and responsibility, the focus of this study is to identify and discuss these factors in terms of attitudes and the subjective norm by using a Likert-scaled survey. This survey will help to better understand what and how "important" these factors are to college students as part of their decision-making process.

Methodology

For the purpose of this research, senior and graduate engineering students at the public Lebanese University (LU) and the American University of Beirut (AUB) were targeted. As of Spring 2013, the total enrollment of senior and graduate engineering students in both institutions was 1241. The sample was intended to ensure the participation of students living in the most urbanized, highly populated and seismically exposed cities in Lebanon. Professors from different engineering specializations in the targeted universities were contacted and asked to distribute the survey to their students. The survey invites students to voluntary participate while ensuring them of complete anonymity. The survey was randomly distributed and data collection ended when reaching 25% of the targeted population [17].

The survey was based on the volunteer functions inventory [18] and included three sections: the first section gathered demographic information about participants, the second section investigated students' awareness of earthquake disaster and their willingness to join an earthquake volunteering program, and the third section asked participants to rate 19 items on a scale of 5 that reflect their attitudes and subjective norm toward volunteering in an earthquake risk reduction program based on the theoretical framework (TRA). Items were designed to be aligned with the volunteer functions inventory [18]:

1. *Values* that refers to contributions to the society and helping people who are in need. This function was also associated to altruism [19]
2. *Understanding* in which volunteerism gives an opportunity to learn, understand, practice, and apply skills. This function is related to the knowledge function.
3. *Career* that serves to increase one's job opportunities and consequently improve his/her career.
4. *Social* in which an individual volunteers due to social pressure or to satisfy people in one's social environment.
5. *Protective* where volunteering is to reduce concerns about those people who are less fortunate.

6. E*steem* o*r enhancement* where volunteerism serves to increase self-confidence.

The 19 Likert-scaled items related to the subjective norm and attitudes revealed a reliability of 0.90. Descriptive statistics were calculated to obtain the measures of central tendency as well as the measures of variability of each of the identified items.

Case Study

Participants (*n*=332) were almost equally distributed between the Lebanese public university (51%) and private universities (49%); mostly male (66%) with only (34%) female. The sample was distributed among the most highly urbanized region as follow: North Lebanon (29%), Mount Lebanon (37%) and Beirut (34%).

Findings

Participants were asked to rate on a scale of 5 their awareness of future earthquake and their interest in joining an earthquake volunteering program as shown in Table 1.

Question	Options	(*n*=332)
I am aware of the risk of future earthquakes in Lebanon	Strongly disagree/Disagree	15%
	Neutral	19%
	Agree/ Strongly agree	66%
I am aware of the important need of volunteering to minimize earthquake risk	Strongly disagree/Disagree	16%
	Neutral	21%
	Agree/ Strongly agree	63%
I am interested in joining an earthquake volunteering program led by the university	Strongly disagree/Disagree	12%
	Neutral	27%
	Agree/ Strongly agree	61%
I am interested in joining an earthquake volunteering program led by the government	Strongly disagree/Disagree	26%
	Neutral	40%
	Agree/ Strongly agree	34%

Table 1: Participants' awareness and interest in joining an earthquake volunteering program

An exploratory Factor Analysis (EFA) was employed in order to determine which of the 19 items formed related subsets. EFA combines into factors variables that are correlated with one another but largely independent of other subsets of item [20, 21]. This method was used as an expedient way to identify a smaller number of constructs (subsets) that represent the Likert-type items. As a means to form the potential factors, EFA was applied with principal components extraction, eigenvalues greater than 1.00, and absolute value more than .40 [22, 23]. Results of Kaiser-Meyer-Olkin (KMO) measure of sampling for students and engineers samples equal to .823, and Bartlett's test (p<.0001) showed that using FA is appropriate for this study [24].

The EFA with the principal components extraction yielded five factors accounting for 62.28% of the total variance. Table 2 shows the rotated factor loadings, which are the correlations between the variable and the factor. The sizes of the loadings reflect the extent of relationship between each variable and each factor. The higher the factor loading, the more the particular item contributes to the given factor. For items that were loaded under two factors, only the highest loading was retained. Factor1 reported a variance ($\sigma^2 = 27.44\%$), factor2 ($\sigma^2 = 11.98\%$), factor3 ($\sigma^2 = 9.87\%$), factor4 ($\sigma^2 = 8.16\%$) and factor 5 ($\sigma^2 = 4.83\%$).

Items for attitude and subjective norms	Component				
	Learning attitude	Altruism attitude	Extrinsic attitude	Social attitude	Subjective norm
It allows me to gain new perspectives on things	.722				
It allows me to explore different career interest	.703				
It helps me learn to deal with people from different background	.656				
It helps me learn something new	.583				
I feel compassionate toward people in need		.847			
I am concerned about those less fortunate than myself		.839			
It is an opportunity to make a difference in the lives of others		.741		.	
I will be rewarded by GOD		.439			
My love for my country motivates me to volunteer for such a cause		.428			
It helps me getting a better professional position or job			.638		
It is good for my resume (CV)			.517		
I will be liked by others				.801	
I will be remembered as a hero				.747	
It makes me feel more important in the society				.717	
It makes me feel better about myself				.514	
It will introduce me to new friends				.505	
My friends motivate me to volunteer for such a cause					.860
My parents motivate me to volunteer for such a cause					.825
My university/professors motivate me to volunteer for such a cause					.748

Table2: Rotated factor matrix with extraction method: principal component. Rotation method: Varimax with Kaiser Normalization.

After evaluation of the items loaded under each factor, descriptive names were generated. Factor1 was labeled Learning Attitude, factor2 was labeled Altruistic attitude, factor3 was labeled Extrinsic attitude, factor4 was labeled Social Attitude, and factor5 was labeled Subjective norm. Four new variables were computed based on the mean of the items falling under each factor. In order to obtain the most important factor, one-way repeated measures ANOVA was applied on the four variables for each sample. Repeated measures ANOVA indicated significant differences among the four factor scores, $(F(4, 1324) = 463.448, p < .000)$. The learning attitude was shown as the most important for participants with a mean of $(\mu=4.35)$ followed by the altruism attitude $(\mu= 4.01)$, the extrinsic attitude $(\mu= 2.89)$, the social attitude $(\mu=2.77)$ and the subjective norm $(\mu= 2.42)$. The Post Hoc tests using Bonferroni technique indicated significance $(p<.0001)$ except between the extrinsic and social attitudes which have close values.
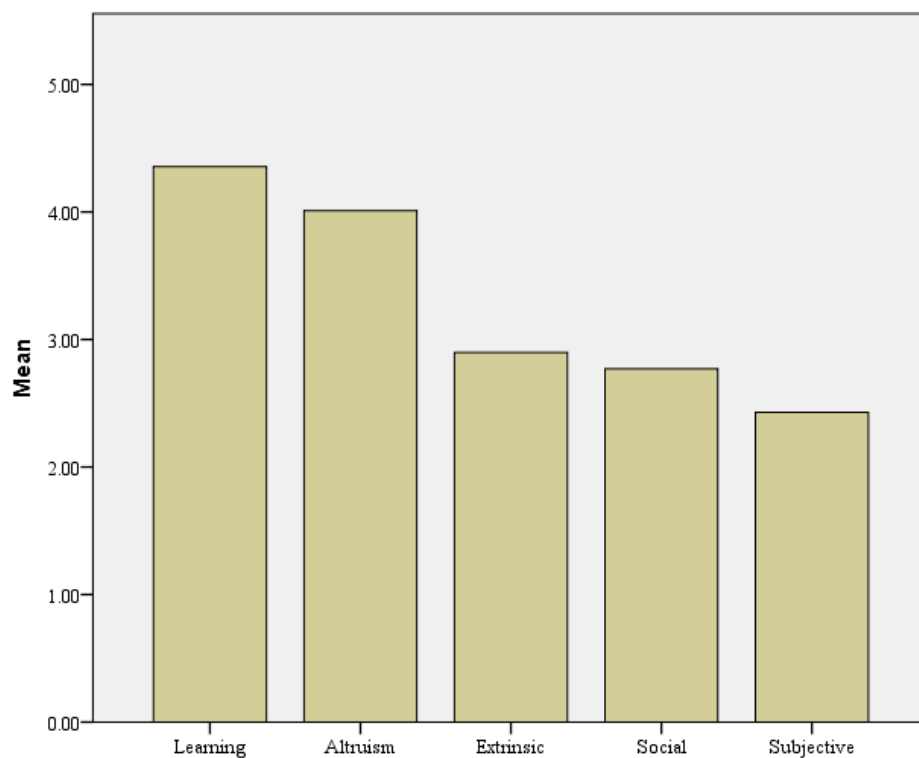

Figure1: Comparing the five types of motives to engage in earthquake disaster program

Discussion

Although the engineering programs in Lebanon do not cover earthquake risk education, the findings revealed that almost the two third (66%) of the respondents are aware of the risk of future earthquake in Lebanon while 19% are neutral and the remaining 15% are not aware. This implicates that engineering students have learned about such hazard from external sources. Also, sixty three percent of respondents are aware of the important need of volunteering to minimize earthquake risk. This reflects the level of responsibility that engineering students have toward earthquake disaster mitigation.

When asked about their willingness to join an earthquake volunteering program led by the university, the majority of participants (61%) showed their interest in such activity. However, the number of participants was sharply declined to (34%) when the program is led by the government. This result reflects that Lebanese students tend to trust the academic institutions more than the government agencies in leading volunteering programs. This is probably due to the failure of government agencies in previous responses to emergency crises such as war refugees, wild fires and building collapse. Previous crises situations in Lebanon have often led to delayed action, chaos, confusion, frustration during operational activities among emergency personnel and dissatisfaction in response outcomes. For example, the recent terrorist attacks[25, 26] of the three car bombs in August 2013, the handling of the raging fire in the north[27], the collapse of the seven storey-apartment building in the Beirut neighbourhood of Fassouh in January 2012 that killed 27 people [28], the failure of the Higher Relief Council to provide the minimum level of assistance and relief aids to the displaced after 2006 war [29] all are evidence for such ineffective response operation that led the public sceptical about government effectiveness in future response to large-scale earthquake disaster.

The main purpose of this study was to investigate the engineering students' motives behind joining an earthquake volunteering program. Participants were asked to rate 19 items that reflects their attitudes and subjective norms. The findings showed that the learning and altruism factors were the highest motivators toward such engagement followed by the extrinsic, social and subjective factors. These findings confirm previous research studies related to volunteerism. As such, Gidron [30] showed that high school and college students perceive volunteerism as an opportunity to learn and as a self-development experience. Within the same inference, the "*understanding*" function which gives the opportunity to learn, to understand and to practice was found as one of the essential functions of volunteerism [18]. Also, Clary et al. [18] showed that the "values" function which was associated with altruism referring to the welfare of others and contributions to the community is essential to volunteerism. Moreover, Anderson and Moore (1978) provided empirical evidence that over 70% of the respondents perceive helping others as a motive for volunteerism.

The findings of this piece of research added an important aspect to the literature in the volunteerism filed. It showed five factors that motivate engineering college students to volunteer in an earthquake while revealing the importance of the learning and altruism factors as being the highest valued by participants. These students are eager to learn from such volunteering activity while helping their community and society. The subjective norms factor appears to be the lowest rated compared to the others. This implies that parents, friends and universities do not have big impact on these students' enthusiasm. The reason behind such finding is most probably due to lack of awareness among parents, friends and university regarding the danger and risk of earthquakes.

Conclusion

The initiation of volunteer programs led by Lebanese universities is essential for effective earthquake disaster preparedness and response. Such initiative is particularly important because it enhances the public awareness about seismic risk. In addition, it can support search and rescue operation by providing specialized task teams with a wide range of skills leading to a greater

chance of saving lives and providing immediate support to earthquake victims. Certainly, such affiliated volunteer response would reduce the suffering and losses that occur during and after earthquake disasters. At the end, engaging engineering students in disaster volunteer preparedness and response programs will enrich their experience and prepare them for the challenges of tomorrow. Also, such programs advance and strengthen the collaboration between universities and their communities leading to improvement of the overall resilience of a country, to prompt response and speedy recovery.

Universities in an earthquake prone country should encourage the implementation of volunteer programs in which interested students can be trained for specific tasks and particular roles. It is important to realize that heroic acts alone will not yield the desirable outcomes unless it is accompanied by knowledge, training and strict affiliation. Also, universities should provide students with incentives to become part of their volunteering efforts and to initiate and sponsor volunteer fairs to recruit more students for such service. Moreover, the spirit of volunteerism should become part of the global educational system in academic institutions leading to transformational experiences that educate and develop leaders for better earthquake resilient communities and for implementation of earthquake disaster risk reduction strategies.
This study explicitly reveals that engineering students in Lebanon are highly motivated to take part in such organized programs. It showed an existing intrinsic aspiration behind the willingness of the engineering student engagement in volunteering program for earthquake disaster risk reduction and mainly learning and altruism. Thus, it is hoped that the outcomes of this study will motivate university administrators and engineering educational leaders to take parts in the mitigation of earthquake disasters and consequently to minimize their destructive potentials.

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