



Effect of a digital family disaster plan e-book on earthquake preparedness among anesthesia nursing students

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ABSTRACT

Background: Indonesia, part of the Pacific Ring of Fire, experiences significant seismic activity. The Special Region of Yogyakarta is particularly susceptible to earthquake hazards, emphasizing the need to strengthen disaster preparedness awareness. A digital family disaster plan (FDP) was designed as an educational resource to guide families during earthquakes.

Purpose: This study aims to examine the effect of the digital Family Disaster Plan (FDP) on the earthquake preparedness of second semester anesthesia students at Universitas 'Aisyiyah Yogyakarta (UNISA).

Methods: This study employed a one-group pretest-posttest pre-experimental design and was analyzed using the Wilcoxon signed-rank test. The sample consisted of 64 second semester anesthesia students from Universitas 'Aisyiyah Yogyakarta, selected through random sampling. Data collection was conducted using a preparedness questionnaire.

Results: Female respondents constituted the majority (59.4%). Baseline assessment showed 87.5% were unprepared prior to the intervention. After exposure to the digital FDP, 89.1% were classified as prepared. The Wilcoxon signed-rank test showed a statistically significant improvement in preparedness scores ($p < 0.001$), indicating the intervention was associated with improved disaster preparedness.

Conclusion: The Digital Family Disaster Plan E-book intervention was associated with improved earthquake preparedness scores among second-semester anesthesia students at UNISA. However, this study was limited using a pre-experimental one-group design; therefore, future studies using randomized controlled trials are recommended to confirm the effectiveness of digital Family Disaster Plan interventions.

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1. Background

Indonesia is highly susceptible to earthquake hazards due to its location at the convergence of three major tectonic plates, namely the Eurasian, Pacific, and Indo-Australian Plates. Furthermore, the country is situated within the Pacific Ring of Fire, one of the most seismically active regions globally, where the majority of the world's earthquakes occur. These geotectonic characteristics expose nearly all regions of Indonesia to varying levels of earthquake risk[1].

The Special Region of Yogyakarta represents one of the area most vulnerable to natural disasters in Indonesia. In addition to its exposure to seismic activity, the region is also threatened by eruptions from Mount Merapi, one of the most active volcanoes in the world. Its location within an active tectonic zone substantially increases the likelihood of disasters that may result in considerable human casualties and economic losses[1],[2].

The vulnerability of Yogyakarta was clearly demonstrated during the Bantul earthquake on May 27, 2006, which registered a magnitude of 5.9. This catastrophic event resulted in approximately 5,700 fatalities, injured tens of thousands of individuals, and caused severe damage to hundreds of thousands of residential buildings. Beyond the immediate physical destruction, the disaster generated prolonged social, economic, and psychological consequences for affected communities[2].

The extensive impacts associated with disasters underscore the critical importance of disaster preparedness. Preparedness encompasses a range of pre-disaster measures aimed at reducing vulnerability, protecting human life, minimizing property damage, and maintaining community resilience. It involves both physical and psychological readiness to effectively respond to potential disaster events[3].

In earthquake-prone regions, preparedness is recognized as a key determinant in reducing mortality and morbidity during disaster events. Practical measures, including knowledge of evacuation procedures, availability of emergency supplies, preparedness of first-aid equipment, and understanding of self-protection strategies, can significantly enhance individual and community survival during earthquakes[4].

The increasing occurrence and consequences of natural disasters in Indonesia necessitate the implementation of sustainable disaster risk reduction and preparedness programs. Effective disaster planning requires continuous assessment, monitoring, and adaptation to evolving risks in order to mitigate casualties and material losses. Consequently, disaster preparedness should be regarded as a shared responsibility involving governmental institutions, communities, and individuals[5].

University students constitute an important target group for disaster preparedness initiatives because of their potential role as agents of change within society. As members of the academic community, students are positioned not only to acquire disaster-related knowledge but also to disseminate information to their families and broader communities, thereby fostering greater public awareness and preparedness[6].

Despite their strategic role, previous studies have reported that students often demonstrate inadequate levels of disaster-related knowledge and preparedness. Evidence suggests that many

students possess limited understanding of disaster management principles and exhibit insufficient readiness to respond effectively to emergency situations. These findings highlight the necessity of educational interventions designed to strengthen disaster preparedness among university populations[7],[8].

Family involvement is equally essential in disaster preparedness efforts. As the fundamental social unit, families serve as the primary source of support and protection during emergencies. Nevertheless, many households remain inadequately informed regarding evacuation routes, early warning systems, designated assembly points, and the management of vulnerable populations, including children and older adults, during disaster situations[9], [10].

Recent advances in information and communication technology have expanded opportunities for delivering disaster education through digital platforms. One such approach is the use of electronic books (e-books), which integrate various forms of multimedia content, including text, images, audio, and video. The accessibility and flexibility of e-books enable users to obtain information anytime and anywhere, thereby enhancing the dissemination and effectiveness of disaster preparedness education.

Previous studies have explored various digital-based interventions for improving disaster preparedness, including online learning modules, mobile applications, and electronic educational materials. These approaches have demonstrated potential in increasing disaster knowledge and awareness among students and communities. However, existing digital interventions have predominantly focused on general disaster information delivery and have not extensively incorporated family-centered preparedness planning. In addition, evidence regarding the effectiveness of digital Family Disaster Plan (FDP) interventions among university students remains limited. The FDP E-book in this study provides a distinctive approach by integrating disaster knowledge with practical family preparedness strategies, including emergency planning, evacuation procedures, preparation of emergency supplies, and individual roles during earthquake events. Therefore, this study was conducted to evaluate the effectiveness of a Digital Family Disaster Plan E-book in improving earthquake preparedness among anesthesia nursing students.

Considering these circumstances, this study aims to examine the effect of a Family Disaster Plan (FDP) e-book on earthquake preparedness among second-semester Anesthesiology Nursing students at Universitas 'Aisyiyah Yogyakarta. The study is driven by the need to strengthen preparedness among students, particularly those originating from regions outside Yogyakarta, so that they are better equipped to respond to earthquake hazards and can contribute to improving disaster preparedness within their families and communities.

2. Methods

2.1 Research design

This study employed a one-group pretest-posttest pre-experimental design and was analyzed using the Wilcoxon signed-rank test to evaluate the effectiveness of digital family disaster planning education in improving students' earthquake preparedness behavior.

2.2 Setting and sample

The study was conducted at Universitas 'Aisyiyah Yogyakarta, serving a diverse student population from remote areas across the Indonesian archipelago. The participants included anesthesia students aged 19-21 years who had been new student second semester in this university. A simple random sampling technique was used to ensure representation across age groups, genders, and histories. Participants were selected using a computer-generated random number from the list of eligible second-semester anesthesia nursing students. The final sample size was 64 participants, based on a priori calculations to ensure sufficient statistical power for Wilcoxon analysis.

2.3 Intervention: Digital Family Disaster Plan E-book

The intervention consisted of a Digital Family Disaster Plan (FDP) E-book used as an educational medium to improve earthquake preparedness among anesthesia nursing students. The E-book contained information regarding earthquake risks, family disaster planning, evacuation procedures, emergency supply preparation, and individual and family responsibilities during disaster situations. The educational materials were presented using structured text, illustrations, infographics, and step-by-step practical guidance to facilitate students' understanding and application of disaster preparedness actions.

Participants were instructed to independently read and study the E-book for seven days. The estimated reading duration was approximately 20–

30 minutes per session according to participants' availability. During the intervention period, participants received reminders to encourage completion of the educational material. Completion of the intervention was monitored through participant confirmation and self-report after reviewing the E-book.

2.4 Instruments and data collection

Data were collected through self-administered questionnaires. The instruments included: A validated knowledge assessment tool consisting of 21 questions Likert scale covering digital family disaster planning measures. The tool's reliability was evaluated through a pilot test with a Cronbach's alpha score of 0.962, indicating high internal consistency.

The questionnaires were reviewed for linguistic appropriateness and cultural relevance by a panel of experts. Participants were guided on how to complete the questionnaires to minimize misunderstandings.

Participants were asked to confirm their responses with assistance from guardians to minimize recall bias. Social desirability bias was addressed by ensuring anonymity and emphasizing that there were no "right" or "wrong" answers to the questionnaire.

2.5 Data analysis

Pretest-posttest with Wilcoxon statistics were employed to analyze the data. Frequencies and percentages were used to summarize demographic characteristics and knowledge levels, with a significance level set at $p < 0.05$. All analyses were conducted using SPSS software (version 26).

2.6 Research ethics

Ethical approval was obtained from the Ethics Committee of Aisyiyah University (Approval No. 62/FIKES-KAN/AU/III/2025). All participants and their legal guardians were fully informed about the study's purpose, procedures, anticipated benefits, and confidentiality protections prior to recruitment. Written informed consent was secured from both participants and their guardians before data collection commenced. Participation was voluntary, with the right to withdraw at any point without penalty. All research activities were conducted in compliance with recognized ethical standards, and strict measures were implemented to preserve participant anonymity and data confidentiality throughout the study.

3. Results

A total of 64 anesthesia students participated in the study. The findings reveal a significant

impact between education and preparedness behavior.

Table 1. Demographic Characteristics of Respondents (n = 64)

Characteristics	Frequency	Percentage
Gender		
Male	26	40.6 %
Female	38	59.4 %
Age Group		
19 years	28	43.75 %
20 years	34	53.13 %
21 years	2	3.13 %

Demographic analysis demonstrated that female respondents were more prevalent than male respondents, accounting for 59.4% and 40.6% of the

sample, respectively. The age distribution indicated that participants aged 20 years formed the largest age group, representing 53.13% of all respondents.

Table 2. Characteristics of Respondents' Preparedness Based on the Pre-Test Before the Provision of the E-Book

Preparedness Level	Frequency	Percentage
Prepared	0	0%
Less Prepared	8	12.5 %
Not Prepared	56	87.5 %
Total	64	100%

Pre-test assessment results showed that the respondents' preparedness levels before the E-book intervention were predominantly classified as not prepared, accounting for 56 participants (87.5%). The remaining 8 participants (12.5%) were

categorized as less prepared, and none achieved the prepared category. These findings suggest that most respondents exhibited inadequate preparedness prior to the intervention.

Table 3. Characteristics of Respondents Preparedness Based on the Post-Test After the Provision of the E-Book

Preparedness Level	Frequency	Percentage
Prepared	57	89.1%
Less Prepared	1	1.6 %
Not Prepared	6	9.4%
Total	64	100%

Following the E-book intervention, most respondents achieved a prepared level of preparedness, accounting for 57 participants (89.1%). In contrast, 6 respondents (9.4%) were categorized as not prepared and 1 respondent

(1.6%) as less prepared. These findings indicate that the intervention was associated with a marked increase in preparedness levels among the participants.

Table 4. Differences in Student Preparedness Level Before and After Intervention

Variable	<u>Pre-Test</u>			<u>Post-Test</u>			<i>p</i>
	<i>f</i>	Mean	S. D	<i>f</i>	Mean	S. D	
Preparedness Level	64	1,13	0.333	64	2,80	0,596	0.000

The Wilcoxon signed-rank test demonstrated a statistically significant improvement in

preparedness following the intervention ($p < 0.001$), indicating that the Family Disaster Plan E-Book

effectively enhanced earthquake preparedness among second-semester Anesthesia students at UNISA Yogyakarta.

4. Discussion

Several factors are believed to influence disaster preparedness, including sex, age, education, experience, income, race, and property ownership. Adequate information flow and sufficient infrastructure enable individuals to develop the competence and responsiveness needed to face disasters without gender-based discrimination. In practice, however, disaster response is often dominated by men in decision-making and resource coordination, whereas women are more frequently involved in food provision teams in public kitchens or in caring for children affected by disasters[10],[11].

Disaster preparedness is an essential competency that should be instilled in anesthesia nursing students. Indirectly, preparedness among anesthesia nursing students is important because it helps them understand the significance of assisting disaster victims and reducing disaster-related mortality and morbidity. Previous studies have shown that community preparedness is often classified as not ready when facing the risk of earthquakes if a disaster occurs suddenly. This low level of preparedness is generally caused by insufficient knowledge about earthquakes, suboptimal emergency response planning, and low community participation in disaster preparedness training[12],[13].

At the individual level, preparedness can be improved through training on self-rescue and assisting others, coordination among related parties, evacuation to safe places, preparation of emergency equipment, first aid for injured persons, and rapid recovery efforts. In this study, preparedness improvement was delivered through digital media in the form of an E-Book, which was designed to allow readers to access information anytime and anywhere, removing barriers to education about earthquake preparedness. The results showed an increase in students' preparedness after reading the Family Disaster Plan E-Book[14].

The improvement in the "ready" category indicates that E-Book-based educational media can serve as an effective and efficient learning tool. The E-Book, written in communicative language, containing locally relevant content, and supported by attractive visual presentation, successfully

encouraged improvements in knowledge, awareness, and disaster-response attitudes among most respondents. This digital medium also enabled students to study independently, flexibly, and repeatedly according to their time and learning needs[15].

Nevertheless, a small number of respondents remained in the "less prepared" and "not prepared" categories. This may be explained by several factors, such as differences in individual learning ability, concentration while accessing the material, and internal motivation to absorb information. Not all respondents may have read or fully understood the E-Book. In addition, psychological factors such as anxiety or fear of disasters may also influence an individual's preparedness level, even after receiving education[16][17].

Overall, this study demonstrates that the E-Book as a disaster preparedness educational medium had a positive effect on improving anesthesia students' readiness to face earthquakes, although further evaluation is still needed regarding individual barriers that prevented a small number of respondents from becoming fully prepared. This finding can be explained by the Health Belief Model, which states that, in addition to knowledge, perceived threat, self-efficacy, and personal barriers also influence an individual's readiness to respond to risk[18],[9].

Thus, even after education through the E-Book, individuals with low-risk perception or insufficient confidence in taking emergency action may still remain unprepared. These findings suggest that the E-Book may be a useful educational intervention, although its effectiveness may still be influenced by internal respondent factors such as motivation, prior experience, and perception of disaster threat. This is consistent with disaster preparedness theory, which states that preparedness is the result of interactions among knowledge, risk perception, self-efficacy, and social norms[8], [19].

In this study, students who previously had not realized the importance of individual roles in disaster planning began to show awareness and initiative in preparing family emergency plans, reflecting improved self-efficacy. From the perspective of learning media, the use of E-Books has also proven effective in improving students' understanding. This aligns with Cognitive Theory

of Multimedia Learning, which states that learning becomes more effective when visual and verbal information are presented simultaneously. The Family Disaster Plan E-Book presents information in the form of text, images, infographics, and step-by-step disaster response illustrations, making the material easier for students to understand and remember[20].

However, although students' understanding improved, not all of them immediately applied concrete actions such as preparing emergency bags or conducting family discussions. This phenomenon can be explained by the Behaviour Change Wheel model, which states that effective behavior change occurs when capability, motivation, and opportunity are available. In this case, students gained capability and motivation after reading the E-Book, but they still lacked sufficient opportunity to implement the knowledge due to time limitations, financial constraints, or limited environmental support[14].

The findings are also supported by previous studies showing that although students are interested in disaster issues and understand the importance of preparedness, not all of them take direct action. This indicates that digital education such as E-Books is effective as an initial step, but it needs to be supported by direct practice or simulation so that behavioral change becomes more concrete. In addition, the findings are consistent with the national disaster literacy policy launched by BNPB, which emphasizes the importance of using digital media to deliver disaster-related information to the younger generation[21].

BNPB states that digital literacy is a key strategy in building a disaster-resilient society. In this context, the use of an E-Book as an educational medium is an appropriate approach and consistent with national policy direction. Therefore, based on theoretical analysis and alignment with the study findings, it can be concluded that the E-Book is an effective medium for improving students' cognitive preparedness, although actual behavioral change still requires external support such as training, simulation, and active participation from the surrounding environment[22].

The Wilcoxon test results showed a significance value of $p = 0.000$, which is less than 0.05, indicating a statistically significant difference in students' preparedness levels before and after the intervention. This means that the Family Disaster Plan E-Book had a positive effect on improving students' preparedness for earthquake disasters.

Specifically, the pre-test mean preparedness score was 1.13 with an SD of 0.333, while the post-test mean increased to 2.80 with an SD of 0.596[23].

According to Field, the Wilcoxon test is highly appropriate for pre-post designs that do not meet the assumption of normality. The advantage of this method is its ability to detect significant differences even when the data are not normally distributed or are ordinal in nature. Sugiyono also emphasizes that the Wilcoxon test is suitable for studies involving repeated measurements on the same subjects, such as this study, which measured students' preparedness before and after an educational intervention. Previous research by Sarwadhamana et al. also used the Wilcoxon test to evaluate the effectiveness of disaster preparedness education among students and found a significant increase in both knowledge and preparedness[23],[24],[25].

This study has several limitations that should be considered when interpreting the findings. First, the use of a one-group pretest-posttest pre-experimental design without a control group limits the ability to determine whether the observed improvement in preparedness scores was solely attributable to the Family Disaster Plan E-book intervention. Second, this study was conducted at a single university involving anesthesia nursing students, which may limit the generalizability of the findings to other student populations and educational settings. Third, the relatively small sample size may have reduced the ability to represent broader characteristics of university students. Fourth, the measurement of preparedness was based on a self-reported questionnaire, which may have been influenced by response bias. Fifth, the short follow-up period did not allow evaluation of whether improvements in preparedness were maintained over time. Future studies involving randomized controlled trials, larger sample sizes, multiple institutions, and longer follow-up periods are recommended to provide stronger evidence regarding the effectiveness of Digital Family Disaster Plan E-book interventions.

5. Conclusion

Prior to the E-Book intervention, most students demonstrated a low level of preparedness across the domains of knowledge, attitude, and behavior. This was evident from their limited understanding of appropriate evacuation procedures, the role of families in disaster response,

and the absence of concrete preparedness actions, such as preparing an emergency supply bag.

After reading and examining the contents of the Family Disaster Plan E-Book, a significant improvement was observed in a) conceptual understanding of disaster mitigation, b) awareness of the roles of individuals and families in emergency planning, and c) intention to undertake practical preparedness measures.

These findings suggest that digital educational media, such as E-Books, can serve as an effective strategy for enhancing disaster literacy among university students. The use of the E-Book as an educational intervention was shown to improve the preparedness of anesthesia students at Universitas 'Aisiyiah Yogyakarta, particularly in responding to earthquake-related disaster risks.

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