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SIMA-DIGI Virtual Reality-Based Disaster Mitigation

Aries Chandra Anandhita[1*)], Nugroho Ari Wibowo[2)], Moh. Dasuki[3)], Miranda Meifa[4)], Gangga Kristin Nurfiyatul Jannah[5)], Muhammad Adam Yulloh[6)]

[1]Faculty of Health Sciences, Universitas Muhammadiyah Surabaya
[2]Faculty of Engineering, Universitas Muhammadiyah Surabaya
[3]Faculty of Architecture, Universitas Muhammadiyah Surabaya
[4]Faculty of Health Sciences, Universitas Muhammadiyah Surabaya
[5]Faculty of Health Sciences, Universitas Muhammadiyah Surabaya
[6] Faculty of Health Sciences, Universitas Muhammadiyah Surabaya

**Corresponding Author: arieschandraanandhita@um-surabaya.ac.id*

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ABSTRACT

The partner targeted by this Community Partnership Program is SD Kreatif Muhammadiyah 01 Lumajang, located in a disaster-prone area that requires further intervention. This has become a crisis situation for SD Kreatif Muhammadiyah 01 Lumajang, which can disrupt the welfare of teachers and students, resulting in anxiety and fear of natural disasters. This service aims to provide a new atmosphere and spirit in disaster mitigation learning, which will be implemented with SIMA-DIGI based on Virtual Reality in accordance with the needs of digital-based education by creating a SIMA-DIGI application based on Virtual Reality for disaster mitigation. The methods used to carry out the activities are in the form of discussions, mentoring, and training. The training, which was conducted over one week, effectively increased participants' knowledge and changed their attitudes. This was evidenced by the pre-test results, which showed that 25 students had a low level of knowledge (62.5%), 10 students had a moderate level of knowledge (25%), and 5 students had a high level of knowledge (12.5%). However, after receiving counseling and training using the SIMA DIGI Design Application, the post-test results showed a significant increase, including a drastic rise in the level of knowledge related to disaster mitigation to 87.5%. Thus, it is hoped that with the level of knowledge possessed by the students, awareness and preparedness for disasters that may occur at SD Kreatif Muhammadiyah 01 Lumajang can be improved.

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INTRODUCTION

The partner targeted by this Community Partnership Program is Muhammadiyah 01 Lumajang Creative Elementary School. At the time of its establishment, Muhammadiyah 01 Lumajang Creative Elementary School was located at Jl. Brantas No. 7 Jogoyudan, Jogoyudan, Lumajang District, Lumajang Regency, East Java. It occupies 584 m2 of land and buildings. The land is one of Muhammadiyah's charitable enterprises, built from reclamation, as evidenced by a right of use certificate from the Lumajang City Land Office and a permit letter.

Over the years, SD Kreatif Muhammadiyah 01 Lumajang has been undergoing development and facing various problems due to suboptimal learning facilities and infrastructure. At the same time, a series of natural disasters have occurred in the school's area. These conditions have motivated the school to develop learning media that can be implemented for emergency disaster mitigation, with the aim of providing a new atmosphere and new enthusiasm in disaster mitigation learning, which will be implemented with SIMA-DIGI based on Virtual Reality in accordance with the needs of digital-based education. Finally,

it was named SD Kreatif Muhammadiyah 1 Lumajang with the launch of the SIMA-DIGI application based on Virtual Reality.

Figure 1. School front view

SD Kreatif Muhammadiyah 01 Lumajang, as an educational institution, plays a crucial role in addressing environmental issues in the surrounding area. Therefore, collaboration with various parties is possible by establishing an easily accessible social network. Therefore, SD Kreatif Muhammadiyah 01 Lumajang has the potential to partner with organizations, governments, and communities involved in education, social, and health sectors to build a healthy environment, thereby contributing to improved well-being and achieving optimal community health (Imam Basuki, 2025).

This has become a crisis situation for SD Kreatif Muhammadiyah 01 Lumajang, which has resulted in disrupting the welfare of teachers and students who are often plagued by anxiety and fear of natural disasters. The crisis situation experienced by SD Kreatif Muhammadiyah 01 Lumajang is an event that will occur and lead to dangers that affect individual teachers and students, so that they must face it whether they like it or not. The area surrounding this school is prone to a series of threatening events such as floods, landslides, volcanic eruptions, forest fires, tornadoes, and earthquakes. These conditions can result in changes in lifestyle, loss of life, environmental damage, property loss, and psychological impacts. Therefore, as part of the educational community, SD Kreatif Muhammadiyah 01 Lumajang must have knowledge about how to be resilient in facing daily life, whether in the school environment, family, or community (Bachri et al., 2024).

Figure 2. The right side of the SD Kreatif Muhammadiyah 01 Lumajang building

The discussion revealed problems faced by SD Kreatif Muhammadiyah 01 Lumajang. The school mentioned that its location in a mountainous area often causes concern and fear of natural disasters. The crisis situation faced by SD Kreatif Muhammadiyah 1 Lumajang has led to instability and danger that affects both teachers and students, forcing them to face these challenges whether they want to or not. This elementary school area is closely associated with a series of threatening events such as floods, landslides, volcanic eruptions, forest fires, tornadoes, and earthquakes (Ali, F. A., Wardhani, P. I., & Hidayatullah, 2023). These conditions can result in changes in lifestyle, loss of life, environmental damage, property loss, and psychological effects. Therefore, as part of the educational community, SD Kreatif Muhammadiyah Lumajang must have knowledge about how to be resilient in facing daily life, whether in the school environment, family, or community.

The lack of knowledge regarding disaster mitigation, particularly volcanic eruptions, within the school environment is a major concern for SD Kreatif Muhammadiyah Lumajang, especially since there are no existing programs or educational initiatives provided to teachers and students on initial actions to take and preparations needed for emergency situations when disasters suddenly occur, particularly in areas prone to volcanic eruptions.

This dedication is based on the fact that Indonesia is a country with high vulnerability to disasters. According to (Dr. Ilona Auer Frege & Befus, 2024) *World Risk Index* 2024, Indonesia ranks second highest in global natural disaster risk, after the Philippines. With this condition, Indonesia's geography can be described as a "disaster supermarket" (Ministry of Research, Technology, 2021) . Meanwhile, climate change also increases the frequency and intensity of disasters. As one of the countries most vulnerable to the impacts of climate change, Indonesia has seven cities included in the 136 priority locations for Disaster Risk Reduction (DRR) as listed in the National Medium-Term Development Plan (RPJMN 2019–2024). This condition is quite in line with the situation in Lumajang Regency, which has three types of climate as listed in the Regional Medium-Term Development Plan (RPJMD 2018- 2023). Lumajang Regency is a disaster-prone area with criteria of a region that is frequently and highly prone to natural disasters such as volcanic eruptions, earthquakes, landslides, and others (Lumajang Regency Government, 2023). Thus, it has great potential to be developed as a city that is resilient to disasters and climate change in Indonesia. Observations and interviews with one of the teachers at SD Kreatif Muhammadiyah 01 Lumajang showed that most of the school staff, both teachers and students, did not have adequate knowledge about preparedness, especially in dealing with emergency conditions during disasters and providing first aid in the aftermath of disasters. Disaster education is very important to be provided from an early age. However, there are still limitations in its implementation, namely the lack of models and media that support disaster education and the weakness of existing policies related to disaster-safe schools (Zagarino et al., 2021).

Understanding disaster mitigation and handling injuries caused by disasters is expected to encourage teachers and students to play a role in forming a community that is resilient in the face of disasters. The interviews revealed four problems.

First, there is a lack of understanding among students about disaster preparedness, especially regarding volcanic disasters, in terms of the steps that must be taken when a disaster occurs, and there is no specific curriculum that comprehensively teaches disaster preparedness. As a result, most school committees do not understand risk management and how to respond initially and carry out the evacuation process when a disaster emergency occurs (Lukitaningtyas et al., 2024). Second, there is a lack of understanding about first aid. This is evident when asked about first aid, many teachers answered that they did not know because there was no adequate training on how to perform first aid on victims of disasters. In fact, trauma injuries caused by disasters are also a special concern that must be treated immediately to reduce the threat to life.

Third, the lack of capacity among teachers to teach disaster preparedness because teachers have not received special training in teaching preparedness and first aid, and there are no systematic guidelines or modules to be applied in learning activities at school. Fourth, limited resources and facilities to support learning about disaster preparedness and handling the impact of disasters. This is due to a lack of interactive learning media that can improve students' understanding of disaster preparedness and first aid.

To address these issues, the team will conduct outreach, training, innovation implementation, mentoring, evaluation, and sustainability of disaster preparedness and first aid programs at SD Kreatif Muhammadiyah 01 Lumajang. The innovation media consists of SIMA-DIGI *Virtual Reality-based* application technology, which can assist schools in learning activities and increase knowledge related to preparedness and first aid for victims affected by disasters.

IMPLEMENTATION METHOD

This community service activity was carried out in September 2025 at SD Kreatif Muhammadiyah 01 Lumajang. The target participants were 40 students. The implementation of this activity included disaster mitigation counseling to increase knowledge using the SIMA-DIGI application based on *Virtual Reality* Disaster Mitigation.

The implementation of this community service activity involved several stages, including:

1. Socialization
   The activity began with a socialization of the service team's work plan with the partner. The service team conducted observations and discussions with the principal of SD Kreatif Muhammadiyah 01 Lumajang and other teachers to determine the form of the activity, time, and location, as well as to explain the next steps in the plan.
2. Preparation
   The community service team prepared the necessary tools and materials, and reconfirmed the attendance of participants in the scheduled community service activity.

3. Activity Implementation
   The activity was carried out by providing disaster mitigation material and demonstrating the use of the SIMA-DIGI application based on *Virtual Reality* Disaster Mitigation directly with 40 students. The activity was carried out in four sessions, the first of which was a pre-test, aimed at determining the participants' level of knowledge about disaster mitigation before the training was given. The second session involved training on general disaster mitigation, its causes and prevention. The third session involved practicing the use of the SIMA-DIGI application based on *Virtual Reality* Disaster Mitigation to attract students' interest in learning about disaster mitigation. The fourth session involved a post-test to determine the participants' level of knowledge about disaster mitigation (Ardiantoro *et al.,* 2022).
4. Evaluation
   Evaluation aims to measure students' knowledge level regarding the activities carried out. Evaluation is conducted by comparing knowledge levels in the pretest and posttest. Assessing students' knowledge is done descriptively regarding knowledge acquisition both before the activity (pretest) and after the activity (posttest).

RESULTS AND DISCUSSIONS

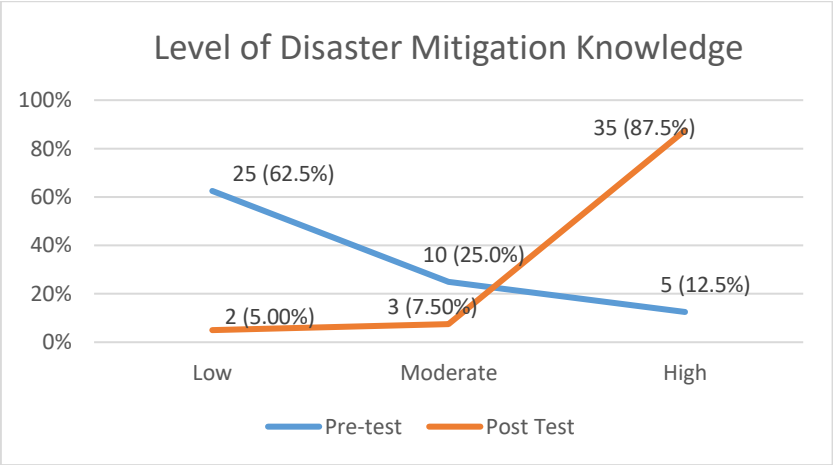
1. Characteristics based on the assessment of the level of student knowledge related to Disaster Mitigation.

Table 5. Characteristics of respondents based on the results of the initial assessment of students' knowledge level.

Category	Frequency (n)	Percentage
Disaster mitigation knowledge	25	68,75%
	10	27,5%
	5	3,75%

Based on the table above, the distribution of respondents' *knowledge levels* in the pre-test shows that most knowledge levels are low. A total of 40 students who were respondents had low levels of knowledge about disaster mitigation.

2. Overview of the distribution of knowledge from the pre-test and post-test results after disaster mitigation counseling using the SIMA-DIGI application based on *Virtual Reality* Disaster Mitigation.



Based on the data in the disaster mitigation knowledge table, it was found that before the program was implemented, 25 students had a low level of disaster mitigation knowledge (62.5%), 10 students had a moderate level of disaster mitigation knowledge (25%), and 5 students had a high level of disaster mitigation knowledge (12.5%). After the material delivery activity was carried out, there was a rapid

increase in the graph of disaster mitigation knowledge levels, with a significant increase, including a drastic increase in high levels of knowledge related to disaster mitigation of 87.5%.

Figure 6. Socialization of the Use of the SIMA-DIGI Application Based on *Virtual Reality* Among Students

Based on the data in the disaster mitigation knowledge table, it was found that before the program was implemented, 25 students had a low level of knowledge about disaster mitigation (62.5%), 10 other students had a moderate level of knowledge about disaster mitigation (25%), and 5 other students had a high level of knowledge about disaster mitigation (12.5%). After the material delivery activity was carried out, there was a rapid increase in the disaster mitigation knowledge level graph, with a significant increase, including a drastic increase in the high level of knowledge related to disaster mitigation of 87.5%.

The use of the SIMA-DIGI Virtual Reality-based application for disaster mitigation education can yield significant results, especially in increasing students' awareness and preparedness for natural disasters that often occur in school areas. After using the SIMA-DIGI Virtual Reality-based application, students will be better prepared to face various natural disasters. They will learn mitigation measures such as how to evacuate themselves and protect their valuables. The SIMA-DIGI Virtual Reality-based application provides learning materials designed to provide direct experiences that are difficult to obtain from traditional media . Through the SIMA-DIGI Virtual Reality-based application, the community can undergo more realistic evacuation training, which will prepare them to evacuate themselves and their families quickly and safely when a natural disaster occurs. The experience provided by the SIMA-DIGI Virtual Reality-based application also allows this training to be conducted without real risks.

The innovation applied to partners is an innovative learning medium using with the SIMA-DIGI Virtual Reality-based application. This application is a game used as a learning medium in environmentally conscious schools and disaster mitigation. This application will guide users to log in and practice their knowledge related to disaster mitigation (Yusmaniar, 2024) . The advantage of this tool is that it is a practical learning medium that is easy to use and enjoyable for anyone, thereby increasing students' interest in learning about environmental health and disaster mitigation. The following is an example of a Virtual Reality-based SIMA-DIGI disaster tool.

The Virtual Reality-Based Digital Literacy for Disaster Mitigation, developed using a website system, can serve as a learning tool for elementary school children, particularly to enhance their knowledge

of disaster mitigation, thereby fostering a disaster-resilient community. Children can learn while playing, ensuring students do not easily get bored and find learning enjoyable (Hakim et al., 2025).

With Virtual Reality-Based Digital Literacy for Disaster Mitigation, students can learn directly while playing. This makes it easier for them to understand how to mitigate before and after a disaster, the tools that must be prepared, and so on. After using this application, students will be better prepared to face disasters.

CONCLUSION AND RECOMMENDATION

Based on the results of the activity, the use of the SIMA-DIGI Virtual Reality-Based Disaster Mitigation Application as an educational medium has had a significant impact on increasing students' knowledge about disaster mitigation at SD Kreatif Muhammadiyah 01 Lumajang. Before the counseling session, it was found that the majority of students had a low level of knowledge about disaster mitigation, with 25 students (62.5%) scoring low. However, after the counseling and socialization using the SIMA-DIGI Virtual Reality-based Application, there was a significant increase, including a drastic rise in the level of high knowledge related to disaster mitigation, reaching 87.5%.

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