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Optimizing the level of disaster preparedness for coastal children in creating a disaster resilient generation

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ABSTRACT

Indonesia is home to various natural disasters, including earthquakes and tsunamis, due to its location in the Ring of Fire. Jember Regency in East Java is one of the areas with a high risk of these disasters. Sabrang Village, bordering the South Coast of Jember, has the potential to become a disaster-resilient village. This program aims to increase disaster preparedness for children on the south coast, optimize partner empowerment in increasing child preparedness, and establish a Disaster Empowerment Center (DEC) in Sabrang Village. The DEC program was implemented over three months, involving coastal children. Methods included education, training, and empowerment through Communication, Information, and Education (IEC) and disaster simulation training. Program evaluation used a preparedness questionnaire covering participants' knowledge, attitudes, and skills. The DEC program succeeded in increasing disaster preparedness for children in Sabrang Village. Collaboration with the village government, public health center, and other partners was crucial to the program's success. DEC implementation can serve as a model for community empowerment in dealing with earthquakes and tsunamis.

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1. INTRODUCTION

Indonesia is known as the home of disasters because it is located in the Ring of Fire area of the world plate so the potential for earthquakes and tsunamis is quite high (BNPB, 2012; Hammad et al., 2018). The risk analysis carried out by BNPB explains that four main areas are at risk of large earthquakes in Indonesia, namely the Mentawai Megathrust, southern Java, southern Bali, Nusa Tenggara, and the Papua region. Several districts in East Java that have the potential for frequent earthquakes are Jember, Banyuwangi, Lumajang, Malang, Blitar, Tulungagung, Trenggalek, and Pacitan. Jember Regency has a Disaster Risk Index with a HIGH Category compared to other districts (Al Harthi et al., 2020; BNPB, 2021). The potential for a megathrust earthquake is strengthened by the discovery of a seismic gap in southern Java which has great potential to cause a tsunami with an estimated earthquake strength of 8.8 on the Richter Scale (SR) and a tsunami wave height of up to 12 meters (Adventari et al., 2021; Widiyantoro et al., 2020). Thus, Indonesia has a high risk of earthquakes and tsunamis, especially in the

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Mentawai Megathrust area, southern Java, southern Bali, and Nusa Tenggara, as well as Papua, with Jember Regency in East Java as the highest risk area.

This potential is also reinforced by data released by the Meteorology, Climatology and Geophysics Agency (or in Indonesia, Badan Metereologi Klimatologi dan Geofisika – BMKG) which states a series of destructive earthquakes in the period 2010 to 2019 in the East Java region, such as in 2016 (6.2 SR), 2018 (6.1 SR), and 2019 (4.7 SR) (Badan Metereologi Klimatologi dan Geofisika, 2019). It is possible that in the future the potential for a more powerful earthquake and tsunami could occur in the coastal area south of Jember, East Java. People living in the Jember coastal area need to be prepared to always be prepared to face potential disasters that could arise at any time. Previous research explains that low levels of community preparedness will have an impact on high numbers of deaths or losses due to natural disasters (Ali & George, 2022; Brewer et al., 2020; Duan et al., 2020; Pahleviannur, 2019). Most coastal communities still do not have a high level of preparedness to face potential earthquake and tsunami disasters (Perdana, 2019). Data from BMKG shows a series of damaging earthquakes in East Java between 2010 and 2019, indicating the potential for more powerful earthquakes and tsunamis in the future, especially on the southern coast of Jember. Considering the low level of community preparedness, which can increase death rates and losses during disasters, Jember coastal residents need to increase their preparedness to face potential disasters.

Profile of Sabrang Village, Ambulu District, Jember Regency is one of the village areas in Jember Regency which directly borders the Indian Ocean. Sabrang Village is required to always be prepared to face potential earthquake and tsunami disasters. The potential for Sabrang Village to become a disaster-resilient village is very large. This village has a population of more than 16,000 people. Sabrang Village also always strives to optimize the disaster-resilient village program, which still finds many obstacles in its implementation. As a result of the team's observations and interviews with village officials, information was obtained that the "Desa Tangguh Bencana" program was still not optimal and had not yet reached vulnerable groups (especially children). This causes the level of preparedness of children on the south coast in Sabrang Village to still be relatively low. Our partners want coastal children to have a strong understanding and skills in dealing with disaster situations because they are the next generation who must have resilience in facing potential earthquake and tsunami disasters.

Elementary school-age children are the age group that has the lowest level of preparedness. This is also reinforced by the unavailability of a disaster curriculum for children in schools, so exposure to information about disasters is very minimal (Setyaningrum & Muna, 2020). This group is most vulnerable in disaster situations. Their lack of understanding of the risks around them makes them less prepared to face disaster situations. Without early disaster preparedness, children can experience stress, anxiety, fear, and inability to face disasters (Estafetta, 2020). Children are a very urgent group to be empowered optimally to have a high level of disaster preparedness (Triyono et al., 2014; Muslim et al., 2015). Empowering groups of children will form a disaster-resilient generation in the future.

Based on this phenomenon, the proposed problem-solving implemented in this assisted village development-based service program is optimizing the level of disaster preparedness for children on the southern coast to create a resilient generation for earthquake and tsunami disasters in Sabrang Village through the Disaster Empowerment Center (DEC) program. We will carry out this program through a process of empowering southern coastal communities (children) in collaboration with village officials, village health workers, health cadres, and community leaders to jointly participate in creating a disaster-resilient generation in Sabrang Village, Ambulu District, Jember Regency. Empowering young people to respond quickly to emergencies and disasters needs to be optimized through a series of education and training (Finali et al., 2020; Rasman et al., 2022; Rokhmah et al., 2020; Yunanto et al., 2017; Yunanto et

al., 2022). The empowerment program (education, training, and formation) for the younger generation regarding responding quickly to emergencies and disasters has proven to be effective in changing the level of knowledge, attitudes, and skills in terms of emergency and disaster actions in rural agricultural and plantation areas. This is also reinforced by the fact that the younger generation from elementary school age should have received basic knowledge and skills about disaster preparedness as a form of preventive effort against the negative impacts that arise if a disaster situation one day occurs. (Labudasari & Rochmah, 2020; Saparwati et al., 2020; Suharwoto et al., 2015).

The objectives of implementing this service are: (1) Increasing the level of disaster preparedness for children on the southern coast; (2) Optimizing partner empowerment in increasing the level of preparedness of children on the southern coast; (3) Establishing DEC (Disaster Empowerment Center) as a community disaster empowerment center in Sabrang Village.

2. METHODS

Design, Time, Location, and Participants

The design offered by the Service Team to partners is a community group empowerment design that consists of several work procedures. This activity will be carried out for 3 months from May to September 2023 starting from the preparation stage, initial dissemination, implementation, and final dissemination. The location for implementing this program is in Sabrang Village, Ambulu District, Jember Regency. The targets involved in this program were a group of 40 coastal children in Sabrang Village.

Procedure

The DEC Program work procedures which will be carried out by the team and partners will be carried out over a period of three years (multiyear) to resolve the problem of preparedness for the community on the south coast of Jember in facing the earthquake and tsunami disaster. Figure 1 show projections for solving coastal community disaster preparedness problems with the DEC program.
Follow-up plans in program continuity

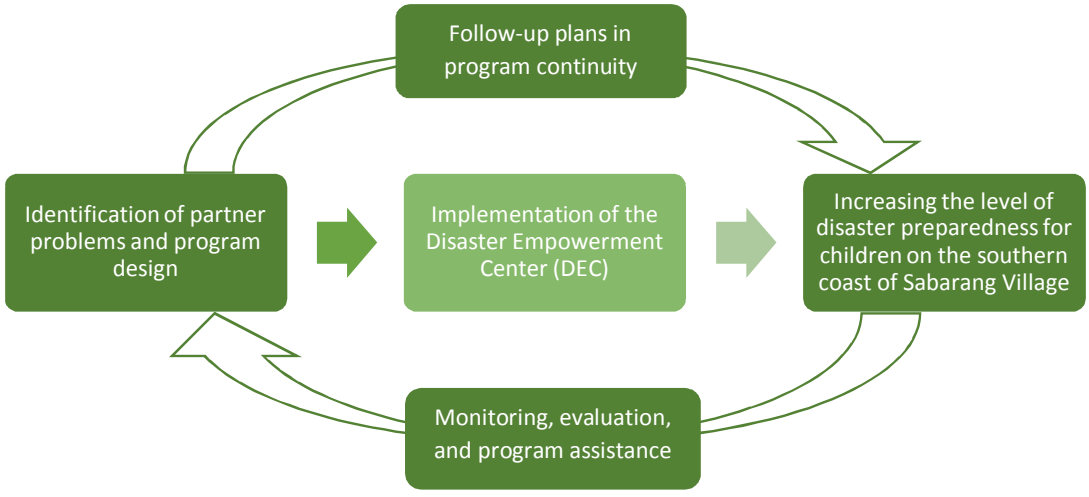

Figure 1. Work procedures for DEC activities in creating a resilient generation for earthquake and tsunami disasters in Sabrang Village, Ambulu District, Jember Regency

Concrete stages of implementing the service program carried out by the service team include: (1) Identify partner needs through initial dissemination; (2) Designing a service program; (3) Implementation of community service programs.

Identify partner needs through initial dissemination

At the first meeting between the service team and the Sabrang Village Government Partners, an initial assessment process will be carried out, determining the problem, formulating solutions with partners, and planning activities to optimize the level of disaster preparedness for children on the south coast to create a resilient generation for earthquake and tsunami disasters in the Village. Sabrang through the DEC program. This initial dedication will be attended by the Sabrang Village government, Sabrang Community Health Center, Sabrang Village health workers, and community leaders.

Designing a service program

After identifying community needs through the first meeting, a second meeting was continued to carry out joint program design. At the second meeting, the results of identifying community needs and joint deliberations regarding the design of the Disaster Empowerment Center (DEC) program will be presented. DEC is a forum for optimizing the level of community disaster preparedness in creating a disaster-resilient generation. DEC aims to prepare the community for every phase of a disaster, starting from preparation, mitigation, individual disaster response, mass disaster response, rehabilitation, and reconstruction.

Implementation of community service programs

The implementation of the service program was carried out with a series of education, training, and empowerment processes for children on the southern coast of Sabrang Village for 12 weeks (six KIE sessions and three intensive training sessions). KIE and intensive training that has been previously formulated by the team and partners will be implemented toward the target through: (1) Establishment of the Disaster Empowerment Center (DEC). At this stage, the service team together with partners tried to initiate the formation of the DEC program as the main house for community empowerment programs in creating a disaster-resilient generation. The service team and partners will establish partnerships with various cross-sectoral parties, the BPBD health service, and the Jember Regency education service. The team will also strengthen cooperation with the village government, community leaders, and the Sabrang Village community in realizing this program. The DEC that has been formed will then begin to be filled with a series of work activities starting from preparing action plans to increase preparedness levels through KIE and intensive training for target groups. DEC also prepares all learning materials needed to optimize the level of disaster preparedness; (2) Communication, Information, and Education regarding earthquake and tsunami disaster management. At this stage, health education will be carried out for the target group regarding the preparedness of southern coastal children in facing potential earthquake and tsunami disasters. Information regarding the concept, causes, characteristics, signs, and impacts of earthquake and tsunami disasters. This strategy will also convey various actions that need to be taken by children on the southern coast in dealing with earthquake and tsunami disasters in the phases before the disaster, during the disaster, and after the disaster occurs. Coastal children will also be provided with steps to access tsunami early warning information issued by BNPB. Education and training activities

begin with carrying out a Pre-test. A pre-test was carried out on all participants before being given education and training. Pre-test activities were carried out by the service team to assess the level of preparedness of service participants before being given the DEC program. The pre-test was carried out for 10 minutes by answering a preparedness questionnaire developed by LIPI & UNESCO in 2006 in the form of a checklist with closed-ended questions. The questionnaire used covers knowledge about disasters, disaster activity plans, disaster warnings, and resource mobilization (Mayzarah & Batmomolin, 2021). The material presented by the service team is in Table 1.

Table 1. Communication, information, and education regarding earthquake and tsunami disaster management

	Material Description
Pre-Test	
Material 1	**Understanding natural and non-natural disasters** This material contains the concept of disasters in general and distinguishes between types of natural and non-natural disasters
Material 2	**Earthquake and Tsunami Disasters** This material contains specific information about earthquake and tsunami disasters by understanding the meaning, causes, signs of earthquakes and tsunamis, as well as the impacts that arise
Material 3	**Earthquake and Tsunami Disaster Mapping** This material contains mapping of areas prone to earthquake and tsunami disasters including safety maps in the face of earthquake and tsunami disasters
Material 4	**Earthquake and Tsunami Disaster Risk Reduction Efforts** This material contains efforts that can be taken to reduce the risk of earthquake and tsunami disasters
Material 5	**Early warning of earthquake and tsunami disasters** This material contains information about various sources of information on early recognition of earthquake and tsunami disasters
Material 6	**Increasing Earthquake and Tsunami Disaster Preparedness** This material contains various preparedness training efforts that can be carried out by the community to be better prepared in facing earthquake and tsunami disasters

Next implementation is: (3) Intensive training on earthquake and tsunami disaster simulation for groups of coastal children. At this stage, intensive training will be carried out on targets to be empowered to face potential disasters. Targets will receive training sessions in pre-disaster management (recognizing disaster risks, preparation, prevention, and mitigation), during a disaster (self-rescue, recognizing evacuation directions, recognizing advice for asking for help), and post-disaster (trauma healing, play therapy, and management evaluation self). This intensive training was carried out involving Sabrang Village partners, Sabrang Community Health Center, and health workers. The training method used is a combination of playing games, audiovisual media, and also self-evacuation simulations for coastal children.

The training is carried out with a minimum duration of 60 minutes each to ensure achievement in understanding and deepening the disaster material provided in this DEC program. All coastal children in Sabrang Village are actively involved in a series of educational and training activities carried out by the service team in this service program.

Table 2. Intensive training on earthquake and tsunami disaster simulation for groups of coastal children

	Training Description
Training 1	**Playing Si-GeMi Snakes and Ladders (Earthquake & Tsunami Simulation)** The Si-GeMi snakes and ladders game is an innovative game developed by the team based on previous research which contains a series of snakes and ladders games with material about personal safety in the event of an earthquake and tsunami so that the value of preparedness for earthquakes and tsunamis can be increased.
Training 2	**Earthquake and Tsunami Disaster Simulation Video with Animation Video Concept with the title MITSU** MITSU is an educational video on earthquake and tsunami disaster preparedness developed by a team based on previous research. This animation-based simulation video is ideal for use as an online training medium for children with the content of increasing preparedness for complete earthquake and tsunami disasters.
Training 3	**Simulation of Preparedness for Earthquake and Tsunami Disasters** This training was carried out by simulating coastal children who were faced with a fictional case of an earthquake and tsunami in Sabrang Village. Children are taught to be able to make preparedness efforts in facing disasters in the pre-disaster, during-disaster and post-disaster phases.

Evaluation Design

The instrument used to evaluate the success of the program is a preparedness questionnaire developed by LIPI & UNESCO in 2006 in the form of a checklist with closed-ended questions. The questionnaire used covers knowledge about disasters, planned disaster activities, disaster warnings, and resource mobilization (Mayzarah & Batmomolin, 2021). The questionnaire used covers knowledge about disasters, disaster activity plans, disaster warnings, and resource mobilization. The total number of questions is 31 questions with a score of 1 for each question. There are sub-questions with a value of 1 divided by the total sub-questions in each question. The Preparedness Questionnaire consists of several indicators, namely Disaster Knowledge Questions with a total of 17 questions (questions 1-17), Disaster Activity Plans with a total of 12 questions (questions 10-22), Disaster Warnings with a total of 7 questions (questions 23-29), and Resource Mobilization with 2 questions (questions 30-31).

The analysis used to evaluate the success of the program is carried out in two ways, namely univariate and bivariate analysis. Univariate analysis was applied to respondent characteristics data. Characteristic data are presented in two ways. Categorical data (gender, have attended disaster training, have experienced a disaster, what disasters have you faced, and where did you get information about disasters) are presented in the form of frequency distributions and percentages, while numerical data (age) is presented in the form of averages and standard deviation. Bivariate analysis was carried out using the t-dependent test on the variables of knowledge, attitudes and skills obtained from the pre-test and post-test scores on partners. The confidence interval (CI) used is 95 percent.

3. RESULTS AND DISCUSSION

Result

The community service program carried out by the team is an effort to create a disaster-resilient young generation targeting children on the southern coast of Jember in Sabrang Village, Ambulu District through the DEC program. This program is carried out in collaboration between the government of

Sabrang Village, Ambulu District, and the Sabrang Community Health Center which is involved in DEC activities in Sabrang Village. This program is a joint means of creating a disaster-resilient generation for coastal children in Sabrang Village facing the earthquake and tsunami disaster. The 40 coastal children of Sabrang Village were very enthusiastic about participating in the DEC program carried out by the service team from KeRis CARING, Faculty of Nursing, Jember University.

Figure 2. Coordination and collaboration of the DEC implementation team with the Sabrang Village Government
Figure 3. Coordination and collaboration of the DEC implementation team with the Sabrang Community Health

Table 3 shows the characteristics of the coastal children of Sabrang Village who are participants in this DEC program.

Table 3. Characteristics of Sabrang Village Coastal Children as DEC Participants (n=40)

Participants Characteristics	Frequency (f)	Percentage (%)
Gender		
Male	23	57,5
Female	17	42,5
Total	40	100
Age (years)	11,1 (Mean)	2,431 (SD)
Have attended disaster training		
Yes	2	5
No	38	95
Total	40	100
Have you ever experienced a disaster?		
Yes	40	100
No	0	0
Total	40	100
Disaster What do you feel? (n=48)		
Earthquake	40	86,95
Drought	4	8,70
Hurricane	2	4,35
Total	46	100
Information about Disasters (n=49)		
Parent	4	8,16
Friend	2	4,08
TV	27	55,10
Village government	1	2
BNPB	1	2
Social media	14	28,57
Total	**49**	**100**

Table 4. Preparedness of coastal children in facing earthquake and tsunami disasters

Disaster Preparedness Indicators	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	95% CI	p-value
Knowledge about disasters	50,99 (10,33)	59,29 (9,18)	(-10,91) – (-5,70)	<0,001
Disaster Activity Plan	4,78 (1,35)	5,20 (0,21)	(-0,890) – (0,030)	0,009
Disaster Warning	2,36 (0,93)	2,68 (0,85)	(-0,640) – (0,002)	0,016
Resource Mobilization	2,00 (1,13)	2,37 (1,23)	(-0,810) – (0,070)	0,048

Figure 4. Delivery of Material 1 on natural disasters by the service team
Figure 5. Delivery of Material 6 for improving disaster preparedness
Figure 6. Training Session 1 playing Si-GeMi snakes and ladders
Figure 7. Training Session 2 disaster preparedness simulation video

The data in Table 3 describes the characteristics of coastal children in Sabrang Village, Ambulu District, Jember Regency who took part in the DEC disaster preparedness training program. From this data, it can be seen that 57.5 percent of the participants were boys, while the remaining 42.5 percent were girls. Based on age data, the average age of participants was 11.1 years with a standard deviation of 2.431 years. This shows that most of the participants have an age range close to this average. In terms of experience taking part in previous disaster training, only 5 percent of the children had taken part, while the remaining 95 percent had never taken similar training before. This shows that even though the government has launched the Disaster Preparedness School (SSB) program, the implementation of SSB in Indonesia is still uneven. All participants, namely 100 percent, have experienced disasters. The disaster felt was mainly an earthquake, covering 86.95 percent of the total participants. Meanwhile, drought and typhoons were only felt by a small number of participants, 8.70 percent and 4.35 percent respectively.

The team conducted a pre-test and post-test to measure the achievements of earthquake and tsunami disaster preparedness among DEC participants and the results are presented in Table 4.

The results of the analysis carried out in Table 4 show that the DEC disaster preparedness training program has succeeded in increasing children's knowledge about disasters, ability to plan activities, understanding of disaster warnings, and resource mobilization. Based on the results of the data analysis carried out, the p-value obtained for the four indicators showed a p-value <0.05. Apart from that, there was an increase in pre-test and post-test scores on each indicator of disaster preparedness for coastal children in Sabrang Village. This shows the effectiveness of the DEC program in preparing coastal children to face earthquake and tsunami disasters.

Discussion

The implementation of the DEC program is the first step taken by the service team in creating a disaster-resilient generation for coastal children in Sabrang Village. The implementation phase starts from the Communication, Information, and Education phase which consists of 6 material sessions, and the training phase which consists of 3 training sessions. In the material session, the service team explained several disaster preparedness materials such as understanding disasters, earthquake and tsunami disasters, mapping earthquake and tsunami disasters, early warning of earthquake and tsunami disasters, and increasing preparedness for earthquake and tsunami disasters. Meanwhile, the training session included three main training activities, namely: playing snakes and ladders SI-GEMI, a video simulation of the earthquake and tsunami disaster with an animated video concept entitled Mitsu, and a simulation of preparedness for the earthquake and tsunami disaster. Implementation of this program will be carried out during May - September 2023.

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All participants, namely 100 percent, have experienced disasters. The disaster felt was mainly an earthquake, covering 86.95 percent of the total participants. Meanwhile, drought and typhoons were only felt by a small proportion of participants, 8.70 percent and 4.35 percent respectively. Earthquakes are one of the disasters most often felt by coastal children because they are located in the southern coastal area of Jember which borders directly on the Indian Ocean with tectonic plates that are actively moving. Earthquakes are a crucial threat to the coastal communities of Jember Regency, as is the tsunami disaster (Rinanda, 2022; Solichah, 2021). Regarding sources of information about disasters, most children get information from TV (55.10 percent) and social media (28.57 percent), followed by parents (8.16 percent), friends (4.08 percent), village government (2 percent), and BNPB (2 percent). Television is still the main source of information in broadcasting disaster information to children compared to social media (Muliarta, 2019). The use of social media is still limited to school-age children because at this age they are still not given access to technological devices such as smartphones so the main source of information on disasters is mostly obtained from television broadcasts (Kholifiah & Dewinggih, 2021; Waluyo, 2018).

The DEC program has interactive educational content and intensive training for the target group. This activity can certainly increase the cognitive, affective, and psychomotor dimensions of participants in increasing preparedness in facing earthquake and tsunami disasters. These results are of course supported by research or activities that have been carried out previously which explain that comprehensive education and training carried out on the respondent/target group will increase the cognitive, affective, and psychomotor dimensions of the respondents/targets involved in the intervention (Ferianto & Hidayati, 2019; Pahleviannur, 2019; Purnamawati et al., 2022; Saparwati et al., 2020; Setyaningrum & Muna, 2020).

The DEC program implemented by the team combines comprehensive education and training. The educational content is carried out using the lecture method which is carried out over six sessions for the target group with different material content. For each material delivery session, the team packages the delivery method interactively with attractive media displays using colored DEC guidebooks and interactive presentation media. Attractive material packaging is a determinant of the success of disaster education for elementary school children (Wibowo et al., 2017). By using an interactive approach and interesting media, children are more involved in the learning process and more easily understand the information presented. This provides an opportunity for them to develop knowledge and skills in disaster preparedness more effectively (Syopyan & Sari, 2021). Children tend to be more interested and involved in learning when presented with attractive visual displays and interactive methods. This helps create a positive learning environment and facilitates a better understanding of disaster preparedness (Pasaribu & br Perangin-angin, 2020).

Training carried out on groups of coastal children also contributes to the psychomotor dimension so that their level of disaster preparedness increases significantly. The series of training started with playing the Si GeMi snakes and ladders game. The Snakes and Ladders game has been widely researched and given during disaster education and has been proven to be effective (Ersani & Mukminan, 2021; Utami & Mustari, 2020). This game is designed to present educational and simulation elements. Through this game, participants are asked questions about earthquake and tsunami preparedness when they go up or down the stairs. This question is based on the KIE material that was given previously. Participants must answer these questions, which creates a more interactive learning atmosphere and actively involves participants. This learning-by-play approach has proven to be effective in improving children's disaster preparedness, because they can learn in a fun and less formal way, but are still serious about gaining knowledge and understanding related to disaster preparedness (Putri, 2020; Yunanto et al., 2022).

Furthermore, participants were also allowed to watch a disaster simulation video in animated form. This video presents virtual information about the earthquake and tsunami disaster, starting from understanding it to the steps that must be taken in this disaster situation. This simulation video is based on the results of previous research which has been proven effective in improving children's disaster preparedness (Amelia, 2021; Saparwati et al., 2020). Through this video, participants can better visualize what happens when a disaster strikes and how they can prepare and act appropriately. The animated video presented provides a deeper and more complete understanding of the earthquake and tsunami disaster, providing participants with a solid foundation of knowledge (Astini et al., 2020).

The final session in DEC training is a disaster simulation. In this simulation, participants are involved in a scenario based on a case provided by the service team. Participants are asked to face a simulated disaster situation and take self-rescue and post-disaster actions (bin Abdullah & Toyoda, 2021; Sari et al., 2019b). This simulation is designed to provide real experience in dealing with disaster situations and

involves participants directly in making decisions and acting. Through this simulation, participants can develop practical skills and a deeper understanding of the actions that need to be taken in a threatening disaster situation. Simulation-based training like this has proven effective in increasing participants' level of preparedness in dealing with real situations that can occur when a disaster occurs (Idrus et al., 2019; Sari et al., 2019a).

4. CONCLUSION AND RECOMMENDATIONS

The DEC program has proven its effectiveness in increasing the preparedness of coastal children in Sabrang Village in facing earthquake and tsunami disasters. Through an interactive educational approach and comprehensive training, this program succeeded in increasing participants' knowledge, disaster activity plans, disaster warnings, and resource mobilization. Collaboration between the service team, village, sub-district government, and community health centers also plays an important role in the success of this program. By involving various activities such as education and training, the DEC program provides an effective and enjoyable learning experience for the coastal children of Sabrang Village.

The community service program carried out by the team aims to create a young generation that is resilient to disasters, however, several limitations need to be overcome to increase the effectiveness of the program, including limited dissemination of disaster information and training and lack of resources and program mobilization for sustainability. Recommendations that can be made to strengthen the DEC program include: (1) Expand the reach of disaster training to more schools and communities in other coastal areas; (2) Hold information campaigns and disaster simulations regularly to increase public awareness and preparedness; (3) increase cooperation with government and non-government institutions to provide evacuation tools and train local volunteers.

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