



Designing Interactive, Contextual, and Technology-Based Disaster Mitigation Learning Materials to Improve Student Preparedness

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Abstract

Disasters such as earthquakes, floods, and landslides often occur in Bengkulu; however, the level of preparedness among residents and children is still lacking. These findings are in line with research conducted in 2023 at educational institutions in Bengkulu City, which showed that students' understanding was still inadequate. The lack of understanding and skills in disaster mitigation increases the risk of casualties and material losses. Therefore, the development of effective disaster mitigation learning materials in schools is important to build students' awareness and ability to deal with disasters. This research aims to (1) identify the obstacles faced by teachers in delivering disaster mitigation materials in high schools in Bengkulu City, and (2) design interactive, contextual, and technology-based disaster mitigation learning materials to improve student preparedness. The research used the 4D method, which includes Define, Design, Develop, and Disseminate. For selecting participants, the study used purposive sampling based on the research requirements. The sample was taken from SMA 6 in Bengkulu City, which includes two classes, X and XI, making a total of 60 students. The findings showed a noticeable improvement in performance after using the learning module. The results of the student preparedness study at SMAN 6 Kota show that 65% of students are in the very prepared category, 18.9% of students are in the prepared category, and 13.6% of students are in the less prepared category. The learning module developed was proven to be valid with an average validation score of 3.50–3.80 (valid category).

Keywords: Development; Learning Materials; Disaster Mitigation; Preparedness; Skills

Introduction

Bengkulu city is an area that is very at risk from different natural disasters like earthquakes, tsunamis, floods, and landslides (BNPB, 2021). Records show that Bengkulu experienced an earthquake of 8.5 on the Richter scale in 2007, and it could face similar events again in the future (PVMBG, 2020). Despite this, the readiness of the local community, especially high school students, to deal with such disasters remains low. Research data shows that 65% of high school students in Bengkulu do not understand disaster evacuation procedures (Fadhilah, N., Supriatna, N., & Malihah, E, 2022). Meanwhile, another study shows that only 30% of schools have structured disaster mitigation programs (Arif, S., Suryono, Y., & Hadi, S, 2021).

This indicates a gap in knowledge and skills that needs to be addressed immediately. The low level of understanding of disaster mitigation among students is also reflected in the lack of integration of disaster-related material into the school curriculum. Education about preventing disasters should be given to everyone in society, including students in schools, as mentioned (Alfi, M., & Maryani, E., 2019). 80% of teachers do not have adequate teaching materials to teach disaster mitigation (Sari, R. P., & Putra, A. D., 2020). In fact, according to UNESCO, school-based disaster mitigation education is an effective strategy for increasing community resilience (UNESCO, 2019). Interactive disaster mitigation learning can increase student knowledge retention by up to 40% (Shaw, R., Chatterjee, A., & Pribadi, K. S., 2020). However, its implementation in Indonesia, including in Bengkulu, is still limited. In addition, conventional disaster mitigation learning methods, such as one-way lectures, are considered ineffective in building student preparedness. Simulations and project-based learning are more effective in improving students' practical skills (Johnson, V. A., et al, 2014). Similar findings state that students who participate in evacuation drills respond 50% faster when faced with an emergency situation (Pratama, A., Nugroho, H., & Sari, D., 2023).

However, a subsequent study explained that only 15% of schools in Bengkulu routinely conduct disaster simulations, thus requiring the development of more applicable learning materials (Wijayanti, E., & Hadi, S., 2022). Based on these findings, the development of effective disaster mitigation learning materials is an urgent need for high schools in Bengkulu City. The importance of a multimodal approach, such as a combination of videos, educational games, and field practice, to improve student understanding.

Therefore, this study seeks to create contextual and interactive learning materials focused on disaster mitigation to enhance students' knowledge and skills in handling disasters, while supporting the government's disaster-safe school policy. In Indonesia, several studies have emphasized the need to include disaster mitigation education in school curricula. For example, Sutopo et al. (2020) developed locally-based teaching resources for elementary students in areas prone to landslides, which led to a noticeable improvement in students' understanding after the program was implemented. b) Rahmawati and Yulianti (2021) stated that a contextual approach based on locality can improve disaster literacy and the relevance of material for students. c) Yuliana et al. (2019) designed interactive multimedia-based disaster mitigation modules for high school students, and the results showed an increase in student engagement and learning outcomes. d) Putri & Widodo (2022) developed an Android-based educational application capable of presenting visual evacuation simulations, improving students' practical skills in responding to earthquakes. Previous studies have shown the effectiveness of using interactive teaching materials and simulation-based learning methods in improving students' understanding of disaster mitigation.

However, there are still shortcomings in the development of contextual materials that are appropriate to local conditions, especially in disaster-prone areas such as Bengkulu City. The novelty of this study lies in the development of disaster mitigation learning materials that: Are based on the

geographical conditions and local disaster potential in Bengkulu City. Use digital tools and engaging learning techniques. Encourage students and the school community to take an active role in their learning.

Research Methodology

Research Type and Approach

This research is an R&D study that follows the 4D model, which includes Define, Design, Develop, and Disseminate. This model was selected because it is structured and enables ongoing assessment throughout the creation of learning materials that are relevant, accurate, useful, and effective (Thiagarajan, S., Semmel, D. S., & Semmel, M. I., 1974).

Research Subjects and Location

The study took place at SMA 6 Kota Bengkulu, which is in an area that often experiences disasters. The participants included 10th and 11th grade students, along with geography teachers who helped with the research. A total of 60 students were selected as the sample, with 30 from the 10th grade and 30 from the 11th grade.

Research Procedure

The following is a description of each stage in the 4D model that will be implemented:

Define Stage

Objective: To identify needs, student characteristics, and existing learning problems.

Activities: Analysis of the curriculum and basic competencies, interviews and questionnaires with teachers and students, literature study and preliminary study at the school, formulation of mitigation material competencies.

Team involved: Team leader (needs analysis) Member 1 (observation & interviews) Member 2 (curriculum analysis).

Design Stage

Objective: To develop a learning product design.

Activities: Compiling the structure of disaster mitigation material, designing media and evaluation tools, compiling the initial draft of the product (digital/print modules, infographics, simulations).

Team involved: Team leader (content design) Member 1 (media design) Member 2 (evaluation tools & initial validation)

Development Stage

Objective: To develop, validate, and test the practicality and effectiveness of the product.

Activities: Expert validation (material, media, learning), product draft revision, limited testing in one school, analysis of student learning outcomes (pre-test–post-test) and observation of skills.

Team involved: Team leader (coordination and data analysis) Member 1 (test instrument processing) Member 2 (field observation and interviews)

Disseminate Stage (Dissemination and Implementation)

Objective: Disseminate the product to other schools and publish the research results.

Activities: Training teachers in the use of the product, distribution to partner schools, publication of results in scientific journals and national seminars, preparation of final reports.

Team involved: Team leader (presentation & publication) Member 1 (teacher training) Member 2 (monitoring & evaluation)

Expected Results The main product is disaster mitigation learning materials in digital and print form, which are: Valid (according to experts), Practical (according to teachers), Effective (according to student learning outcomes). Increased student knowledge and mitigation skills, as demonstrated through pretest–posttest and observation of action skills.

Targeted Achievement Indicators

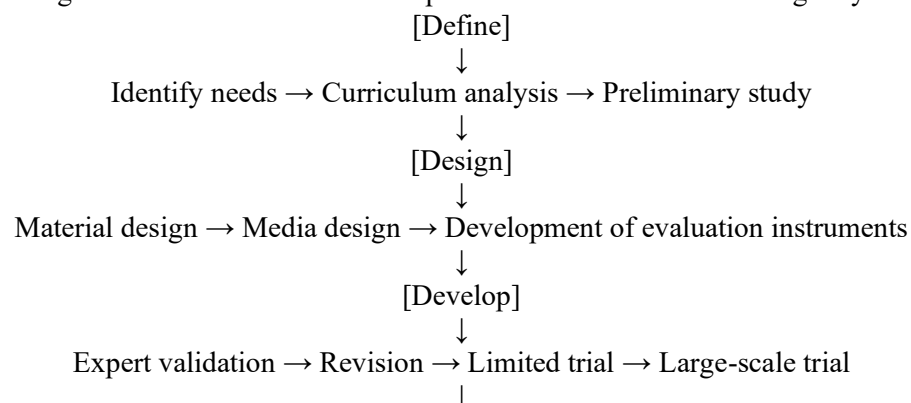
Table 1: Targeted Achievement Indicators

Aspects	Indicators	Targets
Product validity	Expert assessment of materials/media	≥85% (highly valid category)
Practicality	Teacher & student questionnaires	≥ 80% (practical category)
Effectiveness	Improvement in learning outcomes (N-gain)	≥ 0.6 (medium/high category)
Skill improvement	Observation of student actions in simulations	≥ 80% indicates correct mitigation measures

Source: Research Data for 2025

Research Flowchart

The following is a flowchart of the research procedure that describes the stages systematically:



Analysis of student learning outcomes and skills

↓
[Disseminate]

↓
Teacher training → Implementation

Figure 3.1. Research Flow Chart

Data Collection Techniques and Instruments

The data collection techniques used in this teaching material development research were observation, questionnaires, interviews, documentation, and tests. The availability of instruments was used to determine the feasibility of teaching materials to validate the developed products. a. Observation b. Questionnaires c. Interviews d. Documentation e. Tests The instruments for this study were developed based on the opinions of Dick and Carey regarding the criteria for assessing teaching materials (Zimmermann, A. E., King, E. E., & Bose, D. D., 2024). Based on the above, the researcher modified the research instruments to suit the researcher's needs. The researcher divided the instruments into five instruments, namely: 1) Validation sheet by subject matter experts; 2) Validation sheet by media experts; 3) Language validation sheet by language experts. 4) Observation guideline sheet. 5) Interview guidelines for teachers.

Data Analysis Techniques

a. Analysis of teaching material validity data

Data analysis was performed using quantitative descriptive analysis. First, data calculation was performed by calculating the mean of each data obtained using the following formula (Creswell, John W, 2017):

$$\text{Mean (me)} = \sum x / N$$

Description:

Mean (M): Average score

$\sum X$: Total score obtained

N: Total number of items

Based on this formula, the validation results are assessed using a conversion scale of achievement levels referring to the achievement standards (scores) adjusted to the predetermined categories (Chinofunga, M. D., Chigeza, P., & Taylor, S. 2024).

Table 2: Conversion of Quantitative Data to Qualitative Data on a Five-Point Scale

Score Interval	Category	Description
$X > X_i + 1,80 S_{bi}$	Very Valid	No Revision
$X_i = 0,60 S_{bi} < X \leq X_i + 1,80 S_{bi}$	Valid	No Revision
$X_i - 0,60 S_{bi} < X \leq X_i + 1,60 S_{bi}$	Fairly Valid	Revision Needed
$X_i - 1,80 S_{bi} < X \leq X_i - 0,60 S_{bi}$	Less Valid	Revision
$X \leq X_i - 1,80 S_{bi}$	Very Less Valid	Revision

Source: Research Data for 2025

Explanation:

- Ideal mean (X_i): $1/2$ (ideal maximum score + ideal minimum score)
- Ideal standard deviation (S_{bi}): $1/6$ (ideal maximum score + ideal minimum score)
- Actual score (X): Empirical score Based on these calculations, quantitative data was obtained

and converted into qualitative data on a five-point scale as follows:

Table 3: Product Validity Criteria

Score Interval	Criteria
4,22-5	Very Valid
3,41-4,21	Valid
2,61-3,40	Fairly Valid
1,80-2,60	Less Valid
1-1,79	Very Less Valid

Source: Research Data for 2025

b. Test Data Analysis

Field test data was collected using pre-tests and post-tests. The N-gain formula used is as follows.

$$g = \frac{\text{Skor PostTest} - \text{Skor Pretest}}{\text{Skor Ideal} - \text{Skor Pre Test}}$$

After the N-gain results are obtained, continue by calculating the student's score using the N-gain categories in the following table.

Table 4: Criteria for Learning Outcome Improvement

N-gain value	Interpretation
$-1,00 \leq g < 0,00$ T	Decrease
$g = 0,00$	No Decrease
$0,0 < g < 0,30$	Low
$0,30 \leq g < 0,70$	Medium
$0,70 \leq g < 1,00$	High

Source: Research Data for 2025

Findings and Discussion,

Findings

Research Results

a. Overview of SMAN 6 Bengkulu City

1. School Profile School

Name: SMAN 6 Bengkulu City

Address: Jl. Pratu Aidit No.23, Bajak, Kec. Tlk. Segara, Bengkulu City, Bengkulu 38118

Accreditation: A Year Established: 1991

2. Teacher and Student

Data SMAN 6 Bengkulu City has 74 teachers consisting of the principal, vice principal for curriculum, vice principal for student affairs, vice principal for facilities and infrastructure, and subject teachers. Meanwhile, the total number of students from grades X to XII is 496, divided into 29 study groups. There are 215 male students and 281 female students. The curriculum used is the independent

high school curriculum.

- b. Data Analysis
 1. Research Instrument Testing
 - 1) Instrument Validity

Testing Validity is a research instrument with the aim of proving validity. An instrument is said to be valid if it can be used to measure what is to be measured. The research instrument used in this study was a test instrument consisting of 25 multiple-choice questions. These questions were administered to 30 students in grades X and XI at SMAN 6 Bengkulu City. Data is considered valid if the calculated value is greater than the table value. The calculations in this study used product moment correlation with a significance level of 0.05, a two-tailed test, and a sample size of $n = 40$, where r_{table} was 0.444. The following table shows the results of the validity test calculations.

Table 5: Instrument Validity Test for the Pilot Class

Number Question	r_{table}	r_{hitung}	Criteria
1	0,444	0,73456	Valid
2	0,444	0,56384	Valid
3	0,444	0,42313	Invalid
4	0,444	0,76245	Valid
5	0,444	0,63929	Valid
6	0,444	0,57389	Valid
7	0,444	0,56299	Valid
8	0,444	0,78593	Valid
9	0,444	0,41084	Invalid
10	0,444	0,83628	Valid
11	0,444	0,68372	Valid
12	0,444	0,56483	Valid
13	0,444	0,74839	Valid
14	0,444	0,40374	Invalid
15	0,444	0,46372	Valid
16	0,444	0,57282	Valid
17	0,444	0,40762	Invalid
18	0,444	0,46819	Valid
19	0,444	0,84030	Valid
20	0,444	0,67839	Valid
21	0,444	0,72937	Valid
22	0,444	0,42382	Invalid
23	0,444	0,65839	Valid
24	0,444	0,47589	Valid
25	0,444	0,57833	Valid

Source: Annual data analysis, 2025

From the data above, it can be concluded that of the 25 pretest questions tested, 5 questions were invalid because the calculated value was smaller than the table value. The table value was obtained by looking at the 5% significance table for a two-tailed test and $N = 20$, resulting in a table value of 0.444. The five invalid questions are questions 3, 9, 14, 17, and 21. Therefore, there are 20 valid questions that are suitable for testing.

- 2) Item Analysis
 - a) Difficulty Level Test

In the difficulty level test, the instruments that have been piloted are calculated using the difficulty index, and the results are shown in the following table:

Table 6: Test of Difficulty Level

No	Criteria for Difficulty Levels	Number of Questions
	Difficult	0
	Currently	20
	Easy	5
Amount		25

Source: Annual data analysis, 2025

Based on the table above, there are 5 questions with easy criteria, 20 questions with medium criteria, and no questions with difficult criteria or a value of 0. This shows that the number of students who can answer each question correctly is greater than the number of students who answer each question incorrectly.

- b) Discrimination Index

In the discrimination index test on the instrument that has been tested, the results are calculated using Excel and obtained in the following table:

Table 7: Differential Power Test

No	Level of Difficult Questions	Number of Questions
1	Very Good	2
2	Good	8
3	Pretty good	10
4	Not Good (elimination)	5
Amount		25

Source: Annual data analysis, 2025

The table above shows that there were 2 questions with excellent discriminating power, 8 questions with good criteria, 10 questions with fairly good criteria, and 5 questions with poor criteria (eliminated). Questions with low discriminating power were discarded because they could not distinguish between students with high and low abilities.

Respondent Characteristics

This study involved 60 students from SMAN 6 Bengkulu City as respondents selected through purposive sampling. The characteristics of the respondents are presented in Table 1 below:

Table 8: Characteristics of Respondents

Variable	Categori	Amount	Percentage
Gender	Male	22	37%
	Female	38	63%
Class	X	30	50%
	XI	30	50%
Age	15-16 year	33	55%
	17-18 year	27	45%

Source: Annual data analysis, 2025

**Designing Interactive, Contextual, and Technology-Based Disaster Mitigation Learning
Materials to Improve Student Preparedness**

The result of this research is a STEM-based module with natural disaster mitigation material in geography lessons in grades 10 and 11 of senior high school. The data described in this study includes module validation analysis, learning outcomes, and student responses. The development stages, which include analysis, design, development, dissemination, and implementation, will be described in sequence.

Define

The initial stage, analysis, was carried out as a step to analyze the problems and think about the solutions that would be implemented to solve them. This study analyzed students and teaching materials through observation. The observation found that, on average, students had difficulty answering their teachers' questions due to a lack of concentration. Most students were passive, and some even talked with their friends during class. They also found the teaching materials boring. This was also found in previous observations, namely that many students were silent and not focused during the lesson (Rahmayani, et al., 2018; Yanti, et al., 2018).

The material was analyzed to identify the problems experienced by students when learning about natural disaster mitigation. This concept is actually easy and important material because it is closely related to everyday life. As stated by several previous researchers, the material developed must be in accordance with the results of the analysis and the current learning syllabus (Rahmayani, et al., 2018; Koswara & Mudilarto, 2018).

Design

The second stage of 4D development is design, which is the first step in developing this module. The initial draft of the module was written in Indonesian in accordance with EYD so that it would be easily understood by students. The format was selected for designing and arranging the

images. The design and format of this module can be seen in Figures 1(a), 1(b), 1(c), and 1(d).

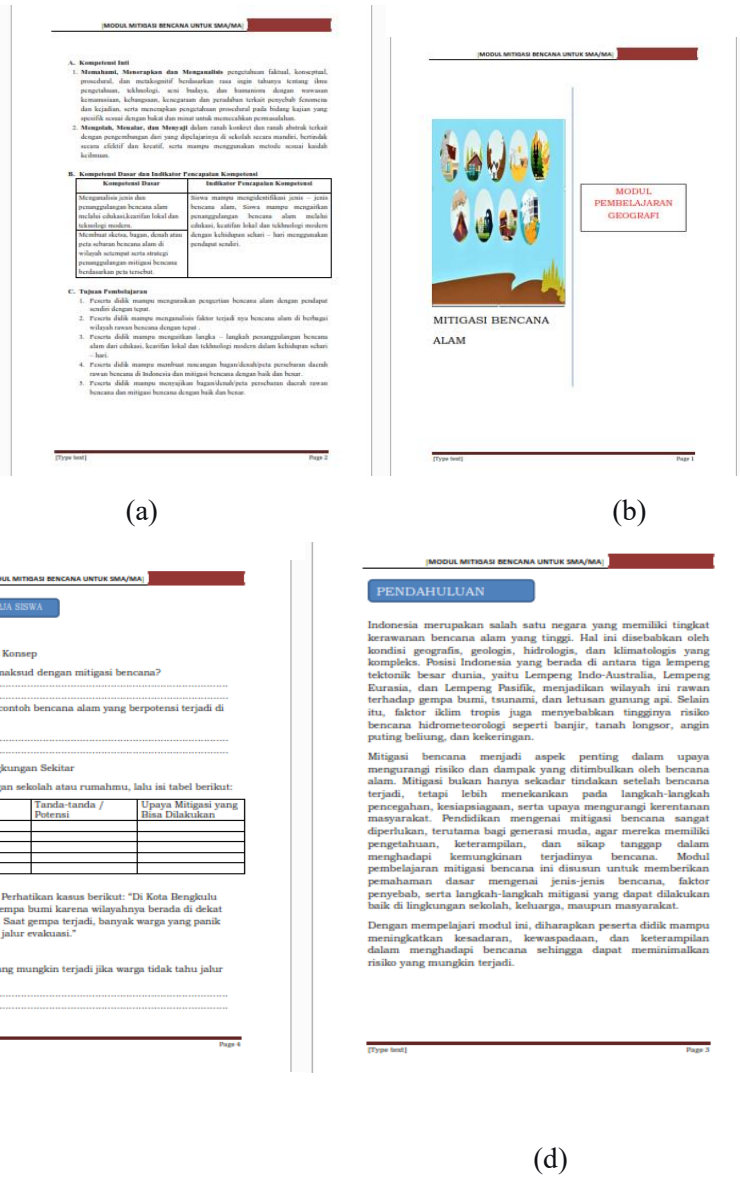


Figure 1. Design of (a) Cover, (b) KI and KD, (c) Introduction, and (d) Student Worksheet

Development

The third stage in this study was development, which involved developing the module design that had been compiled. After the module was developed, validation was carried out to determine its feasibility. This was done by one material validator, namely a high school geography teacher, and two expert validators, namely a lecturer in Indonesian Language Education at Unihaz and a lecturer in Geography at FKIP Unihaz. The average module validation results obtained ranged from 3.50 to 3.80, indicating that the module meets the requirements as a valid instrument and can be used in field research. The module validation results can be seen in the following table:

Table 9: Expert Validation of Modules

No	Aspect	Expert Validation	Category
1	Content	3,80	Valid

2	Language	3,56	Valid
3	Presentation	3,70	Valid
4	Display	3,56	Valid

Source: Annual data analysis, 2025

Based on the validation results from experts, several revisions were made according to the input and suggestions. The cover was redesigned to be clearer and more relevant to the material on natural disaster mitigation. The learning objectives, Core Competencies (KI) and Basic Competencies (KD), were compiled into a single sheet and made more attractive so that students could read them easily. The worksheets and discussion sheets were made more interesting so that students would be more enthusiastic when conducting experiments and discussions. As for the results of the qualitative data validation of the instructional study, two validation processes were carried out because in the first validation stage the product needed to be revised, and in the second validation the product could be used without revision. The results of the qualitative data in the instructional study can be seen in Tables 4.5 and 4.6.

Table 10: Qualitative Data Results of Instructional Study

Validation	Suggestions and Comments	General Assessment
1	Improve module objectives and module writing using Indonesian with good and correct spelling.	Used with revisions
2	Improve concept maps with mind mapping flow.	Used with revisions
3	Improve some of the writing in the module, use attractive fonts and attractive color combinations.	Used with revisions

Source: Annual data analysis, 2025

Table 11: Qualitative Data Results of Instructional Studies After Revision

Validation	Suggestions and Comments	General Assessment
1	Continue to the next step	Used with revisions
2	Continue to the next step	Used with revisions
3	Used with revisions	Used with revisions

Source: Annual data analysis, 2025

Disseminate

The dissemination of this learning module was carried out at SMAN 6 Bengkulu City on a limited basis, only applying to grades X and XI with a total of 60 students. The purpose of this dissemination was to observe improvements in student knowledge and skills.

Student Preparedness for Disasters at Bengkulu City High School

Table 12: of Student Preparedness for Disasters at Senior High Schools in Bengkulu City

No	Research Questions	Percentage of Responses Respondents			
		S	S	S	S
a)	Knowledge About Disasters				

1	I am aware of the types of disasters that could potentially occur in my area	1	0	9	0
2	I am able to recognize the early signs of a natural disaster	6	8	6	0
3	I understand the evacuation routes that have been established at school	8	0	2	0
4	I know the safe assembly points in the event of a disaster	6	0	4	0
8	I know the emergency telephone numbers and disaster management agencies	8	5	7	0
1	I know how to save myself in the event of an earthquake	5	1	4	0
12	I understand the evacuation procedures in the event of a tsunami	6	8	6	0
17	I am able to distinguish between valid information and hoaxes about disasters	9	7	7	0
	Amount	99	39	5	
	Percentage	2%	8%	0%	
b) Preparedness Planning					
5	My family has an emergency plan to deal with disasters.	4	6	0	0
13	My family keeps important documents in a safe and easily accessible place.	6	4	0	0
16	I actively follow early warning information from official sources.	5	3	2	0
19	I understand the importance of complying with early warnings and evacuation instructions.	1	9	0	0
	Amount	56	2	2	
	Percentage	5%	5.8%	3.2%	
c) Keterampilan Praktis					
6	I am trained in performing self-rescue actions during disasters.	5	5	0	0
7	My school regularly conducts disaster simulations.	0	3	7	0
9	I am able to use a fire extinguisher.	0	5	5	0
10	I have basic knowledge of first aid for accidents.	1	5	4	0
15	I know how to use communication equipment during disaster emergencies.	7	4		0
18	I am skilled in performing independent evacuation without the help of others.	5	5	0	0
	Amount	58	7	15	
	Percentage	3.8%	4.2%	2%	
d) Logistics Resources					
14	I have a supply of clean water and food for emergencies.	0	0	0	0
	Amount		5	5	

		0			
	Percentage	3.4%	.3%	.3%	
e) Attitude and Self-Confidence					
20	I am confident that I can handle emergency disaster situations.	0	0		
	Amount	0	5		
	Percentage	3.4%	.3%	.3%	7.5

*SS: Strongly agree; S: Agree; KS: Disagree somewhat; TS: Disagree;

Source: Annual data analysis, 2025

Table 13: Preparedness Knowledge

No	Criteria	Frequency	Percentage
1	Very Ready	40	67.5%
2	Ready	11	18.9%
3	Unprepared Ready	9	13.6%
	Amount	60	100%

Source: Annual data analysis, 2025

Table 13 shows data indicating that 67.5% of respondents were in the very prepared category, 18.9% were in the prepared category, and 13.6% were in the unprepared category. These results suggest that students at SMAN 6 Bengkulu City are prepared to deal with disasters. Disaster knowledge in the second variable can be determined using a questionnaire containing several questions. The questions in this second variable consist of five (5) indicators, namely: (1) Knowledge About Disasters, (2) Preparedness Planning, (3) Practical Skills, (4) Logistical Resources, and (5) Attitude and Self-Confidence.

Conclusion

The results of the study conducted at SMAN 6 Bengkulu City provide a comprehensive overview of the school profile, instrument validity, students' knowledge and preparedness for disasters, obstacles faced by teachers, and the effectiveness of the disaster mitigation learning module developed.

Overview of the School and Characteristics of Respondents

SMAN 6 Bengkulu City is a school with A accreditation and a large number of students, namely 496 students and 74 teachers. The characteristics of the respondents show that most of the students are female (63%) aged 15–18 years, and are evenly divided between grades X and XI. This composition shows representative diversity, so that the research results can describe the general preparedness of high school students in Bengkulu City. These findings are in line with the opinion of

Lestari & Putra (2020) that demographic factors such as age and gender also influence individual understanding of disasters and preparedness.

Research Instrument Testing

The validity test results show that of the 25 questions tested, 20 were valid and 5 were invalid (numbers 3, 9, 14, 17, and 21). This indicates that most of the instruments can be used to measure students' knowledge of disaster mitigation. The level of difficulty of the questions was in the moderate (21 items) and easy (5 items) categories, with no questions being too difficult. This condition is in accordance with the principles of effective instrument development, namely that questions should not be too easy or too difficult in order to differentiate students' levels of understanding. The discrimination test results also support the quality of the instruments, with 20 questions classified as very good, good, and fairly good, and 5 questions eliminated due to low discrimination. Thus, the research instruments can be declared suitable for use in measuring students' knowledge.

Students' Level of Preparedness

Analysis of student preparedness shows that most students are in the very prepared (67.5%), prepared (18.9%) and 13.6% unprepared category, with none in the underprepared category. This preparedness covers five important aspects, namely disaster knowledge, preparedness planning, practical skills, logistical resources, and attitude and self-confidence. However, an interesting finding is that the practical skills aspect is still relatively low (43.8%), especially in the indicators of disaster simulation and the use of fire extinguishers. This confirms that even though students' knowledge is good, practical skills still require continuous training. According to UNISDR (2015), preparedness includes not only knowledge but also practical skills that can be applied when a disaster occurs.

Effectiveness of the Disaster Mitigation Module

The developed learning module was proven to be valid with an average validation score of 3.50–3.80 (valid category). The limited distribution of the module showed a significant increase in students' knowledge and preparedness. This module is also interactive, contextual, and technology-based, thereby increasing the learning motivation of students who were previously passive. This is in line with the findings of Koswara & Mudilarto (2018) that the use of contextual and technology-based teaching materials can increase student active participation and facilitate understanding of abstract material.

Research Implications

The results of this study indicate that disaster mitigation learning can not only increase students' knowledge but also their preparedness in a tangible way. However, there is an urgent need to strengthen practical skills through simulations, first aid training, and the use of emergency equipment. Additionally, support from schools and external agencies such as BPBD, PMI, and BASARNAS is

crucial to enrich students' learning experiences. Therefore, this module can serve as an alternative solution to address curriculum limitations and is expected to be implemented more widely in other schools in Bengkulu City and other disaster-prone areas.

Suggestion

Suggestion Based on the findings of this study, several suggestions can be made for future practice and research.

For Teachers: Teachers are encouraged to integrate interactive, contextual, and technology-based disaster mitigation materials into classroom activities. Such integration can enhance students' engagement, understanding, and preparedness toward disaster risk reduction in schools.

For Schools and Education Stakeholders: Schools should provide adequate facilities and support systems, including digital infrastructure and training, to enable the effective use of technology-based learning materials. Collaboration with local disaster management agencies can also strengthen the practical aspect of disaster education.

For Future Researchers: Future research could explore the long-term impact of interactive and contextual learning materials on students' behavior and disaster response skills. In addition, further studies might focus on developing mobile or augmented reality applications to simulate real disaster scenarios for learning purposes

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