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Effectiveness of Student Oriented Disaster Mitigation Learning Model on Students' Disaster Awareness in Primary School

[1]Kosim, [2]Syahrial A, [3]I Wayan Gunada, [4]Khaerus Syahidi

[1,2,3]Physics Education Study Program, Mathematics and Natural Sciences Education, Mataram University, Jl. Majapahit 62 Mataram, Indonesia 83125
[4]Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Hamzanwadi University, Jl. TGKH Muhammad Zainuddin Abdul Madjid No.132, Pancor Lombok Timur, Indonesia 83611

Email: syahrial_ayub@unram.ac.id

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Abstract

Effectiveness of Student Oriented Disaster Mitigation Learning Model on Students' Disaster Awareness in Primary School *The increase in the incidence of disasters in recent years has given birth to many ideas in disaster mitigation efforts to save lives from the effects of disasters. The disaster mitigation system in Indonesia is still far from ideal. Mitigation technology is only limited to pre-disaster and early warning. There is no technology that facilitates knowledge and preparedness. Education and disaster mitigation procedures that must be imitated by the community are very necessary. The aim of the study was to determine the effectiveness of the disaster mitigation learning model on disaster awareness of students at SD N 6 Mataram. This study was limited to 25 fifth grade or high grade students at SD N 6 Mataram using a one group pretest-posttest design. Disaster mitigation awareness is measured using an objective test instrument with 25 items. Disaster mitigation awareness includes disaster knowledge (PK), disaster signs (TB), risk impact and efforts to reduce (DR), preparedness (KN), and procedures, first aid tools for victims (AP). The disaster mitigation awareness test instrument used has been tested for validity and reliability. The data obtained were statistically analyzed using SPSS 23.0 by performing normality test and paired t-test (paired t-test). The results showed that the student-oriented disaster mitigation learning model was effective in increasing the disaster awareness of students at SD N 6 Mataram.*

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Abstrak

Meningkatnya kejadian bencana dalam beberapa tahun terakhir telah melahirkan banyak gagasan dalam upaya mitigasi bencana untuk menyelamatkan nyawa dari dampak bencana. Sistem mitigasi bencana di Indonesia masih jauh dari ideal. Teknologi mitigasi hanya sebatas prabencana dan peringatan dini. Tidak ada teknologi yang memfasilitasi pengetahuan dan kesiapsiagaan. Edukasi dan prosedur mitigasi bencana yang harus ditiru oleh masyarakat sangat diperlukan. Penelitian ini bertujuan untuk mengetahui keefektifan model pembelajaran mitigasi bencana terhadap kesadaran bencana siswa di SD N 6 Mataram. Penelitian ini dibatasi pada 25 siswa kelas V atau kelas tinggi di SD N 6 Mataram dengan menggunakan one group pretest-posttest design. Kesadaran mitigasi bencana diukur dengan menggunakan instrumen tes objektif dengan 25 item. Kesadaran mitigasi bencana meliputi pengetahuan bencana (PK), tanda-tanda bencana (TB), dampak risiko dan upaya pengurangan (DR), kesiapsiagaan (KN), dan prosedur, alat pertolongan pertama bagi korban (AP). Instrumen uji kesadaran mitigasi bencana yang digunakan telah diuji validitas dan reliabilitasnya. Data yang diperoleh dianalisis secara statistik menggunakan SPSS 23.0 dengan melakukan uji normalitas dan uji t berpasangan (paired t-test).

Hasil penelitian menunjukkan bahwa model pembelajaran mitigasi bencana berorientasi siswa efektif dalam meningkatkan kesadaran bencana siswa di SD N 6 Mataram.

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INTRODUCTION

One of the national issues that still constitutes a polemic among Indonesian people is the issue of natural disasters. Geographically, Indonesia is an area that is prone to natural disasters. This is because Indonesia is located between 2 circums, 3 shoals and the confluence of 4 tectonic plates, namely the Asian plate, the Pacific plate, the Indian plate and the Australian plate. Based on data from the National Disaster Management Authority (BNPB), the total number of disaster cases that occurred in Indonesia reached 4650 in 2020. Moreover, it had reached 1656 throughout 2021 alone. Based on the data from 2018's World Risk Report, Indonesia ranks 36th with a risk index of 10, which means that Indonesia is the 36th (out of 172) most prone country to natural disasters in the world (https://youtube.be/vaQ_QOJzTnM). Sutopo (BNPB's spokesman) said that Indonesian's preparedness to face disasters was very low (Widodo, E, 2014). On August 5, 2018, the Lombok earthquake with a potential tsunami devastated nearly ¼ of the area of the beloved island of Lombok. The earthquake left the survivors rebuilding the debris of their lives. This all-powerful warning proved that there is no power and arrogance in the world that can reject the will of Allah SWT. The trauma from the series of earthquakes two years ago is yet to dissapear, on Thursday, July 4 2019, United States geologist and tectonic expert Rolland A. Harris once again announced a potential earthquake with a maximum magnitude of 9 on the Richter Scale in the southern region of Lombok, which is due to an overlap between Indo-Australian and the Eurasian plate in South Lombok. If this happens, the southern region of Lombok will be hit by a 20-meter-high tsunami that can reach the area within 3 to 4 km from the coast. Disaster is a series of events that threaten and disrupt people's lives caused by natural and non-natural factors (Disaptono, 2005). Disasters are unpredictable in terms of when they occur since their occurences are sudden. Disasters can happen when students are studying at school. Thus, the school community's disaster preparedness is very important to reduce victims and losses due to the disasters. The results of the preliminary study discovered that school community's disaster preparedness is still very low. The increase in the occurrence of disasters in recent years spurs the birth of many ideas in disaster mitigation efforts to save lives from the effects of disasters. There needs to be education and procedures for natural disaster mitigation or any efforts to reduce disaster risk (DAPS Team, 2006), which the community must promptly follow. Due to this, we decided to raise natural disaster mitigation education through classroom learning process. The goal is to raise disaster awareness for elementary school students so as to create disaster-aware schools. Instilling disaster awareness in students is a process (Ayub, S., 2019). This research starts with designing a disaster mitigation lesson plan (RPP) for students in elementary schools. The appropriate lesson plan must be able to achieve the goal of establishing a disaster-aware school (Djamarah, 2005). Disaster mitigation lesson plan (RPP) were designed to be student-oriented. The student-oriented model was developed from discovery learning. Disaster awareness expected in students includes knowledge, attitudes and skills on disaster mitigation (Suprapto, 2002). Disaster mitigation is all efforts to reduce disaster risk, which can be done through construction or through increasing the people's ability to face disaster threats (Rusilowati, A,

2012). The implementation, evaluation and reflection of disaster mitigation lesson plans implemented on students resulted in a student-oriented disaster mitigation learning model. This learning model is displayed in the form of a syntax derived from a student-oriented disaster mitigation learning structure. Disaster mitigation education with student-oriented lesson models in elementary schools is expected to be able to increase students' knowledge and skills and raise their awareness about disasters. It is interesting to reveal the effectiveness of the student-oriented disaster mitigation learning model on students' natural disaster awareness in elementary schools.

METHODS

This study is of a research and development with a 4D research design model, namely Define, Design, Develop, and Desseminate (Borich, G., D., 1994). In Define stage, a series of analyses were carried out, which includes an analysis of the learning objectives of disaster mitigation, an analysis of the students' initial disaster mitigation capabilities, an analysis of the scope of disaster awareness, an analysis of the tasks to be given, and an analysis of the education unit level curriculum (KTSP) and the 2013 curriculum. For Design stage, teaching tools consisting of syllabus, lesson plan (RPP), learning media, teaching materials, and disaster mitigation assessment were designed. In Develop stage, product manufacturing, product validation, product revision, and a test on the disaster mitigation capability evaluation tools for student awareness are conducted. The evaluation was then conducted to a limited number of students in the Desseminate stage. The class used in this research is that of the fifth grade in SD Negeri 6 Mataram. The data for the research are in the form of input and suggestions from expert validators (qualitative data) and validation data for teaching tools and evaluation tool testing. The data collection tools encompass expert validation questionnaires, questions about disaster mitigation abilities, learning observation sheets, and student and teacher response questionnaires. The data were analyzed using validator's validity test using the means of the validators (Ratumanan, 2011):

$$NA = \frac{V_1+V_2+V_3+V_4}{4} \text{ .....(1)}$$

The results of the average value of the validators are shown in table 2, the validity assessment criteria:

Table 1: Validity Assessment Criteria

Average value	Category	Decision
1,00 - 1,75	Not valid	Total Revision
1,76 - 2,50	Fair	Revision
2,51 - 3,25	Valid	Suggestion-based Revision
3,26 - 4,00	Very valid	No Revision

Expert validation data from disaster mitigation capability evaluation tool testing were analyzed using the Percentage Agreement (Borich, G., D. 1994).

$$\textit{Percentage Agreement} = \left(1 - \frac{A-B}{A+B}\right) 100\% \text{ ..... (2)}$$

With that criteria, reliable 75%, Percentage Agreement is the percentage agreement between the appraisers, and that percentage is a percentage of the suitability of values between the first and second raters, where A is the higher scorer and B is the smaller scorer. The quality of

disaster mitigation improvement is seen from the N-Gain value. According to (Hake, 2018), the N-Gain value is calculated by the equation:

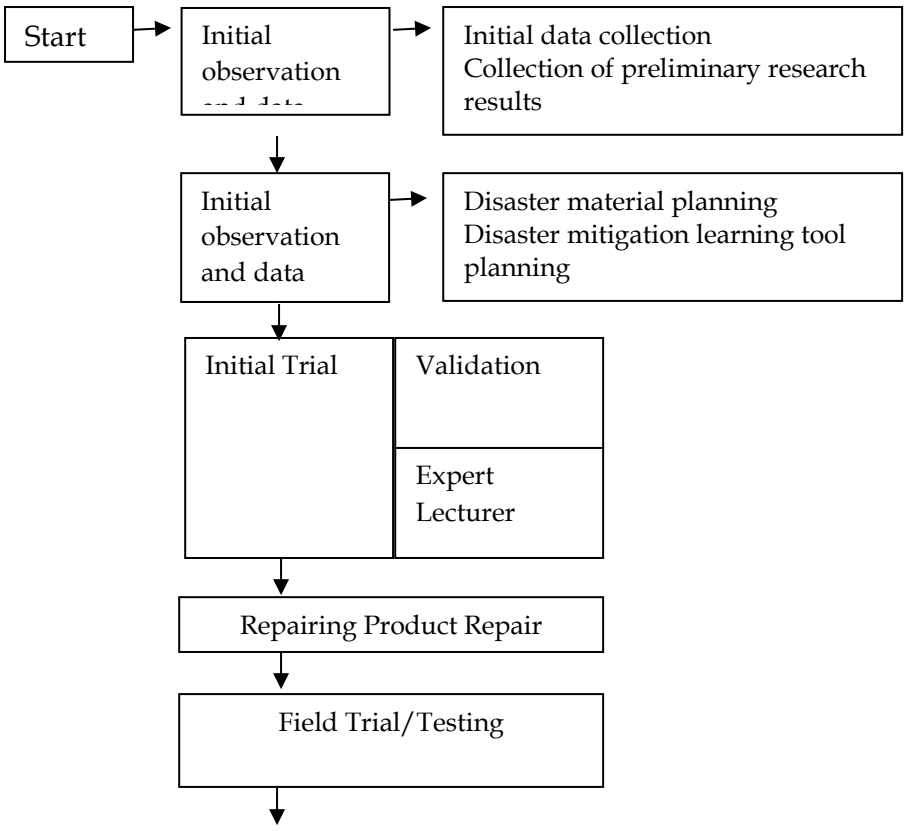
$$< g >= \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} \ldots\ldots\ldots\ldots \quad (3)$$

Where <g> is the N-Gain score, Spost is the posttest score, Spre is the pretest score and Smax is the maximum score.

Table 2: Criteria for N-Gain Score

N-Gain Score Classification	Category
$0.7 < \langle g \rangle \leq 1$	High
$0.3 < \langle g \rangle \leq 0.7$	Moderate
$\langle g \rangle \leq 0.3$	Low

Pretest and posttest data were analyzed statistically using t-test (pair t-test) at a significance level (p-value) of 0.05. Previously, the data were tested for normality. Homogeneity test was conducted to ensure that the hypothesis test was conducted. The research hypotheses tested were Ha (student-oriented learning model disaster mitigation learning tools were effective in increasing students' awareness), and Ho (student-oriented learning model disaster mitigation learning tools were not effective in increasing students' awareness). Statistical analysis was conducted using SPSS 23.0 statistical tool. Figure 1 below is a flow chart of this research:



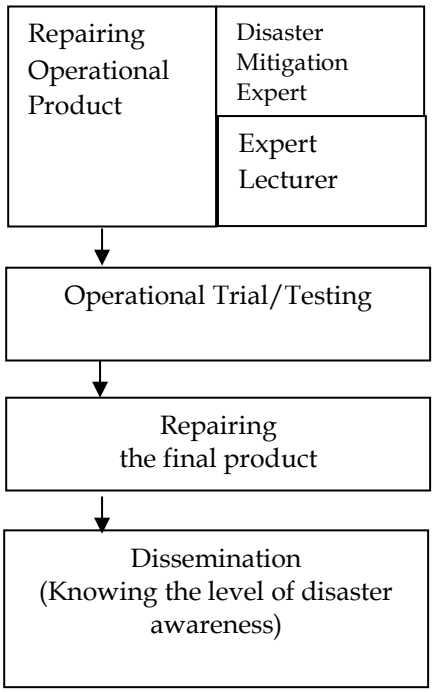
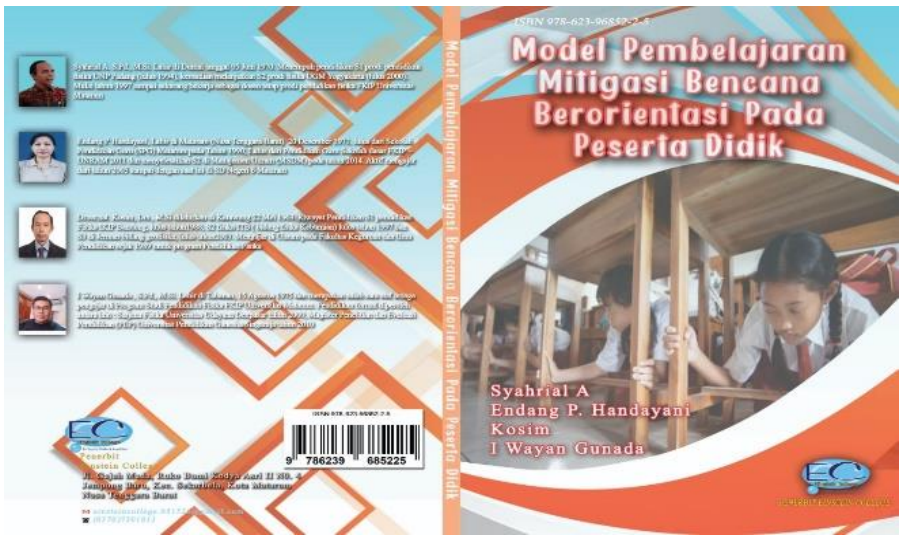


Figure 1: Research Stages

RESULT AND DISCUSSION

The product of the research results in a student-oriented disaster mitigation learning model book, as well as that of tsunami, landslide and flood. These can be seen in Figure 2 below:



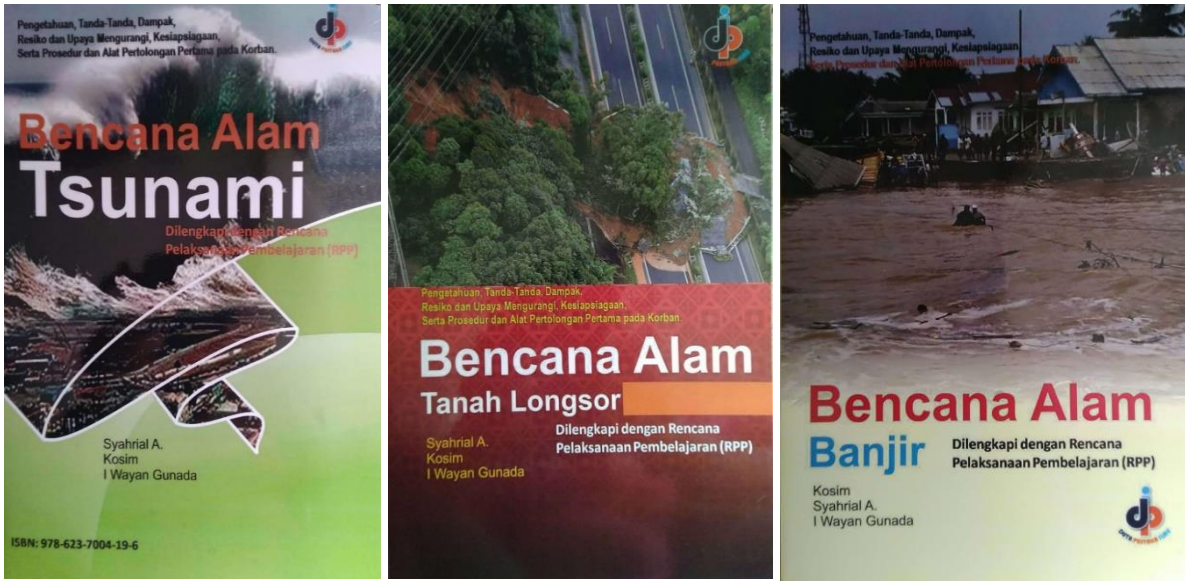


Figure 2: Research product

These books follow the training module for tsunamis, landslides, floods, earthquakes from the Disaster Awarenes in Primary School (DAPS) team of German-Indonesian government collaboration, namely GTZ-Department of National Education Directorate of Kindergarten and Elementary Development and were developed and implemented by the research team. The disaster mitigation teaching tools in this book were developed based on students (student oriented). From the results of implementation, observation, evaluation and reflection there obtained a draft of student-oriented disaster mitigation learning model with the following learning structure:

Table 3. learning structure of student oriented learning

Main Stage	**Learning Stage**	**Alternative Activities**
Early activities	- Introduction	- demo tools brought by teachers - video playback - storytelling/events - sing - review - observe the environment - phenomenon - aperception
Core activities	- Problem formulation	- formulate questions and be written
	- Activities to answer problems	- practice/experimentation - game/simulation - grouping - check disaster mitigation tools - check technical tools - first aid to the victim
	- Observation	- make as many observations as possible
	- Troubleshooting	- student explanation (guess-guess-discussion)

		- the foundation of thought
	- Conclusion	- learners formulate conclusions
Stabilization	- Teacher Explanation	- application
Activities	(when required)	- answer questions
		- create a summary
		- homework

The validation results from disaster mitigation experts and expert lecturers use 4-point assessment scale, in which the lesson plan obtain a score of 3.75 and hence was categorized as not needing revision. Thus, it can be concluded that the lesson plan for student-based disaster mitigation learning is very fitting to be used for disaster learning. The results of the analysis of the Percentage Agreement (PA) value from the validator on the student-based disaster mitigation learning implementation plan can be seen in table 4 below:

Table 4: Reliability Analysis from Expert Validators

Product	PA Value from Validators (%)						V	Note.
	V_{12}	V_{13}	V_{14}	V_{23}	V_{24}	V_{34}		
Lesson Plan	100	98	93	98	96	91	96	Reliable

Disaster awareness in this study, including disaster knowledge (PK), disaster signs (TB), risk impacts and efforts to reduce (DR), preparedness (KN), and procedures, first aid equipment on victims (AP) (Ayub, S. 2019). The pretest includes the 5 disaster awareness knowledge and skills outlined above. Problems that meet the requirements are used to measure the learner's initial ability. After the pretest, then conducted disaster mitigation learning as many as 5 meetings. The five meetings were 1) PK, 2) TB, 3) DR, 4) KS, and 5) AP. Posttest was conducted at the sixth meeting using improved pretest questions. Pretest and posttest results shown in Figure 3.

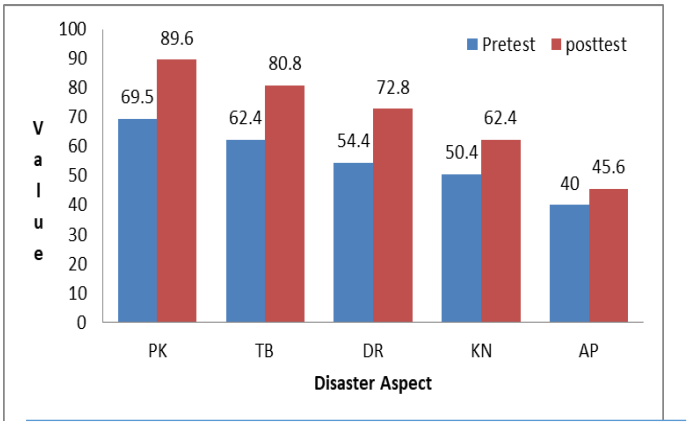


Figure 3. Pretest graph and Posttest Results of Learning disaster mitigation and Aspects of Disaster

Pretest and posttest data used to calculate N-Gain in Table 5.

Table 5. Data Gain Score of each Aspect of Disaster Awareness

AKB	Initial Test	Final Test	Gain Score	Criteria
PK	69.60	89.60	0.89	High
TB	62.40	80.80	0.62	Medium
DR	54.40	72.80	0.49	Medium
KN	50.40	62.40	0.29	Low
AP	40.00	45.60	0.11	Low

Table 5 is an indicator that learning tools can be used for disaster learning in primary schools. Gain Score of disaster awareness learning results shown in Figure 3.

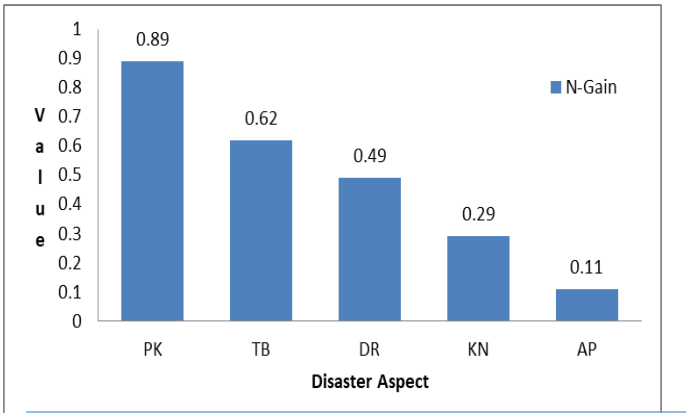


Figure 3. Graph of Gain Score of Disaster Awareness Learning Results

The response of students to learning with disaster mitigation box props was 83.5% of students expressed delight, 73.6% of students expressed easy understanding and 81.43% expressed useful.

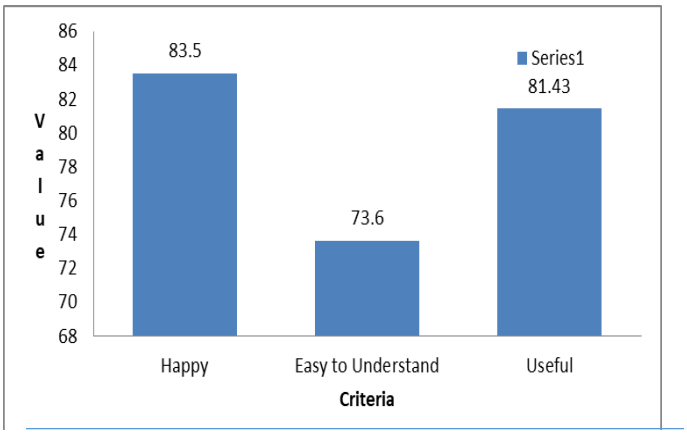


Figure 4. Student Response to Learning with Disaster Mitigation Box

Assessment of the learning process conducted by observers obtained results, aspect 1) learning preparation obtained a score of 3.85 with excellent criteria, aspect 2) the implementation of learning obtained a score of 3.91 with excellent criteria, and aspect 3) the activities of learners

in learning obtained a score of 3.89 with very good criteria. Overall, according to observers disaster learning goes very well.

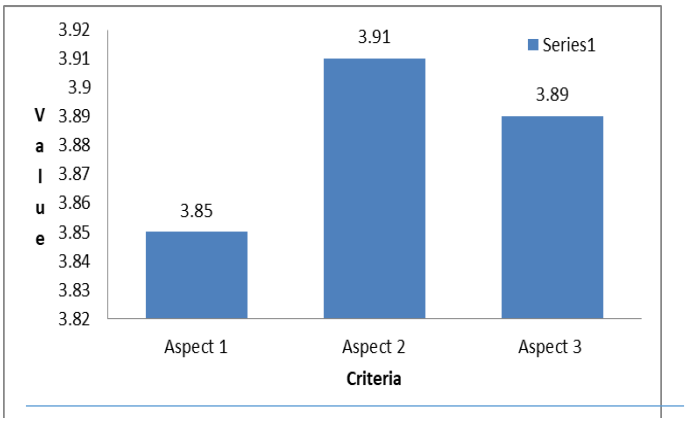


Figure 5. Observer's Assessment of the Learning Process

Based on the data of disaster awareness learning outcomes and improved scores of learning outcomes illustrated that learning with disaster mitigation box props affects the disaster awareness of learners. Normality tests, t-tests and homogeneity tests are conducted using SPSS 23.0. The paired t-test used is a different parametric test on two paired data. In accordance with this understanding, this test is intended for different tests or comparative tests on average two pairs of samples. The two samples in question are the same sample but have two data. Paired t-test is part of parametric statistics, therefore as the rules of parametric statistics research data must be distributed normally. Normal distributed means that pretest and posttest scores have the appropriate proportions between high, medium, and low scores. The score is not concentrated on high, low, or moderate scores only. Kolmogorov-Smirnov normality test can be seen in Table 6.

Table 6. Pretest and posttest normality test results

Criteria	Unstandardized Residual
Kolmogorov-Smirnov Z	0.739
Asymp. Sig. (2-tailed)	0.646

The Kolmogorov-Smirnov normality test is part of a classic assumption test that aims to find out if the residual value is normally distributed or not. A good regression model is to have residuals that are normally distributed. The hypothesis formulation on the normality test is, Ho; normally distributed residual values, and Hi; residual value is not nomal distributed. The basis for conclusion, if the significance value (sig.) > 0.05 then Ho is accepted, Hi is rejected meaning the residual value is normally distributed. If significance (sig.) < 0.05 then Hi is accepted, Ho is rejected meaning the residual value is not normally distributed. Kolmogorov-Smirnov's normality test results showed a value of 0.649 greater than 0.05, meaning that the pretest and posttest in this study were normally distributed. After the normality test is conducted, a paired t-test is conducted to determine the effectiveness of the use of learning devices and disaster mitigation boxes. The results of the paired t-test can be seen in Table 7.

Table 7. Paired t-test pretest and posttest test results

Criteria	t	Df	Sig. (2-tailed)
pretest - posttest	-11.299	24	0.000

The basis of decision making test results paired t-test is; 1) if the value is Sig. (2-tailed) < 0.05, then there is a significant difference between pretest and posttest; 2) if the Sig. (2-tailed) value > 0.05, then there is no significant difference between pretest and posttest. Table 6 showing Sig values. (2-tailed) 0.000 < 0.05, it can be concluded that there is a significant difference between pretest and posttest in learning using disaster mitigation devices and boxes at SD Negeri 6 Mataram. This indicates the effectiveness of the use of disaster mitigation learning model. The learning structure of disaster mitigation model of student oriented learning consists of 3 main stages of learning, namely initial activities, core activities and stabilization activities. Each of the main stages has a purpose. The initial activity is intended to motivate students and make students interested and long for learning. If this has been achieved, it is easy for teachers to achieve their learning goals. The core activities are characterized by problems raised by students through teacher guidance. The teacher formulates and notes on the board. Problems should not be answered directly by the teacher. Teachers are expected to only ask for temporary answers (hypotheses) from students. The hypothesis presented by the students should not be blamed or justified by the teacher, just accommodated because it is expected that later at the end of the core activities will be answered by themselves from the activities carried out. Furthermore, the teacher accompanies the students to do activities in answering the problems that have been formulated. Through activities, observations, discussions and based on the basis of appropriate theory, it is expected that with the facilitation of teachers, students are able to get their own conclusions. Finally, the teacher explains the application of concepts that have been found in life. We recommend that examples of application exist in the environment of the learners taught.

DISCUSSION

The student-oriented learning model disaster mitigation learning structure consists of 3 main stages of learning, namely initial, core and consolidation activities. Each of the main stages has a purpose. The initial activity is intended to motivate students and make students interested and long for learning. If the aim is achieved, it will be easy for the teacher to achieve his learning objectives. The core activity is marked by problems raised by students through teacher guidance. The teacher formulates the question and writes it on the blackboard. However, the teacher must not answer the question directly. Teachers are expected to only ask for temporary answers (hypotheses) from students. The hypothesis put forward by students should not be judged as right or wrong by the teacher, it should be accommodated because it is hoped that at the end of the core activity, the questions will be answered through the activities conducted. Then, the teacher accompanies students to conduct activities to answer the problems that have been formulated. Through activities, observations, discussions and based on an appropriate theoretical basis, it is hoped that with teacher facilitation, students are able to come with their own conclusions. Finally, the teacher explains the implementation of the concepts in real life. It is better if there are already examples of the implementation in the students'

surrounding environment. This structure is what is implemented during the development of the disaster mitigation lesson plan. The implementation of student-oriented learning model disaster mitigation teaching tools is effective in increasing students' awareness of disasters. This is in line with the findings from Widodo, E. (2014), which suggests that teachers and students show great response for disaster mitigation teaching tools. Suhardjo, D. (2011), explained about disaster mitigation education in the context of DRR (Disaster Risk Reduction) such as follows: it must be carried out through formal education in the National Education System program with curriculum design from the National Education Standardization Agency (BSNP). Then, Ayriza, Yulia. (2011) concluded that there was a significant improvement in teacher skills in implementing personal-social guiding services with the aim of increasing students' psychological readiness in dealing with natural disasters between before and after participating in the implementation of guiding module training—both in helping students understand the ins and outs of natural disasters and in managing student affection before and after a disaster. Their skills to guide students in mastering various procedures and skills to save themselves during a disaster also show further improvement. A study by Tohani, E. (2019) discovered that social capital makes a positive contribution in developing a disaster-resistant community even though its existence is not realized in the social life. According to Dwiningrum, A.,I.,S., (2020), the resilience of the students should be understood by the teacher. Teacher efforts to build and develop personal resilience because they are needed to build more effective school resilience. Resilience has the readiness to play a role in disaster mitigation. Disaster mitigation requires social synergy between the roles of principals, teachers, and students in order to build strong social cohesion. Wedyawati, N. (2017) states that there is a significant difference in student learning outcomes in the experimental class and the control class. The results of the questionnaire data analysis show that the integrated natural science learning model for disaster mitigation is very prominent. Muhammad A., (2019), concluded that the religion-related learning material in the 2013 Curriculum contains main/sub-subjects that can be integrated with natural disaster mitigation insights. Agustiana, T., (2013) found that the understanding and resilience of the students who were taught using disaster mitigation learning model was better than the understanding of students who were taught using conventional learning model. A.Rusilowati, (2012) mentioned five learning model feature products such as: syllabus, lesson plans, learning methods, teaching materials, as well as techniques and types of assessment developed covering science materials for grade 5 to 11. The results of the dissemination show that the teaching tools developed are appropriate to be given to students, and can increase students' understanding in recognizing and dealing with disasters. According to Yerizon (2020), the development of teaching tools based on discovery learning models that are oriented to natural disaster mitigation, can be a solution to introduce SMP/MTsN students about natural disaster mitigation. The results of the research described earlier show that teaching tools and disaster mitigation tools make a significant contribution to the knowledge, skills, and attitudes of students in disaster mitigation, so that they are expected to be able to raise students' awareness of disasters.

CONCLUSION

The student-oriented disaster mitigation learning model is effective in increasing students' disaster awareness, which includes disaster knowledge, signs of imminent disaster, risk impacts and efforts to reduce, preparedness, and procedures as well as first aid tools on the victim.

SUGGESTION

The disaster mitigation learning model that has been obtained should be applied on a wider scale in mountainous, coastal and urban areas.

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