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Risk Communication Effectiveness and Earthquake Preparedness of Students at the University of Mindanao, Philippines

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An earthquake is a natural disaster that has been part of history, causing catastrophic events that lead to social and economic losses. As a result, there is a pressing need for a change toward earthquake readiness, with earthquake preparedness playing a significant role in fostering this study. Despite the significant role of earthquake preparedness in lessening the impact of this natural catastrophe, challenges are present that disable the people and the concerned agencies from entirely benefiting from its implication. The extent of each component is examined and correlated in the current study on teacher education students; level of risk communication effectiveness and level of earthquake preparedness. To achieve the study's objectives, descriptive correlation analysis was utilized. Generated 330 University of Mindanao-Main teacher education students as respondents and used convenience sampling methods to gather data. The findings revealed a statistically significant relationship between risk communication effectiveness and earthquake preparedness.

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Furthermore, the effectiveness of risk communication is frequently observed by the students and the students' earthquake preparedness; both variables showed a High overall mean. Consequently, the research is significant to future educators and individuals as it will equip them with the necessary skills and resources to prepare for an earthquake and communicate risk information within and outside the institution. The institution, concerned agencies, and countries with similar experiences and challenges will also benefit by strengthening and improving risk communication systems and earthquake preparedness measures.

Keywords: Disaster readiness; earthquake preparedness; risk communication effectiveness; education; teacher education students; Philippines.

1. INTRODUCTION

As the frequency of earthquake occurrences in the country increases, the people's preparedness is challenged. Devastating magnitudes after magnitude resulted in damage to properties, loss of livelihood, and loss of life. As a result, there is an emphasis on the country's earthquake risk reduction that mainly utilizes preparedness to lessen the devastating effects of an earthquake. However, the people remain defenseless from this disaster. Disaster plans for earthquakes need more practice drills and the application of mitigation measures. Government units have decreased information management and collaboration between stakeholders, and mitigation and recovery efforts could have been better. Despite the awareness of these problems, no efforts have been adequate to tackle the issue and prepare the population as much as possible [1].

Enhanced earthquake preparedness is crucial to reduce the risks of earthquakes. Preparedness is constantly planning, monitoring, providing resources, communicating, and taking proper action. Experts say that being prepared during a disaster plays a vital role in ensuring safety. Knowing how to handle such situations accurately and appropriately is crucial to lessen the impact of earthquakes. Recent studies indicate that an individual's knowledge and perception of earthquakes have significantly affected their actions. Furthermore, systematic measures to examine and manage disasters can lessen the negative impacts [2-3].

Communication is essential in managing disasters to influence public decision-making and ensure appropriate actions that lead to the safety of the public and the reduction of risks. Risk communication has been crucial to emergency mitigation, response, and preparedness as it helps individuals and agencies make the correct judgments during a disaster like an earthquake. The Protection Action Decision Model Theory (PADM) ensures the development of a practical and functional relationship between individuals and information providers to guide people's protective action implementation and preparedness. Consequently, risk communication's primary purpose is to improve the quality of decisions and actions of every individual in the event of a disaster to increase safety and reduce risks [4-7].

A study on senior high school students' preparedness and awareness for earthquakes was conducted in Misamis Oriental, which showed that more than half of the respondents are aware of an earthquake but are not prepared if an earthquake occurs [8]. Moreover, according to [9,10], the preparedness for earthquakes shows that the respondents have high knowledge regarding earthquakes but low behaviour toward earthquakes. Consequently, we can observe that despite being aware and having enough information about earthquakes, the behaviour or application of this information is inadequate.

A local study was also conducted about risk communication effectiveness during floods that focused on analyzing relevant data from different Davao City risk reduction agencies through interviews. Furthermore, results show that Davao City's communication system is a top-down communication system, meaning there is little to no interaction between the people and the sources of information. Given the number of times the city has experienced a flood and suffered economic and life casualties, it can be implied that people in Davao City may not well equip with the knowledge and skills needed to reduce the risks of floods [11]. These studies measure risk communication effectiveness in different contexts and have only focused on these variables. However, it can be observed from the studies mentioned that a person's capacity to act and respond is influenced by how

well risks are communicated before, during, and after a crisis. Communicating risks plays a crucial role in individuals' changing behavior that would help them prepare and be equipped before, during, and after earthquakes.

There were several studies conducted outside the campus about earthquake preparedness. However, no studies locally in the Davao region involving risk communication effectiveness on earthquake preparedness, particularly at the University of Mindanao. The researcher would want to determine a student's readiness when an earthquake occurs. Communication is one effective technique to prevent and lessen earthquake damage. Risk communication manages to Anotify the general public about the implications of an incident and the severity of earthquakes, and how decisions may impact students' preparedness [12]. This study explored students' risk communication effectiveness and how it helped them prepare for an earthquake. The research served as the basis for conducting the study, guiding how they managed themselves when earthquakes occurred.

This study is significant to countries that share the same challenges regarding earthquake preparedness and risk communication and uses the study to strengthen methods in combating the challenges of earthquake preparedness. Moreover, this study will present a different perspective regarding this problem that may contribute to the efforts of global institutions to provide comprehensive and effective action towards earthquake disasters using effective risk communication.

Consequently, this study will help students be prepared for and effectively contribute to lessening the risks and ensuring effective communication between the parties involved. Moreover, future teachers will benefit from this as this study will contribute to their field by making informed decisions to prepare for earthquake disasters and active risk communication. Furthermore, educational institutions will benefit from this study as they are crucial in preparing students for disaster preparedness and dissemination of risks. As well as several government agencies, including the Philippine Institute of Volcanology and Seismology (PHILVOCS), the Philippine National Disaster Risk Reduction and Management Council (NDRRMC), and other humanitarian organizations contribute and provide recovery services to individuals and the community when earthquakes occur [13].

2. MATERIALS AND METHODS

2.1 Respondents

The respondents of this study will consist of education students at the University of Mindanao (S. Y. 2022-2023). The computed sample size of the researchers is 330 participants using Raosoft Calculation. Due to time constraints and a need for more resources for data collection, the researchers utilized the convenience sampling method. It is a practical and viable method of sampling used in research that looks for possible correlations between variables [14]. The study is limited to those who are officially enrolled students of the current semester and courses/majors under the College of Teacher Education. Students that are not enrolled in the current semester and other colleges/programs are excluded from this study.

2.2 Research Instruments

In gathering the data, the researcher adopted two survey questionnaires as instruments to fit the specific objectives of this study. Mainly the Risk Communication and Community Engagement Tool (RCCET) were adapted from WHO and modified from [15]. and Earthquake Readiness Index Tool (ERI) from [16]. These questionnaires are used as an online survey created using Google Forms and printed forms for a face-to-face survey. To improve the reliability of these instruments, the contents were validated thoroughly by experts, and they went through a pilot test and got a Cronbach's alpha score of .887 for the RCCET and .945 for the ERI. Both reliability coefficients are accepted and have relatively high internal consistency [17]. The Likert scale was used in this study to aid the researchers in determining the relationship between the University of Mindanao students' earthquake preparedness and risk communication effectiveness.

The following represents the value range of Risk Communication Effectiveness based on the Likert scale interpretation. A score value within the range mean of 4.20 – 5.00 is *Very High*, indicating that effective risk communication is observed at all times; 3.40 – 4.19 *High* means that effective risk communication is always observed; 2.60 – 3.39 *Neutral* means that effective risk communication is often observed;

1.80 - 2.59 *Low* means that effective risk communication is sometimes not observed; and 1.00 – 1.79 *Very Low* means that effective risk communication is not observed at all times.

The following represents the value range of Earthquake Preparedness based on the Likert scale interpretation. A score value within the range mean of 4.20 – 5.00 is *Very High,* which means that earthquake preparedness is observed at all times; 3.40 – 4.19, *High* indicates that earthquake preparedness is always observed; 2.60 – 3.39, *Neutral* means that earthquake preparedness is rarely observed; 1.80 – 2.59, *Low* means that earthquake preparedness level is rarely not observed; and 1.00 – 1.79, *Very Low* means that earthquake preparedness is not observed at all times.

2.3 Design and Procedure

This paper utilized a quantitative research design, specifically descriptive correlational analysis, to analyze how the independent and dependent variables relate. This methodology uses numerical data to examine the relationship between two variables [18]. The researchers utilized this method because it best suits this study to determine if risk communication effectiveness significantly affects earthquake preparedness. The quantitative research method generates numerical data for a better understanding through survey questionnaires. It seeks to establish a causal relationship between two or more variables, using statistical methods to test the strength and significance of the relationship between the two variables.

After selecting the sample size, the researchers followed four data-gathering steps. First, the researchers sent a consent letter to conduct a study regarding the students' risk communication effectiveness and earthquake preparedness. Second, right after the approval, the researchers administered the survey questionnaires to the respondents following the school's terms and regulations and the respondents' privacy via online and face-to-face surveys. Next, after collecting the data from the online and face-to-face survey, it was tabulated by the assigned statistician. Lastly, after the tabulation of the data, it was analyzed and interpreted by the statistician, and the researchers developed the conclusion and recommendation of the study.

The researchers utilized different statistical tools in interpreting and analyzing the gathered data. Namely, to determine the risk communication effectiveness and earthquake preparedness. Consequently, the Pearson Correlation Coefficient (r) helps the researchers to measure the relationship between risk communication effectiveness and earthquake preparedness. Furthermore, according to [19] stated that, Correlation coefficients quantify the degree and direction of a relationship between variables.

3. RESULTS AND DISCUSSION

3.1 Level of Risk Communication Effectiveness

Table 1 shows the level of risk communication effectiveness by the college of teacher education students through the following indicators: Trusted Source Information, Type of Received Information, and Satisfaction. The overall mean of the effectiveness of risk communication among students is 4.33 or *Very High*, with an SD value of 0.60, which indicates that effective risk communication is observed at all times. Furthermore, among the indicators, Typed of Received Information has the highest mean of 4.45 with an SD value of 0.60, interpreted as Very High, indicating that effective risk communication is observed at all times. On the other hand, Satisfaction has the lowest mean value of 4.11 with a standard deviation of 0.63, which is *High*, signifying that effective risk communication is always observed.

The study revealed that the effectiveness of risk communication among the College of Teacher Education students at the University of Mindanao is very high. With that, the students and relevant agencies observe and apply the overall dissemination of risk in terms of the information they receive, the source of information, and their satisfaction with the data. Moreover, the results showed that the kind of information the students received regarding earthquakes had the highest mean among all the indicators. This indicates that the information received by the students was precise, accurate, and relevant, which helps people make proper decisions amidst complex situations such as earthquakes [20].

Furthermore, the type of information received got the highest mean. This covers earthquake information that must be factual, scientific-based, and without falsification, biases, and non-expert perception to ensure appropriate judgments and avoid economic, emotional, and physical anxieties [21]. Disasters demand strengthened

Table 1. Level of risk communication effectiveness of college of teacher education students

Indicator	Mean	SD
Trusted Source of Information	4.42	0.58
Type of Received Information	4.45	0.59
Satisfaction	4.11	0.63
Overall	**4.32**	**0.60**

Table 2. Level of earthquake preparedness of college of teacher education students

Indicators	Mean	SD
Emergency Needs	3.57	.88
Personal Safety	4.07	.65
Outdoor Safety	4.00	.78
Indoor Safety	4.06	.74
Structural Safety	3.83	1.01
Overall	**3.91**	**0.14**

Table 3. Correlation of risk communication effectiveness and earthquake preparedness

	Earthquake Preparedness					
Risk Communication	**Emergency Needs**	**Personal Safety**	**Outdoor Safety**	**Indoor Safety**	**Structural Safety**	**Overall**
Trusted Source Information	.300*	.426*	.392*	.395*	.378*	.395*
Type of Information Received	.218*	.375*	.416*	.384*	.295*	.395*
Satisfaction	.340*	.375*	.379*	.339*	.302*	.395*
Overall	.286*	.392	.396*	.373*	.326*	.546*

**p<0.05*

and effective communication between the people and the authorities. A study conducted in Beijing, China, supports the current research wherein it illuminates the influences of information comprehension that contribute to reducing the vulnerability of individuals and society and improving the management of communication and information of disasters.

Meanwhile, the results showed that the satisfaction in risk communication of related agencies got the lowest mean among all indicators of risk communication. Governments, the public and private sectors, organizations, institutions, communities, and individuals need to be engaged, and individuals also need to take action to mitigate damage and prepare themselves. Each stakeholder is critical in disseminating risk information to reduce injuries and mortality caused by earthquakes [22]. A study conducted in Turkey supports the importance of satisfaction in the information given by the parties involved in risk communication. It indicates that the encouraging results regarding the campaigns and efforts by the authorities in communicating risks have ensured that the citizens are well-informed, knows how to manage misinformation and make sound judgments regarding the crisis [23].

The level of risk communication effectiveness by the College of teacher education students is very high. This result affirms the study conducted in Bangladesh regarding earthquake risk communication and risk reduction [24], stating the use of different channels and an ongoing and consistent presence of experts ensures effective risk communication. Furthermore, the inclusion of the whole community along with related agencies in disseminating information regarding the disaster is crucial in ensuring sound judgment before, during, and after the disaster. The effectiveness of risk communication and campaigns to promote is necessary to ensure the safety of the people from earthquakes.

3.2 Level of Earthquake Preparedness

Table 2 shows the level of earthquake preparedness by the College of Teacher Education students through the following indicators: Emergency Needs, Personal Safety, Outdoor Safety, Indoor Safety, and Structural Safety. The overall mean of earthquake

preparedness is 3.91 or *High*, with an SD value of 0.14, indicating that earthquake preparedness is always observed. Among the indicators stated, Personal Safety has the highest mean of 4.07 with an SD value of 0.65, interpreted as *High*, indicating that earthquake preparedness is always observed regarding personal safety. On the other hand, among the indicators, Emergency Needs have the lowest mean value of 3.57, interpreted as *High,* meaning earthquake preparedness is always observed.

The results revealed that the overall mean level of earthquake preparedness of the College of Teacher Education students at the University of Mindanao is high. It means they could get most of their emergency needs, personal safety, outdoor safety, indoor safety, and structural safety for preparation. With these, the indicator that gained the highest mean is personal safety, demonstrating that the College of Teacher Education students manage to prepare the things unique to an individual, such as access to the nearby hospitals, executing the "Duck, Cover, and Hold." Understanding what to do before, during, and after an earthquake is essential for minimizing potential harm to our surroundings and ourselves [25]. This leads to the students being more knowledgeable enough about what and how one student performs the act to be safe.

Moreover, the high level of earthquake preparedness of college of teacher education students conforms to the study by [26] asserted that students demonstrate remarkable earthquake preparedness and awareness before, during, and after earthquakes. In the same vein, the results of the study of [27] showed that students typically practice being earthquake-ready for potential calamities. This suggests that they usually prepare for various disasters that could occur in the locality.

Meanwhile, results show that emergency needs are the indicator that gained the lowest mean. This implies that education students are least to be prepared for emergency needs and supplies if an earthquake strikes. However, the results also indicated a high level of emergency preparedness among students in the College of Teacher Education. This suggests that many students were able to gather essential items like first aid kits, drinking water, go-bags, or canned goods both before and after earthquakes. Notably, some students admitted to occasional lapses in preparedness, often due to lacking certain materials or facing unforeseen circumstances. They will only use or prepare what is available. A study by [28] explores the preparedness of teacher education students in the Philippines for natural disasters, including earthquakes. The study found that while the teacher education students had some knowledge of natural disasters. However, most of them needed more practical experience in emergency needs.

Furthermore, emergency needs, such as access to clean water, food, shelter, and medical care, were crucial for survival and recovery, as well as other emergency needs equipment, such as medical equipment and drugs, were critical in providing adequate medical care before or during an earthquake. These studies suggest that teacher education students have a vital move or act to prepare things necessary to lessen the harm caused by an earthquake [29].

Table 3 shows the result findings of the correlation between risk communication effectiveness and earthquake preparedness. The value of r is .546, and the p-value (330) = .000. As interpreted using the correlation coefficient guidelines, this signifies a moderate positive correlation between the two variables. Furthermore, it has been determined that the correlation significance of the two variables is 0.01 or $p<0.5$, which results in the rejection of the null hypothesis. Therefore, there is a significant relationship between risk communication effectiveness and earthquake preparedness.

The findings show that a high degree of earthquake preparedness is highly correlated with the degree of risk communication effectiveness in the College of Teacher Education; hence, several studies have shown that people with access to effective risk communication tend to take appropriate actions for earthquakes against risks. The risk communication and earthquake preparedness reveal that the College of Teacher Education students find risk communication effective and are prepared for an earthquake [30-32].

Moreover, several studies have confirmed that risk communication effectiveness directly affects one's earthquake preparedness. A study in Israel showed that risk communication through social networks is a prime mover in enhancing earthquake preparedness [33]. This study further supports the evidence presented that the information a person receives from multiple sources can directly affect their actions toward earthquake preparedness.

A study in New Zealand investigated earthquake information that individuals are exposed to, how people make meaning of this information, and how this relates to undertaking actual preparedness measures. Furthermore, the results showed that the information they receive relates to starting earthquake preparedness measures [34]. This study supported the current study's findings that communicating risks makes people actively prepare for disaster. Providing accurate and continuous information and knowledge to the potential populations at risk will decrease the chances of injury and death and lessen the costs of property and infrastructure damage when a disaster occurs.

4. CONCLUSIONS

The study determined that the relationship between risk communication effectiveness and earthquake preparedness exists at significant levels. The research determined that the level of risk communication effectiveness and earthquake preparedness of students was generally high and very high. For risk communication, only satisfaction was highly effective among the three indicators: a trusted source of information, received information, and satisfaction. On the other hand, the level of earthquake preparedness generally showed high results, precisely the emergency needs, personal safety, outdoor safety, indoor safety, and structural safety. Based on these findings, the researchers conclude that effective risk communication enhances individuals' earthquake preparedness.

This study showed that efforts and initiatives of the agencies and people involved in risk communication — in both formal and informal communications — had impacted students' decisions in preparing for earthquakes. Thus, there is an emphasis on the importance of managing and analyzing information from experts and primary networks. These findings highlight the critical role of proper risk communication to drive students to be prepared for an earthquake to lessen and manage casualties in both people and infrastructures in and out of the school. Furthermore, the study's encouraging results will help future educators be well-informed and prepared for an earthquake.

As a result of finding the significant correlation between risk communication effectiveness and earthquake preparedness, the research supports the Protection Action Decision Model Theory [35]. This theory believes that a practical and functional relationship between individuals and information providers guides people's protective action implementation and preparedness. With that, effective communication of risks between parties involved will make people prepare and take action on the said risk. Hence, future educators with more access to effective risk communication will likely be ready for an earthquake. Moreover, when in the field, teachers play an essential role in communicating risk to the students.

Drawn from these conclusions, the researchers highlighted some of the pivotal recommendations written as follows:

As the research findings and conclusion were revealed, the researchers recommend that the College of Teacher Education students be subjected to various earthquake-related activities to foster their knowledge, preparedness, and communication of risks through seminars and workshops about effectively disseminating and discerning earthquake risk information. Additionally, students should undergo or be encouraged to participate in drills and training to promote a sense of obligation for disaster preparedness which fosters students' engagement to mitigate the destructive harm of earthquakes.

Moreover, the university is recommended to conduct training and programs for communicating risk information and earthquake preparedness. The university is also encouraged to strengthen its risk communication system and earthquake preparedness measures as defined in the study's indicators. Additionally, one of the university's organizations under the College of Teacher Education, Ilusstrado, will conduct a college-wide workshop to teach students about the risks of an earthquake and be equipped with the skills needed to communicate risks effectively and be prepared for an earthquake. The workshop will be conducted in two days with the help of LGUs and experts. Lastly, this workshop will include every person in the college.

Furthermore, local government units, National Disaster and Risk Reduction Management Council (NDRRMC), and several other government agencies may also offer seminars about emergency needs, give out "Go Bags," strengthen their information dissemination system and warning systems, and create programs to improve further risk communication

and earthquake preparedness such as training and evacuation plans.

Finally, the researchers encourage further research that can be done on the behavioral and psychological impact while communicating risks and experiencing earthquakes. Moreover, future studies can be conducted to better understand the relationship between risk communication and preparedness for other disasters.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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