Research Article

Empowering Communities: The Impact of Digital Health Education Modules on Disaster Preparedness

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Abstract

Aims: The primary aim is to raise catastrophe awareness and preparedness, especially in disaster-prone areas. Health education and consulting by nurses using digital media like modules to teach disaster planning, first aid, and recovery can assist communities recover from disasters.

Method: This research is a Quasi Experiment research with a research design. Quasi-Experimental Two Group pretest-posttest design. The number of respondents was 60. Inclusion criteria in this study were aged 17-35 years.

Results: Mann-Whitney Test Analysis. The average value of the intervention group was greater than the control group. The Sig. (2-tiled) value shows that there is a significant influence of the Digital Module intervention on the level of disaster preparedness in the community with a p-value of 0.000 <0.05.

Conclusion: In this study, it can be concluded that the Digital Module has an influence on increasing community preparedness in the intervention and control groups, there is a significant difference.

Keywords:
Community Awareness, Digital Modules, Disaster Preparedness, Disaster Risk Reduction, Health Education

INTRODUCTION

Indonesia is geographically located in a disaster-prone zone. Natural disasters are phenomena that can occur anytime, anywhere, and cause both material and non-material losses to human life. People often perceive disasters as anomalous events, separate from "normal" life. However, in reality, disasters are a basic reflection of normal life. They result from human economic and social development, the way humans and countries interact, and how relationships between decision-makers are managed. Disasters occur when certain communities or groups settle in areas prone to such events. These disasters have caused numerous fatalities and damage to community infrastructure (Akbar, n.d.).

According to data from the National Disaster Management Agency (BNPB) as of December 4, 2022, there have been 3,318 natural disasters across Indonesia. The most common disaster was flooding, with 1,420 incidents, accounting for 42.8% of total disaster events. Additionally, there were 989 extreme weather incidents, 608 landslides, and 250 forest and land fires (karhutla) during this period. Other incidents included 25 earthquakes, 22 tidal waves/abrasion events, and 4 drought incidents.

West Java was the province most affected by natural disasters, with 775 incidents, followed by Central Java and East Java with 457 and 380 incidents, respectively. These disasters displaced more than 5.7 million people, resulted in 563 deaths, 8,694 injuries, and 43 missing persons. Furthermore, 72,218 houses were damaged, with 13,842 severely damaged, 17,210 moderately damaged, and 41,166 lightly damaged.

In 2022, Bandung City in West Java experienced 22 natural disasters that affected 621 people. Coordination among various parties was established to anticipate future disasters, such as the creation of disaster alert villages. The Bandung City Disaster Management Coordination Meeting on October 10, 2022, revealed that three main disasters occurred: floods, landslides, and tornadoes. Floods, with 9 incidents, affected 503 people, while two landslides affected 13 people, and 11 tornadoes impacted 105 people. Compared to the previous year, the number of natural disasters had increased. In 2021, only three floods, landslides, and strong winds were reported (2,3). The large number of incidents and impacts indicates a lack of disaster preparedness in the community.

Preparedness is an integral part of the disaster management process. It involves mobilizing the community to reduce disaster risks and minimize losses after a disaster occurs. Disaster Preparedness Training is essential in building a safe and resilient culture, particularly for children and adolescents. This training includes self-rescue techniques during disasters and avoiding preventable accidents in everyday life (3).

One effective method for expanding knowledge is simulation-based training. Disaster management simulations can be used as a tool to develop practical skills in the field (4). In this digital era, which is often referred to as the age of globalization, technology and the internet are easily accessible and highly influential.

Nurses play a critical role in helping victims, saving lives, providing emergency nursing care, and maintaining public health (5). Nurses are involved in three stages of disaster management: pre-disaster (pre-event), during the event, and post-disaster (recovery). In the pre-disaster stage, nurses can provide education and training on preparedness to reduce disaster risk through simulation exercises. Nurses should also pay attention to early warnings issued by local or provincial governments, mobilize from the disaster site to designated post areas, and assist with evacuations. In the post-disaster stage, nurses help the community return to normal life through consultation and education.

The use of digital modules in disaster preparedness is crucial. Digital modules are non-printed, systematically organized teaching tools designed for independent learning. These modules can be accessed via smartphones and gadgets, making them available anytime and anywhere. As a medium for community education, digital modules aim to shift people's attention from using smartphones solely for social media to using them for learning about disaster preparedness. With engaging content such as e-books, videos, and audio, digital modules can help improve community literacy and increase disaster preparedness (6).

According to a meta-analysis on Digital Education and Disaster Preparedness (2021), digital-based learning, including digital modules, is more effective than traditional methods in improving disaster preparedness. This is due to the flexibility and accessibility that digital media offers, allowing users to learn at their convenience. Compared to printed materials, digital modules are more practical, durable, and can include multimedia elements like audio and video in one presentation. Each learning activity can be assigned a keyword, ensuring that learners master one concept before moving to the next. This approach

allows for a structured and progressive learning experience (7).

Research by (8) found that students' knowledge of disaster preparedness was lacking, with a score of 29.82. The awareness of disaster preparedness in Indonesia has not been fully optimized, both among students and local residents. Other studies have also shown that integrated Digital Modules for preparedness are not widely developed. However, some research indicates that integrated disaster mitigation teaching materials have had a positive effect on the community (9). Additionally, research by Khair and Fauzi showed that the development of e-books significantly improved knowledge (93%), skills (92%), and attitudes (64%) in students regarding natural disasters.

A study on Community-Based Disaster Risk Reduction through Digital Education Modules found that distributing digital modules via mobile devices in disaster-prone communities helps improve knowledge and preparedness. This method also allows for the rapid dissemination of information, especially in hard-to-reach areas. Given the importance of the topic, this research titled " Empowering Communities: The Impact of Digital Health Education Modules on Disaster Preparedness" aims to investigate how digital modules influence disaster preparedness in communities.

METHODS

Study Design
This study employs a quantitative research design using a Quasi-Experimental Two-Group pretest-posttest design. Quasi-experimental research aims to examine the effects or symptoms resulting from a specific treatment or intervention (10). In this study, there are two groups: the intervention group and the control group. The effect of the intervention is assessed by comparing the pretest and posttest values (11). This method is used to evaluate the impact of digital modules on community disaster preparedness. In a quasi-experiment, an intervention is applied to the research subjects, and the resulting effects are measured and analyzed. The study focuses on the influence of health education through digital modules on disaster preparedness, with assessments conducted before and after the intervention.

Location and Time of Research
The location taken in this study was in Baleendah District, Bandung Regency. The research time was carried out during, starting from 17-24 July 2023. Baleendah was chosen as the location for research on disaster preparedness using digital modules because this area has a high vulnerability to disasters, especially floods, which often occur. The level of public knowledge about disaster preparedness in this area still needs to be improved, making it suitable for testing the effectiveness of digital modules. In addition, technological accessibility in Baleendah is quite good, allowing for effective distribution and use of digital modules. Local government support and local community cooperation also provide opportunities to implement this research well, and demographic variations in Baleendah can provide more comprehensive research results.

Sample population
The population for this study was calculated using G*Power software version 3.1, utilizing a t-test, correlation: point biserial model with a two-tailed assumption, $\alpha=0.05$, and a power level of 0.95. Based on these parameters, the total sample size required was 54 respondents. Considering an attrition rate of 10%, an additional 6 respondents were added, bringing the total sample size to 60 respondents. The sampling technique used in this study is purposive sampling.

Instrument
The instrument used in this research is the Household Emergency Preparedness (HEP) questionnaire, which includes actions and empirical references that represent disaster

preparedness. Increasing HEP levels can save lives, prevent the worsening of chronic medical conditions, and reduce the likelihood of individuals facing dangerous situations when helping those in need. The HEP consists of five components: Preparedness Actions, Communication Plans, Evacuation Planning, Disaster Supplies, and Access or Functional Needs. The questionnaire contains 51 questions, which will be completed by respondents via a Google Form. The questionnaire utilizes a Likert scale, with responses ranging from 1 = Least important, 2 = Slightly unimportant, 3 = Neutral, 4 = Important, to 5 = Very Important (Heagele et al., 2020).

Ethical Consideration
In this study, ethical guidelines were followed to protect participants' rights and well-being. Participants were fully informed about the study's purpose, risks, and benefits before giving their consent to join. Participation was voluntary, and they were free to withdraw at any time without any consequences. To protect privacy, participants' personal data was anonymized

and securely stored. The study aimed to provide benefits, such as increasing disaster preparedness through digital modules, and ensured fair treatment for all participants. Transparency was maintained by providing honest and clear information to participants throughout the process. These ethical measures ensured the study was conducted with respect and integrity.

Data analysis
This study includes univariate and bivariate analyses, as well as validity and reliability tests. Bivariate analysis was used to test the relationship between variables. A normality test using the Kolmogorov-Smirnov approach showed that the data was not normally distributed (pretest p-value 0.20 < 0.05 and posttest p-value 0.000 < 0.05). As a result, bivariate analysis was performed using the Wilcoxon Signed Rank test and the Mann-Whitney test. Additionally, validity and reliability tests were conducted to ensure the accuracy and consistency of the instruments used to measure disaster preparedness.

RESULTS

Table 1. Demographic characteristics of respondents

Variable Group		Intervention N (%)	Control N (%)
Age	Mean	27.47	27.93
	Std. Deviation	5.124	5.146
Gender	Woman	20 (33.3%)	16 (26.7%)
	Man	10 (16.7%)	14 (23.3%)

Table 1 shows the mean age in the intervention group is 27.47 with a standard deviation of 5.124. In the control group the mean age is 27.93 with a standard deviation of 5.146. The gender data in both groups shows more female gender. In the intervention group, there were 20 female genders (33.3%) and in the control group, there were 16 female genders (26.7%).

Table 2. Description of disaster preparedness before and after intervention was given to the intervention group and control group

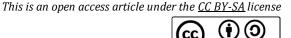| Variable	Intervention		Control	
	Range Min-Max	Mean ± SD	Range Min-Max	Mean ± SD
Pretest	45 – 56	50.80 ± 3.134	43 – 56	50.20 ± 3.367
Posttest	96 – 113	106.97 ± 3.891	45 – 56	± 3,013

Table 2 shows an increase in the respondents' disaster preparedness scores. These scores were obtained from the *Household Emergency Preparedness* (HEP) questionnaire. The mean score in the intervention group was 50.80 for the pretest and 106.97 for the posttest. In the control group, the pretest score was 50.20 and the posttest score was 50.60. There was a significant increase in disaster preparedness in the intervention group compared to the control group.

Table 3. Differences in disaster preparedness before and after intervention in the intervention group and control group

	Group	N	Mean Rank	Z	p-value
Intervention Group	Negative Ranks	0	0.00		
	Positive Ranks	30	15.50	- 4,787	0.000
	Ties	0			
Control Group	Negative Ranks	2	4.25		
	Positive Ranks	6	4.58	- 1,340	0.180
	Ties	22			

Table 3 shows that there are 30 positive difference data or positive ranks in the intervention group, which means that there are 30 people who experienced an increase in disaster preparedness in the community. While in the control group, there were 2 data on the negative rank or negative difference which showed that there were 2 people who experienced a decrease in disaster preparedness. In the control group, there were 6 data on the positive ranks which means that there were 6 people who experienced an increase in disaster preparedness and 22 people whose preparedness did not change. From the data obtained *p-value* before and after the intervention in the intervention group showed a value of 0.000 which means there is a difference in the disaster preparedness value between the pretest and posttest in the intervention group. The *p-value* in the control group was obtained at 0.180 which means there is no difference in the level of disaster preparedness between the pretest and posttest in the control group. It can be concluded that the intervention group has a significant *p-value or there is a difference in the pretest and posttest values in the intervention group.*

Table 4. Differences in disaster preparedness after intervention between the intervention group and the control group

Variable	Mean Rank	Std. Deviation	Z	p-value
Intervention Group	45.50			
Control Group	15.50	28,630	-6.665	0.000

Table 4 shows the results of the *digital module intervention* on the level of community disaster preparedness, *Mann-Whitney Test analysis* . The average value of the intervention group was greater than the control group. The Sig. (2-tiled) value shows that there is a significant influence of the *digital module intervention* on the level of disaster preparedness in the community with a *p-value* of 0.000 <0.05. This shows a significant difference after the *digital module intervention was carried out.* between the control group and the intervention group.

DISCUSSION
Description of Respondents' Demographic Characteristics (Age and

Gender) in the Intervention Group and Control Group

In this study, the average age in the control group was higher than in the intervention group, with a difference of 27.93 years. This was likely due to random sampling, where the control group had more respondents over 30 years old. Preparedness is a shared responsibility between the community and the government. Similar research (12) shows that adults are more prepared than teenagers, as older individuals tend to have more experience and mature planning for disasters. However, older adults may face physical limitations due to age, which can hinder preparedness (13). This aligns with the theory (14) suggesting that younger people generally have a better understanding of disaster preparedness, while those aged 20-35 are often more active in community roles, improving disaster response (15). Regarding gender, women dominated both groups, with 20 women (90%) in the intervention group and 16 women (26.7%) in the control group. This aligns with other research (16) which found more women involved in disaster preparedness. Women are often more engaged in social networks, which helps them spread information and coordinate relief efforts (17). Studies (3,4) also show that women have a better understanding of disaster risks and preparedness. However, some theories suggest that men may be more prepared due to their roles in decision-making and resource access (3,18)

Overview of Disaster Preparedness Before and After Intervention Given to the Intervention Group and Control Group.

Table 2 shows that the intervention group experienced a greater increase in disaster preparedness compared to the control group. In the intervention group, the mean pretest score was 50.80, and the posttest score was 106.97. In contrast, the control group had a mean pretest score of 50.20 and a posttest score of 50.60. This demonstrates a significant increase in preparedness in the intervention group after receiving the digital module intervention, leading to a noticeable improvement in their disaster preparedness levels. Therefore, it can be concluded that the intervention group's preparedness improved more than the control group's.

These findings are consistent with the research of (9), which also showed an increase in disaster preparedness using e-modules. In their study, student preparedness increased from an average of 62.5% at the first meeting to 82.4% by the third meeting. This increase can be attributed to several factors, including heightened awareness and improved attitudes toward disaster preparedness. Additionally, the material in the digital module was tailored to the understanding of laypeople, making it easy to comprehend and accessible for repeated review on smartphones. According to (19), regularly practicing preparedness can greatly enhance the community's ability to quickly take the correct actions and respond effectively during a disaster. Another factor that may contribute to improved preparedness is the community's past experience with disasters. Such experiences often serve as valuable lessons, enabling individuals to better handle similar situations in the future (20).

Differences in Disaster Preparedness Before and After Intervention in the Intervention Group and Control Group

The results in Table 3 show the findings from the Wilcoxon Signed Rank Test. In the intervention group, the p-value before and after the intervention was 0.000, while in the control group, the p-value was 0.180. This indicates a significant difference in the increase in preparedness between the two groups, with the intervention group showing a substantial improvement. The increase in preparedness in the intervention group can be attributed to the digital module, a technology-based

intervention designed to enhance community readiness for disaster preparedness. The digital module encourages individuals to learn independently about potential disasters in their area, fostering a sense of responsibility for their actions (21). With improved disaster preparedness, the community becomes better equipped to plan and prepare for disasters. While disasters may not always unfold as expected, the community can at least minimize risks and potential damage.

Additionally, the digital module is practical and portable, allowing users to access it anywhere and anytime. Unlike printed materials, it is durable and can include multimedia elements such as audio and video. Each learning activity is designed with keywords that help lock in knowledge, making it easier for the community to complete learning activities in a structured and efficient manner (7).

The findings of this study align with the research conducted by (22), where a significant difference in disaster preparedness was observed between the pretest and posttest in the treatment group, after receiving a volcanic disaster module intervention. In this study, observations showed that the community found the digital module more practical to access. Since it was available on smartphones, the module could be easily accessed, reviewed, and read anywhere and anytime. Furthermore, the user-friendly language and attractive design kept the community engaged and motivated to read the module, ultimately enhancing their disaster preparedness.

Differences in Disaster Preparedness After Intervention Between the Intervention Group and the Control Group

Table 4 presents the results of the use of digital modules on community disaster preparedness, analyzed using the Mann-Whitney Test. The results indicate a significant effect of the digital module intervention on community preparedness, with a p-value of 0.000. This value suggests a notable difference in disaster preparedness between the intervention group and the control group after the digital module was introduced.

These findings align with the research by (23), which examined the impact of e-modules on students' disaster preparedness. Their study also found a significant difference between the control and intervention groups, with a p-value of 0.000, confirming the effectiveness of e-modules in enhancing preparedness.

Digital modules play a crucial role in improving community disaster preparedness. Increasing preparedness helps mitigate risks and reduces the potential damage caused by disasters. As noted by (8), Indonesia ranks second after Bangladesh in terms of the highest death tolls from natural disasters in the Asia-Pacific region, with significant economic damage and loss of life over the past two decades. Given these statistics, it is essential to focus on improving disaster preparedness before disasters strike. Interventions like digital modules are essential for enhancing community preparedness. A module is a structured set of learning materials designed for self-study, and when delivered digitally, it becomes more accessible and convenient. According to (24), digital modules can provide the community with systematic, attractive, and self-paced learning that improves disaster preparedness. The advantages of digital modules include their portability (accessible via smartphones), durability, and multimedia features such as audio and video. These elements make learning more engaging and help lock in the knowledge necessary for disaster preparedness. The digital module thus plays a vital role in improving community readiness, allowing individuals to better prepare for potential disasters in their environment. Thorough preparation can lead to more effective and efficient responses when disaster strikes.

CONCLUSION

The research conducted in Baleendah District, Bandung Regency, demonstrates the positive impact of health education using digital modules on disaster preparedness in the community. The findings indicate that age and gender significantly influence disaster preparedness, with older individuals generally exhibiting more mature preparedness plans, and women playing a crucial role in disseminating information and organizing relief efforts. The data also shows that the intervention group, which received education through digital modules, experienced a notable improvement in their level of disaster preparedness compared to the control group. This improvement was evident both before and after the intervention, suggesting that digital modules are an effective tool in enhancing disaster preparedness. Therefore, incorporating digital health education in disaster management programs can significantly contribute to better preparedness, especially in communities at high risk for natural disasters.

Conflict of Interest
The author states that there is no conflict of interest in this research

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