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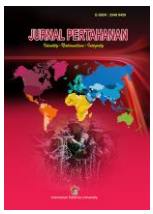

APPLICATION DEVELOPMENT OF EARTHQUAKES DISASTER PREPAREDNESS FOR CHILDREN

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Abstract

Indonesia is a country in the ring of fire and one of the most disaster-prone countries on the planet. As a result of these characteristics, Indonesia is vulnerable to earthquakes at any time. For the children, the earthquake was a traumatic experience. They were overcome with panic and dread. The victims of earthquakes and tsunamis are also susceptible to nightmares related to the natural disasters they have witnessed. As a result, there is a need for early childhood learning development media to deal with earthquakes, one of which is an android application. This program is designed for early childhood earthquakes and children's attempts to comprehend earthquakes. For media development, this study uses the System Development Life Cycle method with Waterfall methodology and BlackBox testing. The results of the application test using BlackBox when generating all scenarios were successfully executed according to the expected results using three different device brands, including Xiaomi, Asus, and Samsung.

INTRODUCTION

Indonesia is a country prone to natural disasters due to geological and meteorological factors. Indonesia is at the confluence of three structural plates on Earth, which the Eurasian Plate, Australia, India, and the Pacific Ocean. This causes frequent earthquakes (Irawan, Subiakto, &

Kustiawan, 2022). Due to these circumstances, Indonesia faces various earthquake threats that can occur at any time (Apriyanto et al., 2021). The destructive power of these natural phenomena can even destroy part of human civilization (Nurrobikha, Novrikasari, & Windusari, 2021). According to the National Disaster Management Agency survey results, the number of potential people at risk of disaster in Indonesia and the number of physical, economic, and environmental losses is in the middle and high category. The potential loss and physical damage to infrastructure and the economy are due to the earthquake, with a total of 648,874 trillion damage and 86 million deaths. This number will increase if mitigation measures are not taken in earthquake-prone areas. The community as a vulnerable group is an indicator of the importance of mitigation efforts, in addition to the community's lack of understanding and awareness of the risks and risks of disasters in the living environment including early childhood (Suryani & Febrianto, 2019).

The earthquake also caused deep trauma to children. Fear and anxiety struck them. Victims of earthquakes and tsunamis are also prone to nightmares associated with the natural disasters they are experiencing, often with negative emotional states such as hypersensitivity, anxiety, and excessive panic. It makes them uncomfortable, sad, even scared, and intimidating (Gani, 2020). Therefore, early Indonesian children living in the Ring of Fire need to have sufficient knowledge and living skills to cope with disasters. Basic knowledge and skills can serve as a guide for understanding what actions children should take in the event of a disaster and reducing the risk of disasters that may strike them.

Learning will be more exciting with the use of learning media. The more appealing the media presentation, the more motivated students are to learn, affecting student learning outcomes (Mahmudah & Fauzia, 2022). This learning media can improve children's learning outcomes by facilitating online learning media that can make the teaching and learning process simple and practical, boosting children's learning concentration due to engaging media, and, of course, according to their needs (Alawiyah, Istianti, & Arifin, 2021).

Technology plays an important role in disaster risk reduction. The application of technology in disaster risk reduction is for post-disaster such as assisting in disaster response (Usman, Fifing, Supriyadi, & Sakinah, 2020; Usman, Supriyadi, Poniman, Nugraha, & Rahmawati, 2021) and for pre-disaster such as providing disaster education. Education using technology, one of which is application-based, has an important role in providing knowledge regarding what to do when a disaster occurs (Sularno, Mulya, & Astri, 2021). To strengthen education in disasters, an appropriate arrangement is needed by designing educational supporting instruments such as syllabus, curriculum, and others (Islam, 2010; Kurniadi & Bahar, 2020).

Several studies are used as sources of literature in research related to disaster learning for early childhood. There are several studies, including the research of Amelia, Izadkhah, Rahma, and Ningtyas, which in their research discuss the design of learning for disaster education. The learning has several variants, such as games (Izadkhah & Hosseini, 2013; Rahma, 2020) models, experiments, demos, visits, and stories (Amelia, Hayati, Musdiani, Milfayetti, & Ichsan, 2020). In addition to using this model, Amelia's research discusses disaster mitigation learning models for early childhood with Disaster Alert Kindergarten Watching (Amelia et al., 2020). The research has not tried to implement learning design for disaster education and has not implemented learning design into technology, especially on mobile phone technology. Ulfah, Ardini, and Winarni research created a learning media in the

form of lift the flap book and game-based applications. Ulfah's research on making media in the form of a lift-the-flap book makes the media more attractive, but it is still not integrated with technology (Ulfah, Bahrun, & Rahmi, 2021). Ardini's research makes game-based learning media using Microsoft PowerPoint, but this research still cannot be used for mobile devices (Ardini, Arifin, Pupala, Syahputra, & Prabowo, 2022). Winarni's research makes game-based learning media for the android operating system (Winarni, Purwandari, & Wachidi, 2021). In order to try other methods besides games, an application is made that can be used for Android devices by providing materials and providing evaluations in the form of quizzes.

One way early childhood prepares to deal with the dangers of an earthquake is to educate them about disaster preparedness. This can later be simulated for children via an Android application. Disaster preparedness education can change the knowledge, attitudes, and skills of children involved in disasters. These changes include understanding where they live in disaster-prone areas, being concerned about preventing casualties before they occur and training their disaster relief skills. Based on the explanation above, therefore this study aims to develop an application for early childhood preparation to deal with disasters.

METHODS

As illustrated in Figure 1, the application was built utilizing the waterfall method, with analysis, design, implementation, verification, and maintenance as development stages. One of the Systems Development Life Cycle (SDLC) models that are extensively utilized in the development of information systems and software is the waterfall model. A systematic and sequential strategy is used in this concept. The stages of this model are carried out in stages, starting with the planning stage and ending with the maintenance step. Developers need to understand how the waterfall model is employed in the system development process, as well as the waterfall model's features (Wahid, 2020).

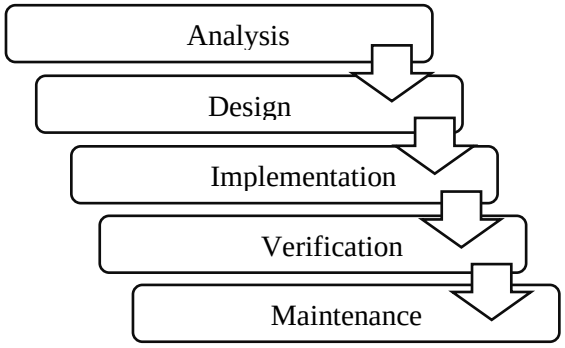

Figure 1. Waterfall Model Step
Source: Processed by the Authors, 2022

Step of Waterfall Model

1. Analysis
   The purpose of the requirements collecting process is to identify software needs so that users may understand what kind of software they require.
2. Design
   Software design is a multi-step process that focuses on data structures, software architecture, interface representation, and coding methodologies to build software systems. The requirements from the requirements analysis phase are turned into a design representation, which is subsequently implemented in the program during this step.
3. Implementation
   The system is first built in small programs, known as units, in this phase, and then combined in the next phase. Unit testing is a feature that has been built and tested for each unit.
4. Verification
   The system is validated and tested in this step to confirm that it fully or partially fits the system requirements. Unit testing (checking how the system reacts when all modules are connected), system testing (examining how the system responds when all modules are integrated), and acceptance testing are examples of these tests (with or to the

customer). You can have it run on your behalf to ensure that all of the customer's needs are met.

5. Maintenance
   The waterfall model's ultimate stage is this. The finished software is run and maintained. Maintenance entails resolving any bugs that were not discovered in the previous step.

Black box testing is a software testing technique that emphasizes the specification of the functions contained in the developed application when testing this application system. Invalid or missing functionality, data structure errors, database access errors, interface errors, performance errors, and initialization&termination errors are all things that black box testing can detect (Rahadi & Vikasari, 2020).

RESULT AND DISCUSSION

The app was created using the Kotlin programming language and is based on the Android operating system. The Kotlin programming language is a development of the Java language. In May 2018, Google Android announced that the Kotlin language was the official language of Android (Banerjee, Bose, Kundu, & Mukherjee, 2018). Kotlin is superior to Java if compared as the introduction language of Kotlin in terms of Central Processing Unit (CPU) and Memory usage measurements and execution speed (Sibarani, Munawar, & Wisnuadhi, 2018). Kotlin also has many features that can be adapted to create android applications (Ardito, Coppola, Malnati, & Torchiano, 2020).

Design Application

The flowchart method employed by the user when applying this program for seismic catastrophe preparedness for early childhood is depicted in Figure 2. Figure 2 explores more into the application's design. Figure 2 shows a flowchart of the system used by this application. The menu is called from the first run of the application. There are four menu functions in this application, namely Earthquake Survival to judge earthquake countermeasures and Earthquake Type to find the earthquake type, Earthquake Games section, and then the system will switch to the final menu Earthquake Definition.

Implementation

The user application design is applied for prototypes. In the first phase, the user will be presented with four menus, one of

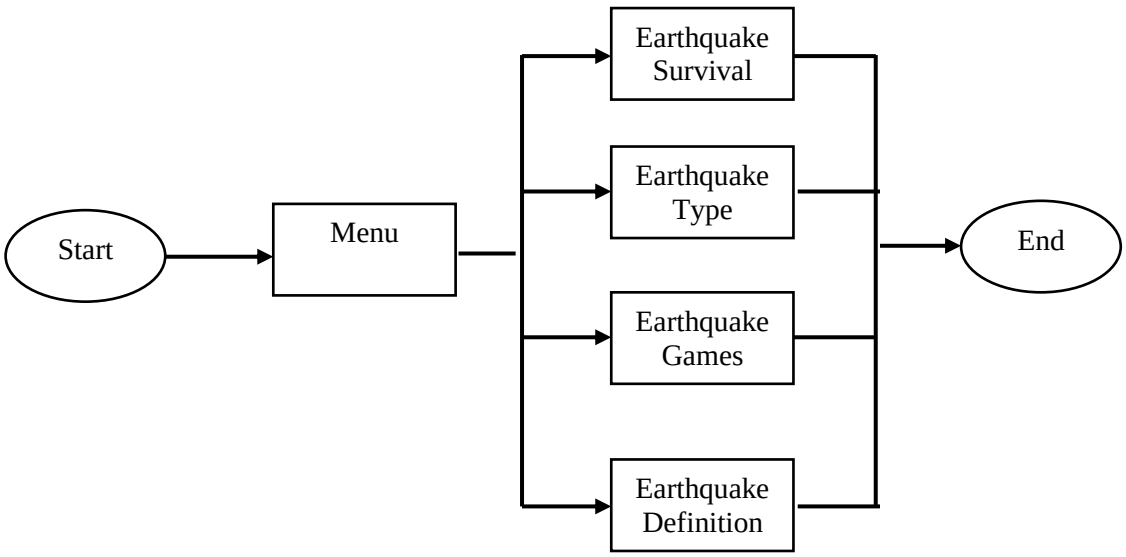

Figure 2. User Application Flowchart
Source: Processed by the Authors, 2022

them is Earthquake Survival which instructs the user on how to deal with earthquakes in early infancy. After that, the application goes to the Earthquake Type tab, where the user may learn about the several types of earthquakes that occur often in Indonesia, as well as their history. The next option is Earthquake Games. In this menu, the children under the age of eight may answer quiz questions about earthquakes. The last menu is Earthquake Definition, which takes the user to the National Disaster Management Agency (*Badan Nasional Penanggulangan Bencana* or BNPB) webpage concerning Indonesian earthquake tragedies. Figure 3 until Figure 8 show the user interface prototype in further detail.

When the user enters the application, the user is presented with a menu screen, as shown in Figure 3. This application menu has four functions. The first feature is used to find a way to prepare for early childhood in case of an earthquake. The second feature is the earthquake type, which recognizes the earthquake type in early childhood. The next menu has a game that allows the user to understand the language of earthquakes in early childhood, and the final feature is the definition of earthquakes that links to the National Disaster Management Agency website.

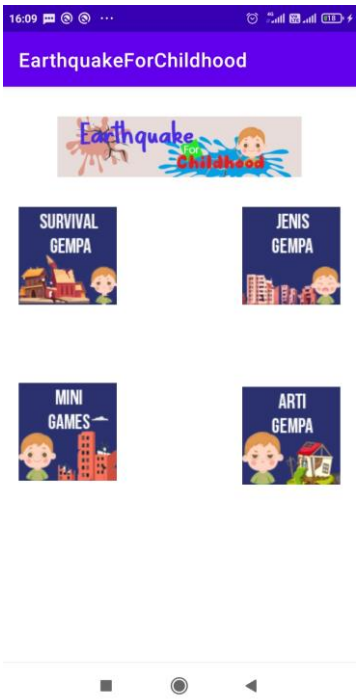

Figure 3. User Application Menu Display
Source: Processed by the Authors, 2022

The first menu is the earthquake survival menu as shown in Figure 4. In this menu, the user can understand how to avoid earthquakes in early childhood. There are three stages namely pre-earthquake, during-earthquake, and post-earthquake. In the pre-earthquake stage, this menu suggests to prepare a bag containing essential items such as the identity card. During the earthquake this application suggests to calm down, protect the head, neck, and upper body, and find a safe haven for the meantime. The last phase is the post-earthquake phase. In this phase, this application suggests to get out of the building, stay in the position, and be alert.

Figure 4. Survival Earthquake menu Displayed on the Application
Source: Processed by the Authors, 2022

Figure 5. Earthquake Type menu displayed on the application
Source: Processed by the Authors, 2022

Figure 6. Display when selecting a list from Earthquake Type
Source: Processed by the Authors, 2022

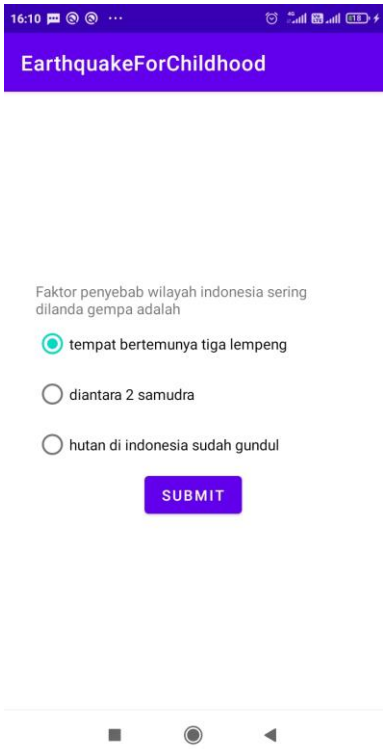

Figure 7. Application display when selecting the Earthquake Games menu
Source: Processed by the Authors, 2022

Figure 8. Application display when selecting the Earthquake Definition menu
Source: Processed by the Authors, 2022

Figure 5 shows Earthquake Type menu that includes common earthquakes in Indonesia. There are three types of earthquakes in this menu namely crustal movement or tectonic earthquakes, volcanic earthquakes, and collapse earthquakes. Figure 6 shows that when the earthquake list view was selected in the previous image, the earthquake description is displayed as in the case of the earthquake collapse, detailing how the earthquake collapse was created. Figure 7 shows the third menu, which is a mini-game about earthquakes. This game allows you to play the game in early childhood with the help of your parents. These games use a multi-choice answers. The final menu can be seen in Figure 8, the Eearthquake Definition menu. This menu uses a web view, so the user can connect to the National Disaster Management Agency website and the user must use an internet connection to run it.

Verification

Testing using the BlackBox method and testing using three devices with different brands. The three devices in question use the brand: Xiaomi, Asus, and Samsung. Tests are carried out using three other devices to determine whether the application can run in different environments. The test results can be seen in Table 1.

Table 1. BlackBox Testing Application

Scenario	Test Case	Device 1		Device 1		Device 1	
		Result	**Check**	**Result**	**Check**	**Result**	**Check**
Main Menu	Appearance	No Error	√	No Error	√	No Error	√
	Click Menu “Earthquake Survival”	Go to the "Earthquake Survival" page	√	Go to the "Earthquake Survival" page	√	Go to the "Earthquake Survival" page	√
	Click Menu “Earthquake Type”	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√
	Click Menu “Earthquake Definition”	Go to the "Earthquake Definition" page	√	Go to the “Earthquake Definition" page	√	Go to the "Earthquake Definition" page	√
	Click Menu “Earthquake Games”	Go to the "Earthquake Games" page	√	Go to the "Earthquake Games" page	√	Go to the "Earthquake Games" page	√
Earthquake Survival	Appearance	No Error	√	No Error	√	No Error	√
Earthquake Type	Appearance	No Error	√	No Error	√	No Error	√
	Click Menu “Tectonic Earthquake”	Go to “Tectonic Earthquake” page	√	Go to “Tectonic Earthquake” page	√	Go to “Tectonic Earthquake” page	√
	Click Menu “Volcanic Earthquake”	Go to “Volcanic Earthquake” page	√	Go to “Volcanic Earthquake” page	√	Go to “Volcanic Earthquake” page	√
	Click Menu “Collapse Earthquake”	Go to “Collapse Earthquake” page	√	Go to “Collapse Earthquake” page	√	Go to “Collapse Earthquake” page	√

Earthquake Type -> Chose “Tectonic Earthquake”	Appearance	No Error	√	No Error	√	No Error	√
	Click the "Back" Button	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√
Earthquake Type -> Chose “Volcanic Earthquake”	Appearance	No Error	√	No Error	√	No Error	√
	Click the "Back" Button	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√
Earthquake Type -> Chose “Collapse Earthquake”	Appearance	No Error	√	No Error	√	No Error	√
	Click the "Back" Button	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√	Go to the "Earthquake Type" page	√
Earthquake Definition	Appearance	No Error	√	No Error	√	No Error	√
Earthquake Games	Appearance	No Error	√	No Error	√	No Error	√
	Chose answer	valid	√	valid	√	valid	√
	Click the "Submit" Button	Success	√	Success	√	Success	√
	Calculation Score	Calculation Correct	√	Calculation Correct	√	Calculation Correct	√

Source: Processed by the Authors, 2022

From the results of the tests carried out in Table 1 using three different devices, the validity level of 100% is obtained. This means that the application can run on three different device environments. The test results also show that all the functions in the application can run on three different device environments. These results indicate that no repair is needed because there is no error function.

This application has early childhood benefits in early childhood disaster preparedness to understand what to do in the event of a disaster. This application has a very easy-to-use menu from early childhood and interesting pictures that make it easier for early childhood to understand this application compared to previous studies, by adding National Disaster Management Agency (BNPB)'s easy-to-understand menu for kids. Helping us understand that we are there is an Indonesian organization tasked with helping victims of the earthquake.

Maintenance

On applications that have been created, run, and maintained. Maintenance entails correcting any faults that were not discovered in the previous step. There are no longer any improvements to the implementation of the system unit in this program, and all systems are functioning normally.

CONCLUSIONS, RECOMMENDATION, AND LIMITATIONS

Based on the methods developed, this approach has been shown to help children understand the importance of seismic mitigation in Indonesia. The success of the black-box test conducted on three smartphones is very effective for children to understand and avoid the occurrence of the Earth's echo, and how to develop learning media using Android applications. It shows whether it is effective. In this study, there are still some limitations, such

as the usability test of the application has not been carried out, the increase in children's understanding after using this application related to the disaster has not been measured, and the application can only run on the Android operating system. In the future, it is hoped that the limitations in this study can be used as additional research and are expected to add more exciting features so that earthquake learning can be more interactive and interesting for children.

REFERENCES

Alawiyah, N., Istianti, T., & Arifin, M. H. (2021). Pengembangan Alat Seismograf Sederhana sebagai Media Pembelajaran Materi IPS di SD. *Journal Civics and Social Studies*, *5*(2), 174–180. https://doi.org/10.31980/CIVICOS.V5I2.1449

Amelia, L., Hayati, F., Musdiani, M., Milfayetti, S., & Ichsan, I. (2020). Integrating Disaster Alert Kindergarten Watching into Preschool Education: Designing a Professional Disaster Mitigation Education Model to Early Children. *International Conference on Elementary Education*, *2*(1), 124–137.

Apriyanto, D. K., Surtono, A., Pauzi, G. A., Ayu, H. R., Anwar, S., & Siregar, G. S. (2021). Pembinaan Pembuatan Alat Deteksi Dini Gempa Bumi Sederhana dan Trauma Healing untuk Guru-Guru SDN 2 dan SDN 3 Merak Belantung. *Jurnal Pengabdian Mitra Masyarakat (JPMM)*, *3*(1), 18–27.

Ardini, P. P., Arifin, I. N., Pupala, B., Syahputra, H., & Prabowo, A. D. (2022). Games Monopoli: Permainan Berbasis Windows Power Point untuk Mengenalkan Konsep Mitigasi Bencana Gempa di Taman Kanak-Kanak. *Jurnal Lonto Leok Pendidikan Anak Usia Dini*, *4*(1), 65–75. Retrieved from https://jurnal.unikastpaulus.ac.id/index.php/jllpaud/article/view/1097

Ardito, L., Coppola, R., Malnati, G., & Torchiano, M. (2020). Effectiveness of Kotlin vs. Java in android app development tasks. *Information and Software Technology*, *127*, 106374.

Banerjee, M., Bose, S., Kundu, A., & Mukherjee, M. (2018). A Comparative Study: Java vs Kotlin Programming in Android Application Development. *International Journal of Advanced Research in Computer Science*, *9*(3), 41–45.

Gani, C. (2020). *Studi Tentang Kesehatan Mental Anak Usia Dini Pasca Bencana Alam di Tk Alkhairaat Huntara Lere Kelurahan Lere Kecamatan Palu Barat Kota Palu*. Institut Agama Islam Negeri (IAIN) Palu.

Irawan, Subiakto, Y., & Kustiawan, B. (2022). Manajemen Mitigasi Bencana pada Pendidikan Anak Usia Dini untuk Mengurangi Risiko Bencana Gempa Bumi. *PENDIPA: Jurnal Pendidikan Sains*, *6*(2), 609–615. https://doi.org/10.33369/PENDIPA.6.2.609-615

Islam, M. (2010). *Disaster Risk in Public Education System in Bangladesh: Emphasis on Tornado*. Retrieved from http://www.iawe.org/WRDRR_Bangladesh/Preprints/S2CDMP.pdf

Izadkhah, Y. O., & Hosseini, M. (2013). *The Evolution of School Earthquake Education in Iran*. Iran.

Kurniadi, A., & Bahar, F. (2020). The Review of Disaster Preparedness School Program in Indonesia Elementary and High School. *Jurnal Pertahanan*, *6*(1), 46–58. https://doi.org/10.33172/JP.V6I1.703

Mahmudah, S., & Fauzia, F. (2022). Penerapan Model Simulasi tentang Pembelajaran Mitigasi Bencana

Alam Gempa Bumi Berbasis Video Animasi untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Basicedu*, *6*(1), 633–645. https://doi.org/10.31004/BASICEDU.V6I1.1974

Nurrobikha, Novrikasari, & Windusari, Y. (2021). Kualitas Hidup dan Kesiapsiagaan Bencana Gempa Bumi pada Masyarakat Pesisir Pantai Panjang Kelurahan Teluk Sepang. *Jurnal Keperawatan Silampari*, *5*(1), 513–520. https://doi.org/10.31539/JKS.V5I1.3027

Rahadi, N. W., & Vikasari, C. (2020). Pengujian Software Aplikasi Perawatan Barang Milik Negara Menggunakan Metode Black Box Testing Equivalence Partitions. *Infotekmesin: Jurnal Informatika, Elektronika, Mesin*, *11*(1), 57–61. https://doi.org/10.35970/INFOTEKMESIN.V11I1.124

Rahma, A. (2020). Pembelajaran Sains untuk Mengenalkan Kebencanaan pada Anak Usia Dini. *Jurnal Golden Age*, *4*(2), 250–260. https://doi.org/10.29408/GOLDENAGE.V4I02.2124

Sibarani, N. S., Munawar, G., & Wisnuadhi, B. (2018). Analisis Performa Aplikasi Android pada Bahasa Pemrograman Java dan Kotlin. *Prosiding Industrial Research Workshop and National Seminar*, *9*, 319–324. https://doi.org/10.35313/IRWNS.V9I0.1116

Sularno, Mulya, D. P., & Astri, R. (2021). Tsunami Evacuation Geographic Information System (GIS) Education as Disaster Mitigation. *IOP Conference Series: Earth and Environmental Science*, *708*(1). IOP Publishing. https://doi.org/10.1088/1755-1315/708/1/012004

Suryani, N., & Febrianto, H. (2019). Sosialisasi dan Simulasi Bencana Gempa Bumi di SMP N 2 Sungai Geringging Nagari Kuranji Hulu Kecamatan Sungai Geringging. *Jurnal Pengabdian Kepada Masyarakat DEWANTARA*, *1*(2), 30–40. Retrieved from https://ojs.unitas-pdg.ac.id/index.php/jpmd/article/view/401

Ulfah, K. U., Bahrun, & Rahmi. (2021). Pengembangan Media Pembelajaran Lift The Flap Book untuk Menstimulasi Kesiapsiagaan Anak Usia Dini dalam Menghadapi Bencana. *Jurnal Ilmiah Mahasiswa Pendidikan Guru Anak Usia Dini*, *6*(2), 10–19. Retrieved from http://www.jim.unsyiah.ac.id/paud/article/view/17601

Usman, M. L. L., Fifing, Supriyadi, A. A., & Sakinah, L. (2020). Refugee Based Data Collection in Disaster Response. *Jurnal Pertahanan*, *6*(2), 151–161. https://doi.org/10.33172/JP.V6I2.640

Usman, M. L. L., Supriyadi, A. A., Poniman, A., Nugraha, M., & Rahmawati, N. (2021). Design and Development of Tetos Application for Location Detection in Supporting Disaster Victim Searching Based on Global Positioning System (GPS). *Jurnal Pertahanan*, *7*(1), 29–36. https://doi.org/10.33172/JP.V7I1.1181

Wahid, A. A. (2020). Analisis Metode Waterfall untuk Pengembangan Sistem Informasi. *Jurnal Ilmu-Ilmu Informatika Dan Manajemen STMIK*.

Winarni, E. W., Purwandari, E. P., & Wachidi, W. (2021). The Effect of Android-Based Earthquake Game Toward Bengkulu City Elementary School Students' Knowledge about Earthquake Disaster Preparedness. *Journal of Physics: Conference Series*, *1731*(1).