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The effect of using simulation strategy on preparatory school students' earthquakes preparedness

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Abstract---Background: Earthquake disaster preparedness in schools is an effective, adaptable, and long-lasting approach to disseminating disaster education. Undoubtedly, systematic, quantifiable, and effective measures to increase the capacity of school community members will lessen the impact of catastrophe risk in schools. Aim: To evaluate the effect of using a simulation strategy on preparatory school students' earthquake preparedness. Design: A quasi-experimental design pre-and post-tests were utilized. Setting: The study was carried out at El-Shaheed Ahmed Bahaget Preparatory School in Damanhour. Sample: A multi-stage stratified sample consists of 60 preparatory students. Data collection tools: The

student's personal data questionnaire, preparatory school students' knowledge regarding preparedness for earthquakes, and preparatory school students' skills during and after the earthquake were implemented. Results: There was a highly significant improvement in preparatory school students' knowledge regarding earthquakes in the post-simulation than pre-simulation. Moreover, there was a significant improvement in preparatory school students' preparedness for earthquakes in the post-simulation than pre-simulation. Conclusion: Using the simulation strategy improved preparatory school students' earthquake preparedness. Recommendations: All children of different ages should be included in disaster preparedness programs. Innovative methods should be widely used to educate children about disasters. Protecting preparatory school students from disasters requires the cooperation of many different stakeholders, including the family, community, government, civic institutions, and businesses.

Keywords---earthquake, preparatory school students, preparedness, simulation strategy.

Introduction

Between 1998 and 2017, 91% of all catastrophes included a climate change-related component, with more people being affected by floods, storms, droughts, and heat waves. They have a close coupling and fall one after the other. For instance, heat waves and drought frequently coexist. Dry soils come from drought, which causes solar energy to evaporate, which causes an increase in surface temperature and an increase in evaporation rate. Wildfire risk will increase due to drought and extreme temperatures. Sandstorms, smog, and water conflicts are additional effects of drought (AghaKouchak et al., 2018). One type of natural calamity that claims a lot of lives is an earthquake. Earthquakes are sudden, unforeseen, uncontrolled movements of two tectonic plates that cause soil to shift and shake as a result of earthquake waves. They are a short-lived natural occurrence with a destructive effect (Rij, 2016).

Preparatory school students are among the groups in many developing nations that are most susceptible to natural disasters, and in the event of a catastrophe, children make up the majority of the victims (Enarson et al., 2017). Around 175 million youngsters are typically exposed to natural disasters every year. Their dependence on adults prevents them from acting autonomously in the event of a disaster (Peek L. 2018). Children who experience natural catastrophes may experience both physical harm and psychological anguish (Winarni et al., 2018).

To reduce the effects of an earthquake, education on disaster preparedness activities is crucial. Activities related to disaster preparedness are carried out by a wide variety of groups and individuals, including emergency response agencies, public servants, corporations, individuals, and those who work for international non-governmental and humanitarian organizations. People, communities, and nations work to lessen their vulnerability and enhance their resilience to disasters through the preparedness and mitigation processes, which were replicated and

elaborated earlier. Sadly, disasters continue to occur all over the world despite preparation (having the greatest emergency plans, extensive preparedness programs, and strong risk reduction policies in place) (Coppola, 2015).

Preparedness schools have a vital role in developing countries in improving knowledge and preparedness activities for natural disasters because any type of message can reach parents, relatives, and the entire community through the school students and the teachers. Building preparedness can benefit greatly from formal instructions and prior earthquake experience. Preparing for natural disasters forms part of a national government's responsibility; every member of a community, including children, must prepare for natural disasters (Dixit et al., 2018).

While preparedness knowledge and skills are included in the curriculum and textbooks, it is also crucial that different educational actors—including head teachers, students, non-teaching staff, and the school as a whole—are prepared (Merchant, 2019). The level of preparedness (e.g., knowledge of the effects of a disaster, taking precautions, being attentive, etc.) and the ability to self-reliance in such situations determine one's ability to deal (Paton & Johnston, 2017). Educational simulations to improve preparedness should be as natural so that may raise a "disaster-aware generation" (Tuladhar et al., 2015).

The simulation training system can provide preparatory school students with a simulation training environment similar to the actual situation. To a large extent, it has changed the arduous circumstances of conducting emergency drills due to restrictions, such as high cost, time requirements, challenging organization, and a constrained scope (Caballero and Niguidula 2018). As a result, the simulation training system built on visualization has emerged as a crucial training tool for emergency drills for major natural disasters (Evain, et al. 2020).

The school nurse must promote preparedness since it is the most crucial factor. Improving students' experiences makes them better equipped to deal with disasters, and the damage caused by disasters can be greatly lessened if students are better prepared for disasters. School nurses must serve as centers of instruction that offer both knowledge and skills to students. Additionally, school nurses can serve as a vehicle for effectively disseminating knowledge and skills to the families and communities that are nearest to them through instruction (Basnet, 2018). Therefore, educating students about earthquake disaster preparedness to understand disaster warning signs and steps that may reduce the risk of earthquake disasters must be a priority in schools (Merchant, 2019). The school nurse must teach students about preparedness techniques such as self-protection during an earthquake, preparation before an earthquake disaster or the risk reduction phase, evacuation following an earthquake, and providing first assistance to victims. (Nanda & Raina, 2019).

Significance of the study

Earthquake preparedness in schools is a successful, dynamic, and sustainable strategy for disseminating disaster education. Students should be aware of disasters at a young age because they are among the most vulnerable groups in

society. This will help ensure that they are well-prepared and independent when responding to disaster. Furthermore, education awareness can increase their odds of surviving the disaster if they are aware of disasters and can act wisely in the event of one, when they may not be near their parents or even be by themselves (Chalupka et al., 2020). So, the study was done to evaluate the effect of using a simulation strategy on preparatory school students' earthquake preparedness.

Operational definition

Earthquakes

It is a sudden and violent shaking of the ground. Earthquakes are significantly important in the study since they focus on earthquake disasters. Earthquake is a period used to explain each surprising slip on a fault, and the ensuing floor shaking and radiated Seismic power as a result of the slip, or via way of means of volcanic or magmatic activity, or different unexpected strain modifications inside the earth.

Preparedness

In this study, disaster preparedness is defined as knowing how to deal with a disaster when it arises as well as skills in disaster management that may be used to recognize and lessen the impact of disasters. Also, defined as actions that ensure resources necessary to carry out an effective response are available before disaster. It pertains to what to do and what to prepare for when a disaster happens in a certain community to ensure safety among persons.

Aim of the study

This study aimed to evaluate the effect of using a simulation strategy on preparatory school students' earthquake preparedness.

Research Hypothesis

To achieve the study's objective, the following assumptions were developed: the post-simulation strategy knowledge and skills scores of preparatory students who received simulation strategy intervention will be higher than the pre-simulation strategy scores regarding earthquake preparedness.

Methods

Research design

A quasi-experimental design of one group pre-and post-tests was utilized.

Setting

Among the ten educational departments in the governorate of Damanhour, then one educational department was selected, and after that Damanhour City's southern district was selected, finally, a preparatory government school was

chosen randomly for conducting the research from this district. The study was carried out at El-Shaheed Ahmed Bahaget Preparatory School in Damanhour City. The school serves first to third-year preparatory classes. It comprises four buildings, twelve classrooms, and computer labs equipped with data projectors and whiteboards.

Subjects

Preparatory school students enrolled in the previously mentioned setting will be selected randomly.

Sampling technique

A multi-stage stratified sample technique was used to select the sample of the study. One school was chosen randomly from the Damanhour-affiliated educational department in the southern district of Damanhour. After selecting the preparatory governmental school, six classes were randomly selected from the list of 1st to 3rd-grade classes.

Sample size

The population size was 450, and the sample size was computed using the Cochran method for sample size with an 8% error margin (Pourhoseingholi et al., 2013) equal to 60 school students.

$$n = \frac{z^2 * p * (1-p) / e^2}{z^2 * p * (1-p) / e^2 + N} \cong 60$$

where n is the minimum required sample size, z: The z-value represents the desired level of confidence or significance level. N= the population size, and e is the margin of error.

To guarantee randomization, there were two stages in the selection procedure. First, a computer-generated random number was used to choose the sample randomly. Subsequently, random selection is carried out within every grade. To guarantee representation from all pertinent groupings, a fixed number of students (n = 20 for each grade) are randomly selected.

Tool for data collection: Data was gathered through a pre-designed structured self-administered questionnaire, it was generated by the researchers after reviewing the related recent literature and involved three parts as follows:

Part I: student's data questionnaire:

It consisted of 6 questions, such as age, gender, and parent's educational level & occupation.

Part II: Preparatory school students' knowledge regarding preparedness for earthquakes:

Comprised 8 questions (multiple choice questions) to assess the participant's knowledge regarding earthquakes such as the definition, types, and causes of earthquakes, identify the responses to earthquake hazards, identify objects that could cause death or injury and secure them, select a safe site in the building, know earthquake drills, take immediate action, remain calm during an earthquake, and what kind of safety precautions should students use in the schoolyard. (Evain et al. 2020, Skryabina et al. 2020, Merchant, 2019, Paton, & Johnston, 2017)

Scoring system

The participants' knowledge who checked an item (yes) received two points, while those who checked an item (no) received zero, in addition, the total knowledge score was categorized as follows. The overall knowledge score ranged from 0 to 16, with 0 being the lowest and 16 being the highest. The knowledge score was considered to be unsatisfactory knowledge for those who scored from $0 < 10$ ($< 60\%$), and those who scored from 10 to 16 were considered to have satisfactory knowledge ($\geq 60\%$). A question regarding the source of information about preparedness for earthquakes was added but not included in the total knowledge score.

Part III: Preparatory school students' skills during and after the earthquake: comprised nine multiple-choice questions regarding practice earthquake drills. Actions to take during an earthquake such as Drop: Get under the desks or tables, position as much of their bodies as possible under cover, Cover their eyes by leaning their faces against an arm as they hold on, and Hold On to a leg of the desk or table. If you are indoors during an earthquake, you should run out of the building. Also, actions to take after an earthquake such as immediately going back inside to see whether everything is okay, and checking for gas leaks should be ready for another earthquake to happen very soon, the ground has stopped shaking, you should evacuate your house, If a family member is trapped inside, you should wait for search and Rescue teams to help before entering a building and teaching about first aid skills. (Chalupka et al., 2020, Skryabina et al. 2020, Peng et al. 2018, Paton, & Johnston, 2017)

Scoring system

The participants were scored "two" for the "correct" response and "zero" for the "incorrect". The total score ranged from 0 to 18, where higher scores signify adequate at a rate equal to or more than 60%, while inadequate is considered if the participants report skills below 60%.

Tool validity

The study tool was tested for validity by a panel of five experts in the fields of pediatric and community health nursing to assess their clarity, comprehensiveness, and appropriateness. The modifications were done as required.

Tool reliability

Cronbach's Alpha was used to assess the reliability of the tool; it was (0.94) for part I, (0.86) for part II, and (0.89) for part III which revealed that the tool consisted of relatively homogenous items as indicated by high reliability.

Administrative considerations

An official letter of approval was obtained from the Dean of the Faculty of Nursing to the educational directorate, the educational zones, and the manager of the previously selected preparatory school. This letter includes permission to conduct the study and explains the aim and nature of the study.

Ethical consideration

Before starting the study, official approvals from the educational directorate, the educational zones, and the manager of the previously selected preparatory school were obtained. Involvement in the research was dependent on parental and student approval and was voluntary. Informed consent was acquired from each parent. Further, the privacy and confidentiality of students' data were protected. The student's participation in the research was approved by verbal permission. The researchers developed and preserved unique coding to maintain the pupils' anonymity. Moreover, students were informed of the goal of the research to elicit their participation and enable data collecting. The collection of data continued for two months.

Pilot study

The pilot study was conducted randomly on 10% of the total sample (6 students). They were selected from each grade randomly, it was conducted to evaluate the items, clarity, and relevance of study tools, estimate the time required for data collection, and identify the possible obstacles that may hinder the process of data collection. The data obtained from the pilot study were analyzed. Accordingly, no modifications were made to the tools. So, these students were included in the study sample.

Fieldwork

The actual fieldwork was carried out for about four months from the beginning of April until the end of July 2021; and was conducted in four main phases:

The preparatory phase

- The researchers reviewed past and currently available literature relevant to the study topic to acquire in-depth knowledge of the theory of the different aspects of the program. Then the study tools were designed after an extensive review of the literature.
- Following that, the researchers assessed the student's personal data and requested them to complete the questionnaire aimed at assessing their knowledge of earthquake preparedness as well as their skills both during

and after the earthquake. It takes about 15 to 25 minutes to complete.

Planning phase

Based on the results of the preparatory phase, the researchers identify the needs of the sample and start to develop the simulation strategy items (session times, outline, the content based on recommended guidelines of earthquake preparedness made by CDC, PAHO & WHO, official website of the United States government (Earthquakes – Ready.gov, 2020).prepare the design the simulation strategy, and prepare for the evaluation).

Intervention phase

The intervention was conducted in six sessions, once a week, for 40- 50 minutes, for one and a half months. There was a designated facilitator for each practical and theoretical session. The school administration determined the session's location and timing. Throughout this phase, teaching approaches and media were designed as well as the total number of sessions.

Using a simulation strategy was conducted during this phase for the study group. The designed simulation strategy was presented in simple Arabic language. Moreover, each session was conducted as a teaching class with pre-created educational materials. Every session started by going over the goals of the new topics and the previous sessions. Handouts of contents and activities were given to the students. After each session, feedback was provided. Lectures and demonstrations were employed as teaching techniques before the simulation strategy's implementation regarding the theoretical part. Besides, data shows and whiteboards were employed as instructive tools during the session. Supporting materials for every session, like pictures and PowerPoint slides, were utilized.

The simulation strategy's implementation was designed as follows (included 4 sessions)

First session: familiarization and preparation: Achieving an atmosphere of familiarity and trust between researchers and students. The researcher asked the students what they think causes deaths and injuries when an earthquake has happened. Ask them to imagine what would happen if an earthquake shook the ground where they live. Allow them to express their ideas and, after some discussion, make sure that the students realize that the movement of the ground during an earthquake seldom directly causes people to get hurt. Most people are hurt from things falling on them inside or outside buildings.

Second session: Introduce the meaning of the earthquake disaster, and the types, and causes of earthquakes. As a class, define the term "earthquakes. Also, the researcher asked the students to help make a class list of the types of earthquakes. The researcher guided the students about responses during and post earthquakes such as Damage to the classroom and hallways includes falling objects from shelves and walls, pieces of ceiling and wall collapsing, overturned bookcases, furniture, and appliances, and broken windows with glass falling from them. On the other hand, there was damage outside the school building, such as

glass from broken windows, roof shingles and bricks falling from walls and chimneys.

Third session: Help students select a safe site in the building, during an earthquake, security precautions should be taken in the schoolyard, and identify items that could cause death or injury and secure them. In addition, there were power outages, fires caused by damaged electrical and gas lines, flooding from burst water pipes and poisonous gas leaks from chemicals that were spilled within the school building. Additionally, there is damage to the community from downed power lines and power outages. Lastly, damage to railway tracks, bridges and highways; flooding caused by dam failures; harm to water towers and reservoirs; fires caused by leaking gas lines and chemical spills; and landslides, causing loss of support for buildings and bridges

Fourth session: Help students recognize the immediate action and remain calm. Also, the researcher explains that there may be some hazards that we cannot correct; however, there are many others that we can. After a Quake." the researcher explains that all these photographs depict earthquakes that occurred when schools were not in session. No one was hurt. Practicing Drop, Cover, and Hold On would have prevented injuries had children been in the school buildings. Safe evacuation would have been possible, although the darkened hallways would have been challenging for students to navigate. As students view the photographs, have them point out the hazards they see. (Suspended ceiling tiles and metal brackets were not stable; bookshelves were not bolted down; heavy objects and boxes fell from shelves; etc.) Which of these hazards could have been eliminated? Explain. (Bolt bookcases to wall studs; move heavy or breakable objects from high shelves to low shelves; move filing cabinets away from exits; do not use suspended ceiling tiles; and install emergency lighting in hallways.) After viewing and discussing the photos, the researcher divided the class into three groups for a school hazard hunt. Assign one of the three areas to each group: Group 1: Classrooms (yours and others) Group 2: General school building (halls, cafeteria, gym, offices, custodian's closets or storerooms) Group 3: School grounds (fields, parking lots, playground, etc.). the researcher Provides time for the students to visit and examine each of the areas they must search for earthquake hazards. The researcher Tells them to look carefully for things that might cause injuries during an earthquake and things that might block exits and escape routes after the quake.

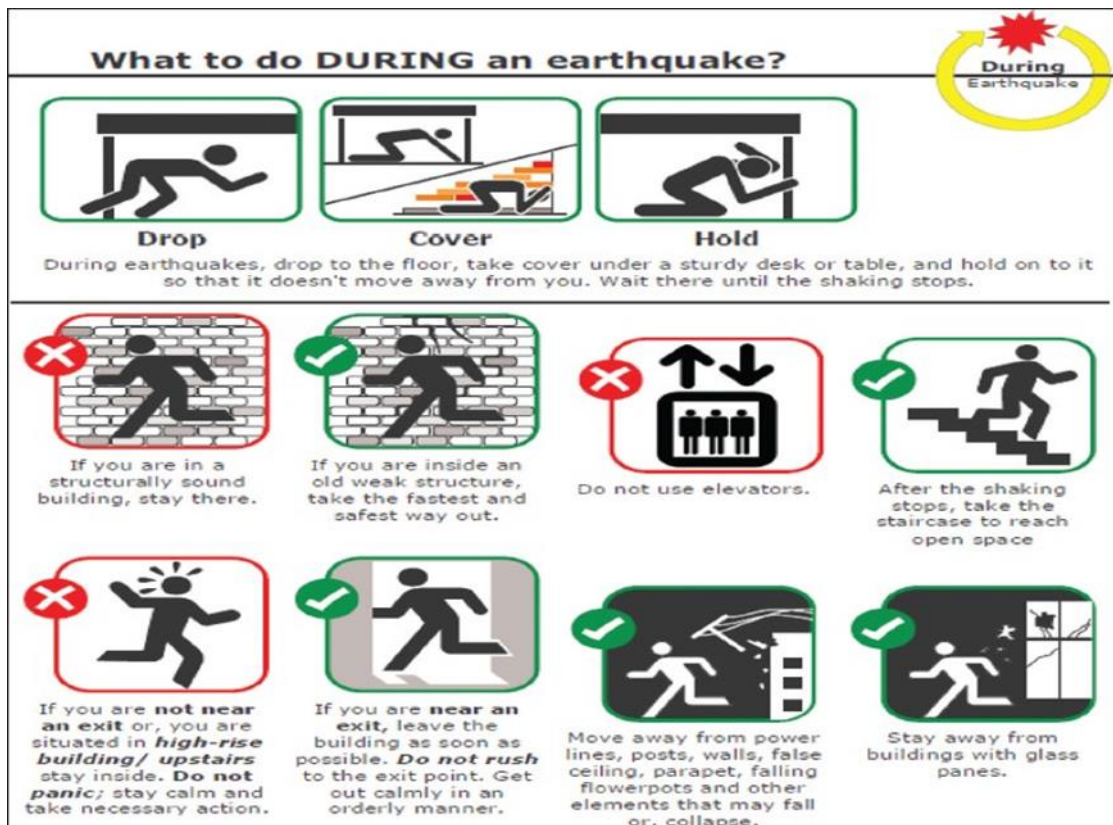
The practical part included (2 sessions)

In the first session: The researcher asked the students if they would know what to do if an earthquake started right now. Explain and demonstrate to the students the correct behavior. In the event of an earthquake students should • Drop: Get under the desks or tables, positioning as much of their bodies as possible under cover. • Cover their eyes by leaning their faces against an arm as they hold on. • Hold On to a leg of the desk or table. (Their hands and heads should be about halfway between the floor and the top of the desks or tables.) . The researcher Explain to the students that you want them to practice when you say, "Drop, Cover, and Hold On." Have the students drop. Keep them quiet. Once they have mastered the position, you should drop it as well. After 10 to 15 seconds in place,

ask them to get up carefully and check themselves and their neighbors. Ask, "Is everyone all right?" Wait for their answers and look around to visually check the students and the room.

The researcher Repeats the drill regularly until the students have mastered it. When you think that students are comfortable with the drop drill, conduct an imaginary earthquake exercise. Explain that you are going to create an imaginary earthquake by reading a story to help the students understand what to do if a real earthquake were to happen. The researcher reminds the students that "imaginary" means "pretend." Appoint student helpers for the simulation. • One student to flick the lights on and off a few times and then eventually turn them off • One student to be the "timer" who will count the seconds to see how long the earthquake lasted

In the first session: Several students created earthquake sound effects such as windows rattling, desks or tables scraping, drawers opening, dogs barking, books falling, trees scraping the building, people shouting, babies crying, car alarms sounding and doors banging shut. Before the simulation, the researcher reminds the students at their desks to follow the Drop, Cover, and Hold On procedure. Remind helpers to complete their assigned tasks when you cue them in the story. Read the simulation, noting the students' ability to Drop, Cover, and Hold On at the appropriate times. After the simulation allow the students to share their feelings during the imaginary earthquake. Were they scared? Why? Did they feel safer in the Drop, Cover, and Hold On position? Challenge them to give reasons why each step in the procedure is important to their safety. The researcher Has the timer report the length of the simulated earthquake. The researcher Explains that most earthquakes that we feel last from a few seconds to a minute. Very powerful earthquakes can last up to several minutes. Longer quakes cause greater damage. The researcher Repeated the simulation, selecting different students to provide the effects so that each student has an opportunity to practice the Drop, Cover, and Hold On procedure.



Earthquakes – Ready.gov, 2020

Evaluation phase

Using the same data collection instrument (parts II and III), it was possible to compare the results before and after one month of the intervention to evaluate the effect of using a simulation strategy on preparatory school students' earthquake preparedness.

Statistical analysis

The acquired data were tabulated and statistically analyzed using an IBM computer and the Statistical Program for Social Science (SPSS) Advanced Statistics, version 25 (SPSS Inc., Chicago, IL). To ascertain whether quantitative variables had a normal distribution, the Kolmogorov-Smirnov test was performed. Numerical data were represented using the mean and standard deviation. The qualitative data were expressed using frequency and percentage. T-paired tests were used to examine the association between the variables. The Spearman method was used to analyze the correlation between numerical variables. A p-value < 0.05 was considered significant and a p-value <0.001 was considered highly significant.

Results

Table (1): Displays that 50% of the studied preparatory school students their age were between 14 and < 15 years old and 61.4% of them were girls. Regarding the father's education, it was observed that 40% had a university education and 46.6% worked privately. Concerning mother's education, it was noted that 36.7 had basic education and 58.5% were housewives.

Figure (1) highlighted that the common source of information among the studied preparatory school students about earthquake preparedness was teachers (52%).

Table (2): Portrays that, the preparatory school students' knowledge mean scores regarding preparedness for earthquakes increased post-simulation strategy implementation with a high statistical significance after one month of simulation strategy implementation.

Figure (2): Shows that there were statistically significant improvements in all items of preparatory school students' total knowledge pre and post-simulation strategy implementation. Additionally, it was demonstrated that 20% of the preparatory school students had a satisfactory total knowledge level regarding preparedness for earthquakes pre-simulation strategy implementation which improved to 80% post-simulation strategy implementation.

Table (3): Portrays that, the preparatory school students' skills' mean scores regarding preparedness for earthquakes were increased post-simulation strategy implementation with a high statistical significance after one month of simulation strategy implementation.

Figure (3): shows statistically significant improvements in all items regarding preparatory school students' total skills during and post-earthquakes pre- and one-month post-simulation strategy implementation .Also, it illustrates that 13.3% of the preparatory school students' total skills had adequate practice levels regarding skills during and post post-earthquake pre-simulation strategy implementation which improved to 90% post-simulation strategy implementation.

Table (4): illustrates the existence of a positive association between the total skills scores of the preparatory school students with the total knowledge scores post the implementation of the simulation strategy at ($p \leq 0.05$) regarding earthquakes preparedness tube ($r = 0.86$, $r = 0.42$, respectively) with a highly statistically significant value of $p < 0.001$.

Table (5): Revealed a significant correlation between preparatory school students' level of knowledge pre and one-month post-simulation strategy implementation in the items of gender and age (with P-value 0.022, 0.007) respectively.

Table (6): Revealed a significant correlation between preparatory school students' level of skills pre and one-month post-simulation strategy implementation in the item of gender (with P-value 0.007). There was no correlation between the level of preparatory school students' level of skills pre- and one-month post-simulation strategy implementation and age.

Table (1): Personal data of the studied preparatory school students and their parents (n = 60)

Personal data	Items	N (%)	
Age	12 to < 13	11	18.3
	13 to < 14	5	8.3
	14 to < 15	30	50.0
	≥ 15	14	23.4
	Mean ± SD	12.45 ± 1.53	
Gender	Boys	23	38.3
	Girls	37	61.4
Fathers' education	Illiterate	10	16.7
	Read and write	10	16.7
	Basic education	16	26.6
	University education	24	40.0
Fathers' occupation	Employee	22	36.7
	Dead	10	16.7
	Private workers	28	46.6
Mothers' education	Illiterate	10	16.7
	Read and write	20	33.3
	Basic education	22	36.7
	University education	8	13.3
Mothers' occupation	Employee	10	16.7
	Housewife	35	58.5
	Dead	7	11.68
	Private workers	8	13.3

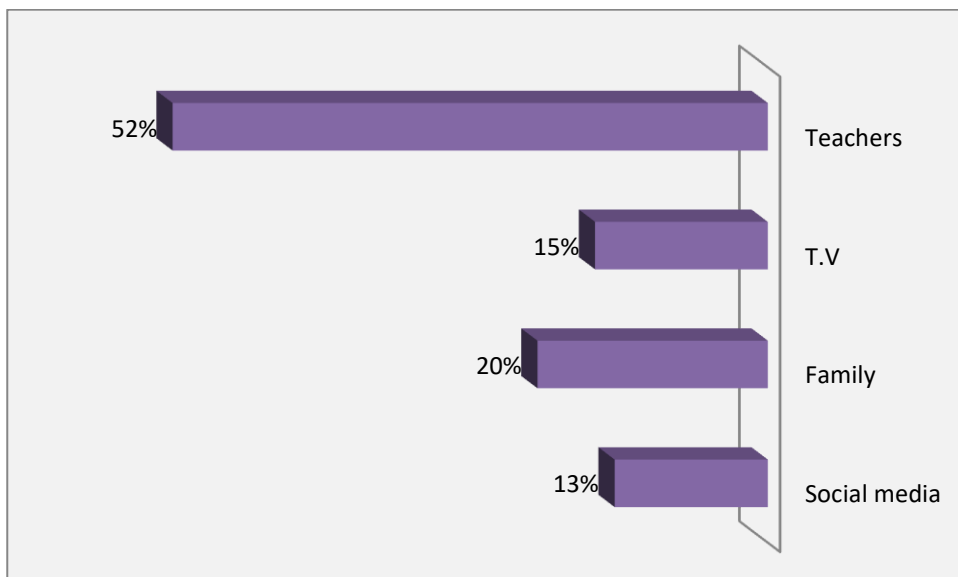


Figure (1): Source of information among preparatory school students about earthquake preparedness (n=60)

Table (2) Differences between the mean score of studied Preparatory school students' knowledge regarding preparedness for earthquakes pre-, and post-one month of simulation strategy implementation (n=60).

Variable	Pre- simulation strategy intervention	One-month post-simulation strategy intervention	Paired t-test	P-value
	Mean \pm SD	Mean \pm SD		
Definition of earthquakes	.57 \pm .46	1.94 \pm .56	17.2	<0.001
Types of earthquakes	.65 \pm .47	1.64 \pm .48	20.3	<0.001
Causes earthquakes	.45 \pm .67	1.38 \pm .28	15.04	<0.001
Select a safe site for your building	.75 \pm .55	1.77 \pm .38	18.3	<0.001
The researcher guides the students about responses during and post earthquakes	.55 \pm .45	1.45 \pm .37	9.07	<0.001
During an earthquake, security precautions should be taken in the schoolyard.	.74 \pm .25	1.15 \pm .37	16.3	<0.001
Take immediate action	.75 \pm .65	1.57 \pm .28	13.3	<0.001
Identify items that could cause death or injury and secure them	.55 \pm .65	1.67 \pm .34	16.5	<0.001

Paired t-test **Highly significant at $p < 0.001$.

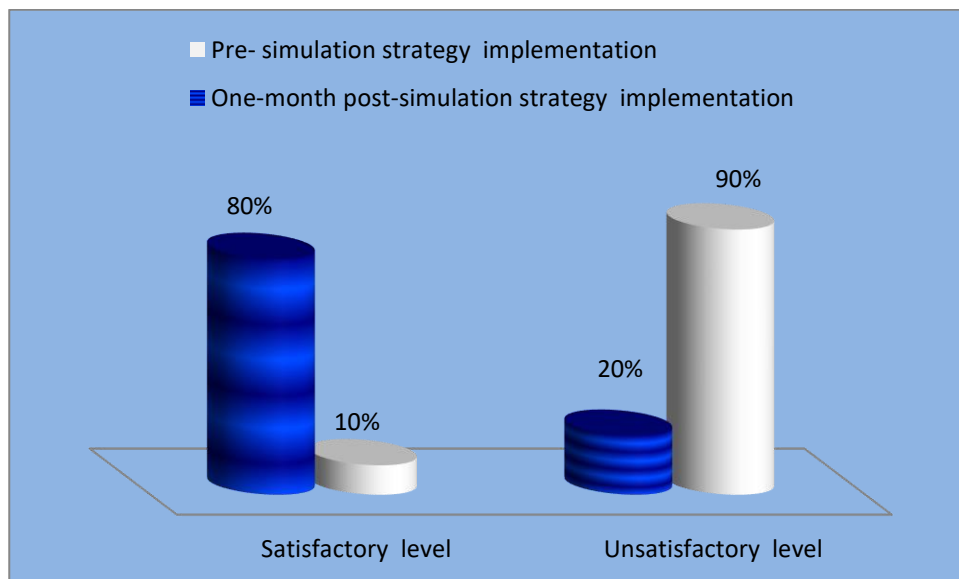


Figure (2): Total knowledge level regarding preparedness for earthquakes among the studied preparatory school students pre and one-month post-simulation strategy implementation (n=60).

Table (3) Differences between the mean score of studied preparatory school students' skills regarding preparedness for earthquakes pre-, and post-one month of simulation strategy implementation (n=60).

Variable	Pre- simulation strategy intervention	One-month post-simulation strategy intervention	Paired t-test	P-value
	Mean \pm SD	Mean \pm SD		
Actions to take during an earthquake such as				
Drop: Get under the desks or tables, positioning as much of their bodies as possible undercover	.56 \pm .45	1.94 \pm .45	13.3	<0.001
• Cover their eyes by leaning their faces against an arm as they hold on.	.63 \pm .46	1.64 \pm .39	15.2	<0.001
• Hold On to a leg of the desk or table.	.44 \pm .64	1.38 \pm .37	20.04	<0.001
If you are indoors during an earthquake, you should run out of the building	.73 \pm .53	1.77 \pm .29	16.7	<0.001
Actions to take after an earthquake such as				
Immediately went back inside to see whether everything was okay	.57 \pm .43	1.55 \pm .28	8.05	<0.001
Checking for gas leaks should be ready for another earthquake to happen very soon	.72 \pm .23	1.24 \pm .36	14.2	<0.001
After the ground has stopped shaking, you should evacuate your house,	.76 \pm .63	1.63 \pm .26	16.4	<0.001
If a family member is trapped inside, you should wait for search and Rescue teams to help before entering a building	.53 \pm .62	1.71 \pm .39	17.2	<0.001
Teaching about first aid skills.	.73 \pm .60	1.57 \pm .28	18.5	<0.001

Paired t-test **Highly significant at $p < 0.001$.

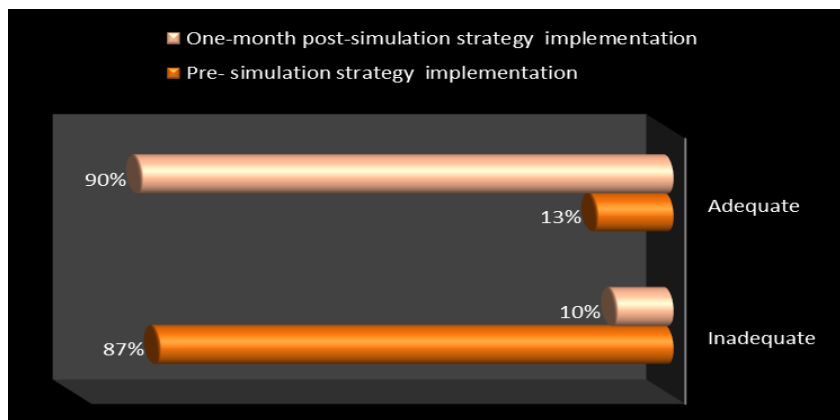


Figure (3): Total skills level regarding skills during and post-earthquakes among the studied preparatory school students pre and one-month post-simulation strategy implementation (n=60).

Table (4) Correlation between total knowledge and skills among the studied preparatory school students (n=60)

Variables	Total Knowledge scores			
	Pre- simulation strategy implementation		Post-simulation strategy implementation	
	r	p-value	R	p-value
Total practices scores	0.86	0.003**	0.43	<0.001**

r: Pearson coefficient, No significant at $p > 0.05$, *Significant at $p \leq 0.05$, **Highly significant at $p < 0.001$.

Table (5): Correlation between personal data and preparatory school students' level of knowledge pre and one-month post-simulation strategy implementation (n=60)

Personal data	Pre-test				Post-test				p p-value
	Satisfactory (n=6)		Unsatisfactory (n=54)		Satisfactory (n=48)		Unsatisfactory (n=12)		
	No.	%	No.	%	No.	%	No.	%	
Gender									
Male	3	50.0	33	61.0	25	52.0	12	100.0	0.022*
Female	3	50.0	21	39.0	23	48.0	0	0.0	
Age									
12 to < 13	2	33.3	30	55.5	25	52.08	0	0.0	0.007**
13 to < 14	2	33.3	10	18.5	13	27.08	12	100.0	
14 to < 15	1	16.65	7	13.0	5	10.41	0	0.0	
≥ 15	1	16.65	7	13.0	5	10.41	0	0.0	

* P- value is statistically significant

Table (6): Correlation between personal data and preparatory school students' level of skills pre and one-month post-simulation strategy implementation (n=60)

Personal data	Pre-test				Post-test				p p-value
	Adequate(n=8)		Inadequate (n=52)		Adequate (n=54)		Inadequate (n=6)		
	No.	%	No.	%	No.	%	No.	%	
Gender									
Male	8	100.0	27	51.9	27	50.0	6	100.0	0.007**
Female	0	0.0	25	48.1	27	50.0	0	0.0	
Age									
12 to < 13	2	25.0	20	38.46	16	29.62	1	16.67	0.532
13 to < 14	2	25.0	15	28.85	20	37.05	2	33.33	
14 to < 15	2	25.0	10	19.23	12	22.22	2	33.33	
≥ 15	2	25.0	7	13.46	6	11.11	1	16.67	

* P- value is statistically significant

Discussion

Schools are crucial in helping populations in developing nations become more aware of and prepared for natural catastrophes since students and instructors may convey any message to parents, relatives, and the entire community. Formal education and prior earthquake experience can be extremely important in developing preparedness. Every member of a community, including children, has a responsibility to prepare for natural disasters. This is a duty shared by the national government (Dixit et al., 2013).

In the curriculum and textbooks, it is very crucial that many educational actors including head/teachers, students, non-teaching personnel, and the school as a whole—be prepared. During trans-earthquake impacts and even after an earthquake, people might only have a limited amount of access to necessities. The degree of readiness (e.g., knowledge of the consequences of disasters, protective measures, awareness, etc.) and independence required to cope with these circumstances rely on each other (Paton & Johnston, 2017).

Disaster awareness education can be given early through a program of disaster awareness at school so that children can be aware of the ways to save themselves in times of disaster (Finnis et al., 2019). Education and training in disaster management aim to increase preparedness to deal with and manage natural disasters (Lindell et al., 2015). The role of simulations in disaster management in assessing one's readiness to deal with disasters. In addition, it is worth noting that most current simulation training systems are usually only provided for a small number of trainees. There is less data support for the effectiveness of the simulation training system in the actual disaster emergency and the application of simulation training systems for major natural disasters in the future (Oral et al., 2015).

Results of the current study highlighted that the common source of information among the studied preparatory school students about earthquake preparedness was teachers. This result is not similar to a survey conducted by Peleg et al., (2018) found that television was assumed by most respondents to be the major source of information.

Concerning knowledge mean scores regarding preparedness for earthquakes, the results of the present study highlighted that, the preparatory school students' knowledge mean scores regarding preparedness for earthquakes were increased post-simulation strategy implementation with a high statistical significance after one month of simulation strategy implementation. From the researcher's point of view, this indicated the importance of introducing a simulation strategy for school students to improve their knowledge.

As a result, preparation on the part of the education system, including the curriculum, textbooks, and teachers, is essential both before and after a disaster. Farahat et al. (2017) conducted a study to assess the contribution of school-based interventions to disaster readiness. According to the study's findings (Nanda & Raina, 2019), the percentage of students who had sufficient knowledge increased

from 43% before the intervention to 68% afterward. Similar advancements were noted in studies carried out in many parts of the world (Bradley et al., 2016).

The children's participation in and aptitude for carrying out the simulation indicate an increase in preparedness to 87% following the simulation. This is consistent with the study's goal of educating children about disaster preparedness, and it meets the target for the children's capacity to provide for themselves (Finnis et al., 2019).

According to the other research, Terpstra T. (2016) also mentioned that education about catastrophe awareness that incorporates simulations into games or activities can produce superior outcomes to those which does not. The use of fictitious settings to grasp particular ideas, principles, or talents is known as simulation. The assumption that not all learning processes can be carried out directly on the actual objects allows for the use of simulation as a teaching tool and statistical evidence indicates that using an earthquake disaster awareness simulation method increases children's involvement in the simulation (Muttarak & Pothisiri, 2017).

Espina & Teng-Calleja (2015) found that using a simulation method will help children accept and understand the lesson because they can virtually perform in the real event, and it can give the children a direct experience and increase their interest and spirit to learn, so children are more willing to follow the lesson and get the desired result.

The other study by Winarni & Purwandari (2018) found that the simulation method is a good technique to use with children and that games and activities involving simulation, demonstration, and pictures about earthquake disaster mitigation are effective in enhancing understanding of the topic. Similarly, the results of Adiyoso & Kanegae (2013) concluded that the effect of schools adopting curriculum-based disaster issues on school children about disaster risk reduction is effective in increasing disaster knowledge, increasing the level of risk perception, individual preparedness, and school.

Melisa's research findings supported Fitria's (2017) conclusion that Indonesian youngsters needed to be taught about a culture of self-protection against disasters. Students may achieve this by giving youngsters access to material that is both exciting to them and simple for them to comprehend. This is due to the respondent's ability to recall and process the information gained during the intervention; it is evident through expression. According to Arif in Wahyuddin (2019), a person's knowledge is obtained from 11% of the hearing experience, 83% from vision, and 20% and 50%, respectively, from their capacity to recall what they have heard and seen.

There are differences in the knowledge scores related to the catastrophic behavior of self-rescue during the disaster between respondents who had received a disaster education exercise with the unheard-of, according to research by Finnis et al. (2018) who examined the level of knowledge, perception, and disaster preparedness applications for children in Taranaki, New Zealand.

Both Oral et al. (2015) and Lindell et al. (2015) make the same argument, stating that persons who participate in earthquake hazard exercises are more likely to be knowledgeable than not. The study also demonstrated a statistically significant rise in mean knowledge value from the pre-test to the post-test following intervention. Since the respondent had firsthand experience with the simulation action, it is predicted that the score would increase since they will be more motivated to carry out the readiness action. According to Terpstra (2016), having experience with previous disaster preparedness behaviors will increase motivation to act in future disaster preparedness.

The findings of the current study showed that there were statistically significant improvements in all items of preparatory school students' total knowledge level pre and post-simulation strategy implementation. From the researcher's point of view, this highlighted the success of simulation strategy implementation that is associated with knowledge improvements.

Findings of the current study showed statistically significant improvements in all items regarding preparatory school students' total skills during and post earthquakes pre- and one-month post-simulation strategy implementation. From the researcher's point of view, this highlighted the effectiveness of simulation strategy implementation that leads to skills improvements.

The findings of Lindell, & Whitney (2015), concluded that precautionary measures including securing fixtures and furniture are consistent with this outcome. Similar to this, (Merchant, 2015) noted that disaster go-kits, which are necessary supplies to keep on hand in case of emergency, include food, water, and other necessities. Household emergency plans, such as those for school buildings, must also include natural disasters like earthquakes (Paton, & Johnston, 2017). To deal with the effects of earthquakes, everyone involved, including the education system as a whole, needed to be prepared.

Studies carried out in Asia corroborate the conclusions of global research on education levels and catastrophe preparedness. According to studies, villages in Nepal with the highest levels of education, for instance, experience the fewest human and nonhuman casualties as a result of floods and landslides (K.C. 2018). Similar findings have been found in Indonesia, where greater education levels are associated with better post-tsunami coping (Frankenberg et al., 2018). These results demonstrate that education is a key tool for lowering Asia's susceptibility to environmental risks. To prepare for and respond to disasters, participation is necessary, according to Brooks (2018), "from the federal level down to Joe Q. Citizen (grassroots level)".

As a result, preparation on the part of the education system, including the curriculum, textbooks, and teachers, is essential both before and after a disaster. Farahat et al. (2017) conducted a study to assess the contribution of school-based interventions to disaster readiness. According to the study's findings, (Nanda & Raina, 2019) it was found that from 57% to 65% of students had good practice. Also, studies carried out in many parts of the world found similar improvements (Bradley et al., 2016).

Espina et al. (2015) stated the same thing, concluding that the experience improves people's ability to plan for disasters. Accordingly, responders' prior experience will be an asset when they eventually deal with earthquake calamities. Since the simulation procedure is enjoyable and the facilitator explains the simulation's information simply while simultaneously interspersing entertainment, it is also believed that knowledge scores and attitudes would improve. Student acceptance of the message is therefore also improved. The simulation process serves as a good example of this because the children appear eager to follow along with the exercise's simulation activities until they are finished. Specifically, Bandrova et al., (2015) study found that the presentation of information with simulated training and entertaining games makes children participate actively in educational activities.

Results of the current study demonstrated that there was a highly statistically significant correlation between total knowledge and skills among the preparatory school students after the implementation of the simulation strategy. From the researchers' point of view, this association between knowledge and skills implies that good knowledge does necessarily lead to good skills. This result reflects the benefit of administering the simulation strategy, which met the preparatory school students' needs and provided them with sufficient knowledge and skills to cope with the disaster. Also, reflected the success of the study's aim.

The present study revealed that there were correlations between the knowledge, skills, and personal data of the studied preparatory school students. This finding can be explained by the fact that the studied preparatory school students who are older and with a high school level of education had access to more information that would be helpful to them in enhancing their knowledge and skills.

Conclusion

Based on the findings of the current study, it can be concluded that using the simulation strategy improved preparatory school students' earthquake preparedness.

Recommendations

Based on the findings of the current study, the following are recommended:

- Disaster preparedness programs should be developed to include all children of different ages without discrimination.
- Traditional disaster education programs for children and new and innovative methods should be widely used.
- The involvement of various stakeholders such as family, community, government, civic institutions, and industries is essential in protecting children from disasters.
- Empowering the school health nurse to take the lead in implementing the program to enhance students' disaster preparedness is strongly recommended.
- Replication of the study is essential to strengthen confidence in the intervention's effectiveness and ensure generalizability. References

- Different innovative approaches can be applied to continue education within online and digital formats including virtual reality, digital games, and online platforms.

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