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Improving Disaster Preparedness of Families: "Keluargasiaga" Application Development

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ABSTRACT

Indonesia, located in the Pacific Ring of Fire, is highly vulnerable to various natural disasters such as earthquakes, tsunamis, floods, and volcanic eruptions. Despite significant efforts to mitigate risks, family preparedness in facing disasters remains inadequate, particularly in terms of access to relevant information and training. To address this gap, this study developed "Keluargasiaga," a web-based application designed to enhance family disaster preparedness through self-assessment and educational features. The application integrates two core components: (1) a self-assessment tool called KAGANA (Family Disaster Preparedness), which evaluates general family readiness, and (2) educational modules, including E-Ben (Disaster Awareness Education), E-PDB (Early Disaster Warning Education), E-PEDE (Self-Rescue Education), E-VAPER (Evacuation and First Aid Education), and KITANA (Disaster Preparedness Kit). These modules provide families with essential knowledge and skills to prepare for and respond to disasters effectively. The development of "Keluargasiaga" followed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). After development, the application underwent functionality testing with 15 families around Universitas Pembangunan Nasional "Veteran" Jawa Timur. Feedback indicated that the platform was easy to use, visually appealing, and provided clear and understandable content. All participants rated the application highly in terms of user-friendliness, design, information quality, and overall satisfaction. By enabling families to assess their preparedness and engage in self-education, "Keluargasiaga" aims to empower households to create disaster-resilient environments. This application has the potential to contribute significantly to disaster risk reduction efforts in Indonesia and strengthen community resilience.

Keywords: Disaster mitigation, Family readiness, Integrated technology, Resilient families

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Introduction

Natural disasters are global phenomena that can affect any country; however, the characteristics and responses of each nation may vary significantly depending on geographical conditions, infrastructure readiness, and disaster management systems (Kourtit et al., 2023). The Philippines, Japan, and Indonesia are all located within the Pacific Ring of Fire, a region prone to earthquakes and volcanic eruptions, and frequently impacted by storms and floods (Bollettino et al., 2020; Ayuningtyas et al., 2021; Nishiyama & Glauberman, 2022). The Philippines is particularly vulnerable to tropical cyclones, flash floods, and earthquakes. The country experiences an average of approximately 20 tropical storms annually, with its susceptibility further exacerbated by densely populated coastal areas and informal housing (Santos, 2021). Japan also faces a high level of disaster risk, especially from earthquakes and tsunamis. One of the most catastrophic events occurred in 2011, leading to the Fukushima nuclear disaster (Widiandari, 2021). Similarly, Indonesia encounters substantial threats from volcanic eruptions, earthquakes, tsunamis, and flooding (Yulianto et al., 2021). Each year, Indonesia experiences numerous natural disasters that result in both material losses and casualties (Mohadih, 2024). According to the 2023 World Risk Index (WRI), Indonesia ranks as the second-highest disaster risk country, with a risk index score of 43.5%, following the Philippines, which holds the highest position (Monalia & Noorratri, 2024). The Indonesian National Disaster Management Authority (BNPB) reported that between January 1 and December 31, 2023, a total of 4,936 natural disaster events occurred in the country. These included 31 earthquakes, 4 volcanic eruptions, 31 tidal waves and coastal abrasions, 168 drought events, 579 landslides, 1,155 extreme weather incidents, 1,166 floods, and 1,802 forest and land fires. These disasters led to 262 fatalities, 33 missing persons, 5,781 injuries, and the displacement of 8,823,307 individuals (Khomariah & Susilowati, 2024).

Preparedness is a series of efforts undertaken by organizations, families, and individuals to prevent the loss of life, property damage, and disruption to societal structures in the future (Yustisia et al., 2024). Japan faces significant disaster preparedness challenges due to its geographical conditions, which render the country highly susceptible to earthquakes, tsunamis, volcanic eruptions, and major storms. The primary challenges in Japan are technical and systemic, including the need for upgraded early warning technologies and the reinforcement of disaster-resilient infrastructure (Suparji et al., 2024). In response, Japan has developed a highly structured system comprising disaster mitigation education from an early age, routine community-wide drills, and the use of advanced technologies such as earthquake sensors and satellite-based warning systems (Savitri et al., 2021). In contrast, Indonesia faces more complex challenges from both geographical and sociocultural perspectives. The vast dispersion of its islands and its cultural diversity contribute to uneven levels of disaster preparedness across the country. Inadequate infrastructure, limited access to early warning technologies in remote areas, and varying cultural approaches to disaster response are among the primary obstacles (Lestari et al., 2020). Moreover, comprehensive disaster management regulations were only introduced in 2007, and their implementation still faces considerable challenges, particularly regarding cross-sector coordination and public awareness (Sunarty & Akmal, 2024). In other words, Japan's disaster preparedness efforts are focused on refining a mature and established system, while Indonesia is still in the process of building an inclusive, equitable system that can integrate local wisdom with modern approaches. This contrast illustrates the distinct strategies required by each country: Japan emphasizes technology and systemic discipline, whereas Indonesia must adapt its strategies to suit its diverse geographical and cultural context (Suparji et al., 2020).

Law No. 24 of 2007 has become a comprehensive legal framework for disaster management in Indonesia; however, its implementation still faces a number of serious gaps that affect the effectiveness of the policy. First, the disparity between regions due to decentralization and regional autonomy has led to uneven disaster preparedness. Second, coordination between agencies, both vertical (between central and regional authorities) and horizontal (among institutions), remains unsynchronized (Sunarty & Akmal, 2024). This often leads to delays in emergency responses due to

differing perspectives, convoluted bureaucracy, and weak operational communication. Third, the low level of community participation, particularly in rural and remote areas, indicates that public education and involvement have not been optimized. Many people still do not understand their role in early warning systems or emergency response, which results in low community preparedness (Ariyani & Endiyono, 2020). Fourth, the limitations in human resources and financial support exacerbate these gaps. Budget allocations for mitigation activities are often not prioritized, while disaster training and education for local personnel remain insufficient (Suryajaya & Suhendra, 2019; Biomi et al., 2024). In this context, technology has become a key solution to bridge these gaps. Technologies such as sensor- and satellite-based early warning systems, risk mapping with GIS, and real-time disaster data management can accelerate detection, coordination, and response to disasters (Setyowati & Suryaningsih, 2020). Digital technology can also be used to reach a broader community through mobile applications, social media, and online educational platforms that can enhance disaster literacy (Hidayah, 2023). Additionally, the integration of technology-based systems allows for more efficient and accountable cross-sector coordination, as data and information can be accessed collaboratively, quickly, and accurately.

Family preparedness in facing disasters is crucial for minimizing risks and impacts. However, despite various efforts, family preparedness in Indonesia still shows significant gaps, particularly in terms of access to relevant information and understanding the actions to be taken during a disaster. Many families still do not fully comprehend the importance of having an emergency response plan, nor the need for training and education regarding the appropriate steps to take during a disaster (Ihsan et al., 2023). The development of information and communication technologies for disaster mitigation has become one of the key innovations in efforts to enhance resilience in the face of disasters. Several technologies have been developed to improve community disaster preparedness. Research conducted by Nisya et al. (2023) successfully developed the "Natural Disaster Educational Game" aimed at elementary school students. The application includes disaster-related materials, disaster-prone areas on a map of Indonesia, emergency kit information, as well as various games such as rescue and evacuation simulations, among others. Meanwhile, research by Direja & Herdiani (2023) succeeded in developing an Android-based application (Edu-Siaga Bencana) as an educational tool for earthquake and tsunami preparedness, intended for teenagers or university students. The features of this application include disaster-related materials in the form of video information, preparedness surveys for students, contact numbers of relevant disaster institutions, and assembly point maps. However, research on digital platforms for evaluating and educating family disaster preparedness has yet to be developed. Therefore, this study aims to develop a digital platform for evaluating and enhancing family disaster preparedness.

Material and Methods

Development model

This study employed the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Adesfiana et al., 2022). Below are the procedures for developing the digital platform "Keluargasiaga" using the ADDIE model:

1. Analysis
   The analysis stage aimed to identify the initial requirements for developing the digital platform. This involved user needs analysis, which determined the target users of the digital platform. Content analysis, which aimed to understand user needs and preferences, ensuring the quality and relevance of the presented content. Hardware and software analysis, which identified the necessary hardware and software for development and the devices to operate the application.
2. Design

The design stage focused on creating the framework for the digital platform. This included outlining key elements to be incorporated into the application and designing a storyboard. The storyboard served as a guide for the platform's templates and features.

3. Development
4. The development stage involved creating and testing the product. At this stage, the digital platform was built based on the storyboard and design developed earlier. The platform consists of 2 features, namely evaluation features and education features. The content in both features refers to the disaster-resilient family module developed by the National Disaster Management Agency (BNPB, 2021).
5. Implementation
6. During implementation, the digital platform was tested and introduced to the community, particularly families. Testing involved using structured questionnaires to evaluate family responses to both the media and content of the application.
7. Evaluation
8. The evaluation stage assessed the quality of the product before and after implementation. Data collected during the testing phase, including feedback from families, were analyzed to evaluate the platform's quality, benefits, and feasibility.

Product trial design

The "Keluargasiaga" digital platform was tested on 15 families around Universitas Pembangunan Nasional "Veteran" Jawa Timur. The trial aimed to assess the platform's usability and identify potential issues. Feedback from this trial was used to refine and improve the digital platform.

Data Collection Techniques

Data collection utilized two methods observation and structured questionnaires. Observation through observing respondents while using the application to identify operational challenges. Structured questionnaires were distributed to 15 families around UPN "Veteran" Jawa Timur to gather detailed information about identified issues. The questionnaires were designed to evaluate the platform's media quality and content relevance to ensure broader community acceptance. The questionnaire assessment is presented in Table 1.

Table 1. User satisfaction categories

Type of Assessment	Score	Information
User-friendliness	1	Very difficult
	2	Difficult
	3	Easy
	4	Very easy
Design	1	Not interesting
	2	Quite interesting
	3	Interesting
	4	Very interesting
Information quality	1	Very difficult to understand
	2	Difficult to understand
	3	Easy to understand
	4	Very easy to understand
User satisfaction	1	Very dissatisfied
	2	Dissatisfied
	3	Satisfied
	4	Very satisfied

Data analysis

Data analysis was conducted after data collection to evaluate the developed product. Feedback from the structured questionnaires filled out by families using the "Keluargasiaga" platform was analyzed qualitatively and descriptively.

Results and Discussion

Description of the "Keluargasiaga" platform

The research results from the "Development of a Decision Support System (DSS) Platform for Families in Disaster and Emergency Preparedness" include the web platform "Keluargasiaga" and the results of a user satisfaction survey regarding the platform's usability. The "Keluargasiaga" platform (keluargasiaga.com) provides information on practices for building more resilient families in the face of disasters. The dashboard or homepage of the "Keluargasiaga" platform is shown in Figure 1.

Figure 1. Dashboard of "Keluargasiaga" Platform

The "Keluargasiaga" platform consists of several features that can be utilized, as shown in Figure 2:

KAGANA Assessment Tool

The KAGANA (Family Disaster Preparedness) assessment serves as the cornerstone of the platform. It evaluates a family's level of readiness based on predefined criteria, categorizing them into three levels:

- Not Prepared (score < 50): Families in this category lack essential knowledge and resources to respond effectively to disasters.
- Unprepared (score 51–79): Families demonstrate partial readiness but require additional education and preparation.
- Fully Prepared (score > 80): Families are well-equipped to handle emergencies.

During the trial, families that scored below 80 were directed to engage in targeted educational modules to address their specific gaps in preparedness. This adaptive approach ensures that families receive personalized recommendations, enhancing the platform's effectiveness in improving disaster resilience.

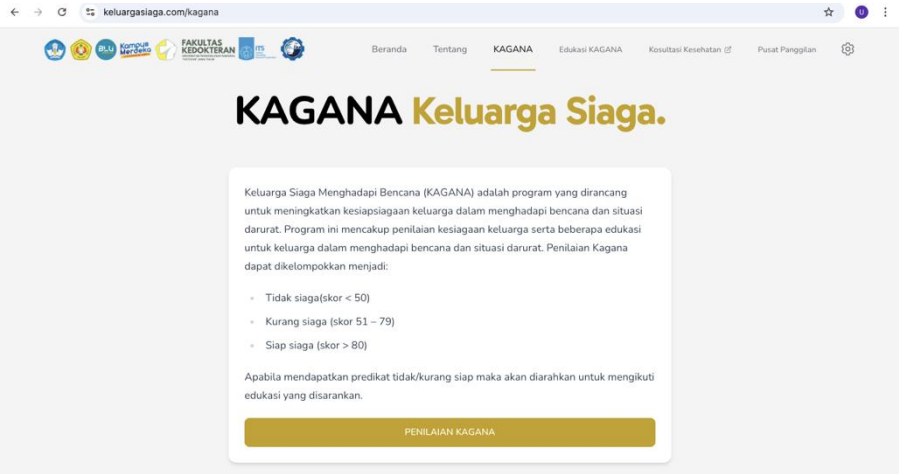

Figure 3. KAGANA Assessment Feature

E-Ben (Disaster Awareness Education)

The disaster education feature is part of the platform designed to provide the public with knowledge and information about various types of disasters and their causes, such as earthquakes, floods, volcanic eruptions, and wildfires, as well as their impacts on life and the environment (Figure 4).

Figure 4. E-Ben Feature

E-PDB (Early Disaster Warning Education)

The early disaster warning education feature provides understanding and information about early warning systems designed to detect, inform, and minimize risks from potential disasters. This material includes an introduction to disaster detection tools or technologies, such as earthquake sensors, weather radar, or tsunami detection systems, as well as how these systems function to issue warnings. Additionally, education covers the importance of recognizing early signs of disasters, the process of disseminating warning information to the public, and the actions that should be taken after receiving a warning (Figure 5).

Figure 5. E-PDB Feature

E-PEDE (Self-Rescue Education during Disasters)

The self-rescue education during disasters feature provides practical guidance and safety steps that individuals or groups can take to protect themselves when a disaster occurs. This material includes evacuation techniques, such as finding a safe location, taking cover under a table during an earthquake, staying away from river currents during a flood, or using a mask to avoid smoke during a wildfire (Figure 6).

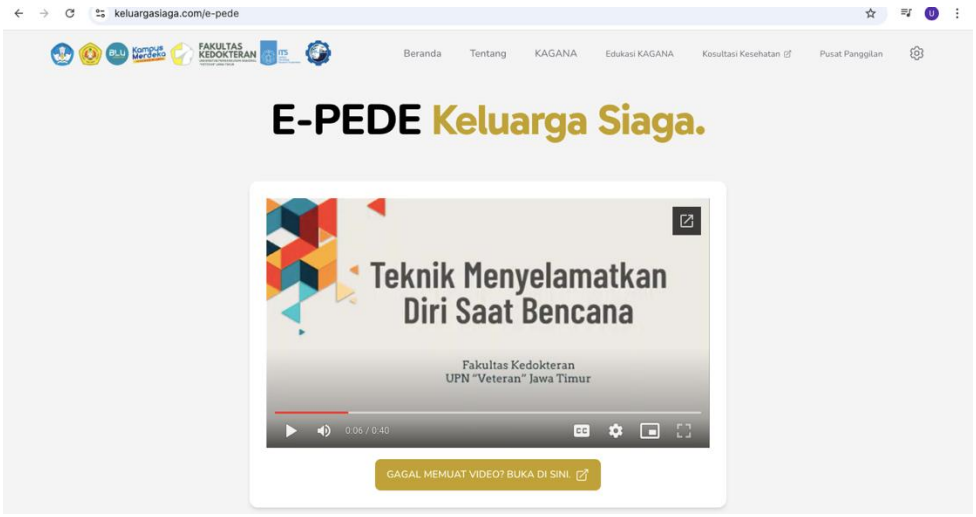

Figure 6. E-PEDE Feature

E-VAPER (Evacuation and First Aid Education)

The evacuation and first aid education feature provides essential guidance on how to rescue and provide basic assistance to victims during a disaster. This material covers how to safely evacuate oneself and others to designated shelters, understand evacuation routes, and avoid additional risks such as debris, fire, or strong water currents (Figure 7).

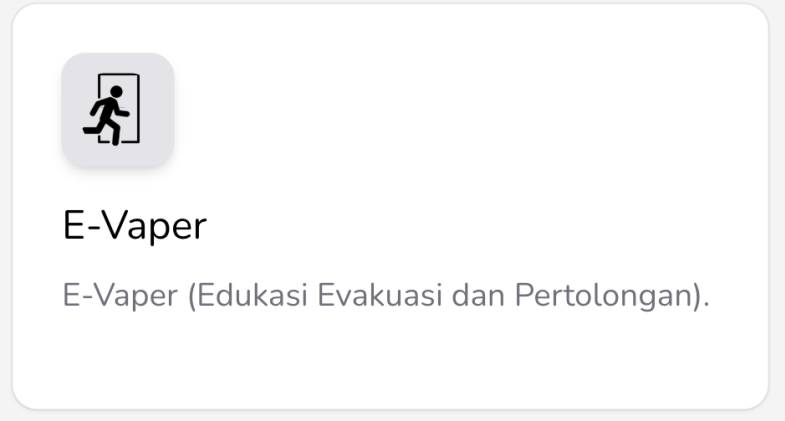

Figure 7. E-VAPER Feature

KITANA (Disaster Preparedness Kit)

The disaster preparedness kit education provides information on the importance of preparing an emergency kit to support safety and meet basic needs during disasters. This kit typically includes essential items such as drinking water, non-perishable food, flashlights, and spare batteries, medications and a first aid kit, warm clothing, important documents, evacuation maps, and communication tools like a radio or mobile phone. The educational material also covers how to assemble and store the emergency kit in an easily accessible location and the importance of regularly checking and updating its contents (Figure 8).

Figure 8. KITANA Feature

Community Assessment of the "Keluargasiaga" Platform

The assessment results of the "Keluargasiaga" website are presented in Figure 9. The evaluation of user-friendliness indicates that 15 families around UPN "Veteran" Jawa Timur found the website very easy to operate, achieving a score of 4. Figure 9 illustrates the evaluation of the website design, where all 15 families rated the design of the "Keluargasiaga" website as highly attractive, also scoring 4. Furthermore, the assessment of information quality revealed that 15 families considered the educational content provided on the "Keluargasiaga" website to be very easy to understand, with a score of 4. Lastly, user satisfaction evaluation showed that all 15 families were highly satisfied with their experience using the "Keluargasiaga" application, achieving a score of 4. Here are some examples of feedback that users might provide regarding their experience with the application:

1. User 1 : "The website's ease of use was a major highlight for many families. One participant remarked, 'We didn't need any extra help. The instructions were clear, and everything was right where we needed it."
2. User 2 : "When evaluating the website's design, all the families agreed it was visually appealing. One family said, 'The design is clean and modern—it's not overwhelming, yet very informative."
3. User 3 : "The content quality was another strong point. A participant shared, 'The educational materials were not only simple to understand but also engaging. It felt like we were learning something important without feeling lost."
4. User 4 : "One family expressed, 'We feel much more confident now in our preparedness plan, thanks to the clarity of the information provided. It's a real eye-opener on what we should do in case of an emergency."
5. User 5 : "Satisfaction levels were high across the board. 'Using the website was a great experience,' said another family. 'It was easy, informative, and made us feel better equipped to handle any disaster situation."

The Keluargasiaga application is specifically designed for families as its target users and includes features for disaster and health education, as well as evaluation and consultation for families. This contrasts with the application developed by Nisya et al. (2023), which focuses on educational content for elementary school students. Their app features disaster education, a map of disasters in Indonesia, emergency kit information, and various games for rescue and evacuation simulations. Meanwhile, the application developed by Direja & Herdiani (2023) is an Android-based application (Edu-Siaga Bencana) aimed at educating teenagers or university students about earthquake and tsunami preparedness. The features of this app include disaster-related video materials, preparedness surveys for students, contact numbers for relevant disaster institutions, and assembly point maps. Platforms such as BNPB and BMKG primarily provide real-time alerts, warnings, and official guidelines. While these features are crucial during a disaster, they may not offer the same level of family-centered preparedness content or user-friendly design. On the other hand, Keluargasiaga provides more practical and everyday preparedness advice that is accessible and easy to understand for non-experts.

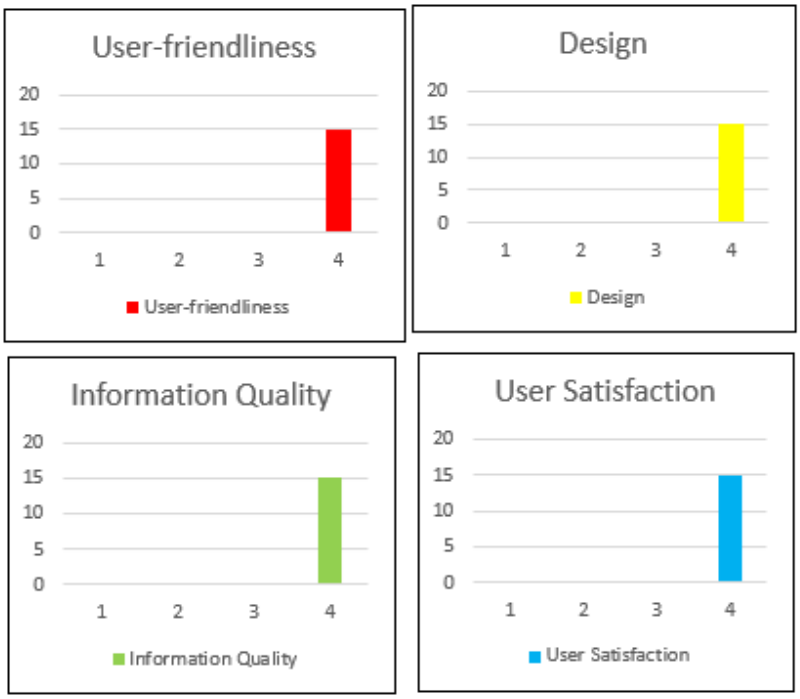

Figure 9. "Keluargasiaga Platform Assessment Result

Conclusion

This study highlights the critical role of technology in enhancing family disaster preparedness, particularly in disaster-prone regions like Indonesia. The "Keluargasiaga" application was developed to empower families to assess their readiness for disasters and improve their knowledge through self-education. By integrating two core components—self-assessment (KAGANA) and educational modules (E-Ben, E-PDB, E-PEDE, E-VAPER, KITANA)—the platform provides a comprehensive solution to address gaps in family preparedness. The trial conducted with 15 families around Universitas Pembangunan Nasional "Veteran" Jawa Timur demonstrated that the application is user-friendly, visually appealing, and effective in delivering clear and understandable content. Participants rated the platform highly in terms of usability, design, information quality, and overall satisfaction, achieving the maximum score of 4 across all evaluation categories. These results underscore the platform's potential to serve as a practical and accessible tool for improving family disaster preparedness. Through the "Keluargasiaga" application, families can conduct self-assessments to evaluate their level of readiness and identify areas for improvement. If a family is found to be unprepared or only partially prepared, they are directed to engage in targeted educational modules designed to enhance their knowledge and skills. This interactive approach ensures that families are not only informed but also equipped to take actionable steps toward disaster resilience. Looking ahead, the "Keluargasiaga" platform has the potential to contribute significantly to disaster risk reduction efforts in Indonesia. By empowering families to prepare for emergencies, the application aligns with national disaster management policies, such as Law No. 24 of 2007, and supports broader goals of community resilience. Future work could focus on expanding the platform's features, conducting larger-scale trials, and exploring strategies to overcome barriers such as digital literacy and internet access. The "Keluargasiaga" application represents a promising step toward creating disaster-resilient families and communities. Its ease of use, educational value, and alignment with policy frameworks make it a valuable tool for enhancing preparedness and mitigating the impacts of disasters in Indonesia.

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