The Development of Local Disasters-based Mitigation Module Integrated to Physics Learning

Yuliani* and Wahyono

Sub-Department of Physics Education, Faculty of Teacher Training and Education, Tadulako University, Jl. Soekarno Hatta KM. 9 Kampus Bumi Tadulako Tondo Palu-Sulawesi Tengah, Indonesia

* yulianiy13@gmail.com

Abstract. This study aimed to develop a local disaster potential-based mitigation module that is integrated into physics learning. The compilation of these teaching materials can be utilized as one of the learning media for students to learn about disaster mitigation materials independently. This study was research and development using 4D model that consisted of 4 phases namely, Define, Design, Development, and Disseminate. The participants in this study were 12 students from SMPN 1 Palu. The feasibility test phase of the product was conducted to determine the feasibility of the instructional materials. The trial phase was conducted on trials of material experts, media experts, teachers, and students. Based on the results of trials and questionnaire analysis, the average score of the material experts assessment was 3.24 categorized as “Good”, the average score of media expert assessment was 3.00 categorized as “Good”, the average score of teacher assessment was 4.00 categorized as “Very Good”, and the average score of the assessment based on student responses was 3.52 categorized as “Very Good”. The result of the study shows that the teaching materials generated, particularly those on disaster mitigation, are very suited for use in the learning process.

1. Introduction

Physics is a way of looking at the universe, comprehending how it works and how its various components interact. Students cannot be separated from studying the symptoms or phenomena that occur in the universe, especially those that are near to everyday life, when studying physics. In conclusion, learning physics is a process of gaining information through the study of diverse physical processes that occur throughout the universe [1].

Natural phenomena are non-artificial events in the eyes of physics, which means that they are not caused by humans, despite the fact that they can have an impact on humans. Natural disasters are intimately linked to environmental factors. Natural disasters caused by human activity can be avoided by protecting the environment. Recognizing and maintaining the area's local potential is one strategy to conserve the environment [2].

Palu City is on of cities in Indonesia that is prone to natural disasters. Earthquake, Tsunami, and Liquefaction are the natural disasters that have struck Palu. Delivering disaster mitigation items is an approach to combat these natural disasters. One of the fields that is applied to avert disasters is science [3,4].

Learning about disaster mitigation issues can be delivered through a variety of teaching materials, one of which is printed teaching materials in the form of modules. A module is a learning package that is linked to a certain unit of study content [5]. The modules are organized in a logical and appealing
manner, and they provide content, methodologies, and evaluation that can be utilized independently [6]. According to the research findings of Pambudi [7] modified modules incorporating natural disaster materials into science lessons are appropriate for use and can improve students’ learning outcomes.

According to an interview with one of the science subject teachers at SMP Negeri 1 Palu, the students at the school had never been taught about science learning related to disaster mitigation and had never used a module on science learning related to disaster mitigation; instead, they only use textbooks that teach about science learning in general, with no disaster mitigation material. To address this issue, modules should be used as teaching materials to stimulate students' interest in learning environmental science in order to lessen the danger of natural disasters. Modules are contextually structured and can attract students.

2. Methods
This research was Research and Development (R&D) is a research model that is used to generate products and to evaluate their efficacy [8]. It utilized 4D model that consists of 4 phases namely Define, Design, Development, and Disseminate.

In define phase, the researcher established and defined the learning criteria at this point. In addition, the researcher conducted observations in schools that covered five primary steps: initial and final analysis, student analysis, concepts analysis, task analysis, and learning objective analysis. Meanwhile, in design the researchers designed the product. It covered four steps, namely the tests preparation, media selection, format selection and initial design. The next phase is the development stage. This phase aimed to produce product development which is carried out through two steps, namely expert assessment (materials and media) followed by revision and development trials (students). The last phase was the dissemination. This stage aimed to promote the development product so that it can be accepted by users, whether individuals, groups, or systems. At this phase, the module developed was distributed to several agencies in Palu city including SMP Negeri 1 Palu, the the National Disaster Management Coordinating Board (BPBD) office in Palu City, supervisor and reviewer, and the library of the Physics education study program to determine the quality of the disaster mitigation module. For limited test, 12 students of 8th grade were involved as research subjects to assess the feasibility of teaching materials.

The instrument utilized in this study was a questionnaire which aimed to assess the feasibility of the learning content/material and media. The questionnaire was distributed to material experts, media experts, teachers to assess the feasibility of the module and questionnaire that was distributed to students as research respondents. The questionnaire was a 4-scale of Likert scale. For the data analysis, descriptive statistic was used to calculate the average value of each aspect. This average value analysis technique was determined based on Arikunto's opinion [9] which states that to find out the final score rating for each item of the research questionnaire, the total score obtained is divided by the number of respondents who answered the assessment questionnaire. The average value was by numbering the options from the strongly disagree to strongly agree option sequentially from 1 to 4. The average scores from the evaluation of expert validators, teachers and students then were converted into qualitative form based on Table 1 [10].

| Average Score | Criteria          |
|---------------|------------------|
| 3.25 < X ≤ 4.00 | Very Good (SB)   |
| 2.50 < X ≤ 3.25 | Good (B)         |
| 1.75 < X ≤ 2.50 | Less (K)         |
| 1.00 ≤ X ≤ 1.75 | Very Less (SK)   |

The assessment score or the feasibility level for both each aspect and the whole of the module as a learning medium utilized Tables 1 and 2 above as a reference for assessing data generated from the
material experts and media experts validations, feasibility tests for use by teachers and trials on students to make it easier to determine a value category whether or not the generated module is feasible to be used as a learning media.

3. Results and Discussions

3.1. Content Validation
The material expert is one of the physics lecturers at Tadulako University who assesses the material presentation, linguistic, and educational values feasibilities. The detailed scores for each aspect are provided in Table 2, 3 and 4. Overall, the average score of content assessment was 3.24 and is in the “Good” category.

Table 2. Validation results of materials presentation feasibility aspects

| Assessment Aspect                                                                 | Score | Category |
|----------------------------------------------------------------------------------|-------|----------|
| The material presented is suitable/relevant to the applicable learning.          | 4.00  | Very Good|
| The concepts and definitions presented are in accordance with the existing concepts and definitions in physics. | 4.00  | Very Good|
| The description of the material presented is logical (reasonable), coherent, and beneficial for SMP students. | 3.00  | Good     |
| The materials and examples presented support independent learning for SMP students. | 3.00  | Good     |
| The examples presented are in accordance with the existing conditions in the surrounding environment. | 3.00  | Good     |
| Average                                                                          | 3.40  | Very Good|

Table 3. Validation results of linguistic presentation feasibility aspects

| Assessment Aspect                                                                 | Score | Category       |
|----------------------------------------------------------------------------------|-------|----------------|
| The language used is in accordance with the students' thinking level.            | 4.00  | Very Good      |
| The language used encourages students' curiosity to finish learning the material. | 3.00  | Good           |
| The language use remains polite and does not reduce educational values.          | 3.00  | Good           |
| Average                                                                          | 3.33  | Very Good      |

Table 4. Validation results of educational value feasibility aspects

| Assessment Aspect                                                                 | Score | Category |
|----------------------------------------------------------------------------------|-------|----------|
| The media is easy to use in the student learning process both independently and in class. | 3.00  | Good     |
| The media is able to increase students' motivation in learning about disasters and how to overcome these disasters. | 3.00  | Good     |
| The media is able to expand students’ insight in dealing with disasters.          | 3.00  | Good     |
| The media can assist teachers to provide references about the relationship between physics and science and technology development. | 3.00  | Good     |
| Average                                                                          | 3.00  | Good     |

3.2. Media Validation
The media expert is one of the employees of the Palu City Regional Disaster Management Agency (BPBD) who assesses presentation quality feasibility, design feasibility, and implementation feasibility. The average score for all aspects was 3.00. it indicates that the feasibility assessment by media expert was in the good category. The data can be seen in tables 5, 6, and 7.
Table 5. Validation results of display quality feasibility aspects

| Assessment Aspect                                                                 | Score | Category |
|----------------------------------------------------------------------------------|-------|----------|
| The language used is in accordance with the students’ thinking level and is easy to understand. | 3.00  | Good     |
| The font size and color used are proportional and clear.                         | 3.00  | Good     |
| The presentation of images and disaster information is attractive and proportional. | 3.00  | Good     |
| Average                                                                         | 3.00  | Good     |

Table 6. Validation results of design feasibility aspects

| Assessment Aspect                                                                 | Score | Category |
|----------------------------------------------------------------------------------|-------|----------|
| Media display is attractive.                                                      | 3.00  | Good     |
| The media can be an option to obtain knowledge about the process of disaster (Earthquake, Tsunami, and Liquefaction) and the signs of a disaster and reduce the burden on teachers. | 3.00  | Good     |
| The media design has its own attractiveness that makes students want to read and use it in the learning process. | 3.00  | Good     |
| Average                                                                         | 3.00  | Good     |

Table 7. Validation results of implementation feasibility aspects

| Assessment Aspect                                                                 | Score | Category |
|----------------------------------------------------------------------------------|-------|----------|
| The disaster mitigation media can encourage students’ curiosity on how to take action when a disaster occurs. | 3.00  | Good     |
| The disaster mitigation module is easy to use in learning both inside and outside the classroom. | 3.00  | Good     |
| The disaster mitigation module supports students to learn independently.          | 3.00  | Good     |
| The disaster mitigation module increases students’ enthusiasm in learning about disasters, especially about the occurrence of disasters (Earthquake, Tsunami, and Liquefaction) as well as efforts to reduce the risks of these disasters. | 3.00  | Good     |
| Average                                                                         | 3.00  | Good     |

3.3. Limited-test

The limited test was carried out on 12 students of SMPN 1 Palu, the students were provided a questionnaire containing 13 statements and there were 4 categories of choices from strongly agree to strongly disagree. The result obtained from the overall average value of this limited test is 3.52 and is in “very good” category. Since the score is in very good category, the module is suitable for use as a student learning media. The data can be seen in Table 8.

Furthermore, the assessment results of the overall feasibility test conducted by one of the physics teachers from the same school obtained a perfect score for all aspects. The aspects included the feasibilities of content, material, design, module display and module completion. Therefore, the average result of the feasibility test of overall assessment was 4.00 and is in the “Very Good” category. It shows that this module of disaster risk reduction is suitable for further use in learning in SMP without any revision. The data can be seen in Table 9.

Table 8. Analysis result of average rate based on students’ responses

| Statements                                                                 | Score |
|---------------------------------------------------------------------------|-------|
| I become more excited to learn physics with the disaster mitigation module than just listening to the explanations about natural disasters in general. | 3.25  |
| I like the display of this module media design because it has a harmonious and attractive composition, color, font, image, and design. | 3.41  |
In my opinion, using this disaster mitigation module can make physics lessons less boring.  
This disaster mitigation module can be an alternative learning resource.  
Guidance such as a disaster mitigation module is required so that the community is more prepared for disasters.  
The disaster mitigation module presented encourages you want to learn more about the process of Earthquake, Tsunami, and Liquefaction.  
The module media presented are interesting both in material and in design.  
The disaster mitigation module can expand your knowledge about the process of earthquake, tsunami and liquefaction disasters. Therefore, you become more prepared to face these three disasters.  
Every material in the disaster mitigation module is understandable and interesting to read.  
The disaster mitigation module media requires further development.  
The image design of the disaster mitigation module is a special attraction for readers.  
The module media presented can evoke your interest to participate the efforts to reduce the risk of earthquakes, tsunami and liquefaction.  
The disaster mitigation module media can provide information on how to take action when an Earthquake, Tsunami, and Liquefaction disaster occur.  

Average  

| Table 9. Analysis result of teacher feasibility average |
|-----------------------------------------------|--------|----------------|
| Indicators                                      | Score  | Category       |
| The attractiveness of the module cover.         | 4.00   | Very Good      |
| The orderliness of cover page design.           | 4.00   | Very Good      |
| The selection of type and font size makes the media more attractive. | 4.00   | Very Good |
| The transitions continuity between pages        | 4.00   | Very Good      |
| The easiness to read the written text.          | 4.00   | Very Good      |
| Color selection                                 | 4.00   | Very Good      |
| The conformity of stories, images and materials | 4.00   | Very Good      |
| The completion of module.                       | 4.00   | Very Good      |
| Average                                        | 4.00   | Very Good      |

4. Conclusions
Overall, based on the evaluation of expert validators and prospective users, the module for disaster risk reduction (DRR) with the context of Palu, Central Sulawesi in learning physics is feasible to be used as one of the teaching media.

Acknowledgement
We highly acknowledge the support of the Program Kompetisi Kampus Merdeka (PK-KM) Grant of the Education, Culture, Research, and Technology of the Ministry of the Republic of Indonesia, with funding identity: 119/E1/KM.05.03/2021.

References
[1] Young H D and Freedman R A 2003 Fisika universitas edisi kesepuluh jilid 1 (Jakarta: Erlangga)
[2] Ibrohim I 2015 Prosiding Semnas dan Enterpreneurship 2 1–19
[3] Hening W R N, Sudarmin S and Mustikaningtyas D 2013 Unnes Sci. Educ. J. 2 254–261
[4] Masfuah S, Rusilowati A and Sarwi S 2011 J. Pendidik. Fis. Indones. 7 115–120
[5] Ayriza Y 2009 J. Kependidikan Penelit. Inov. Pembelajaran 39 141–156
[6] Setyowati R, Parmin P and Widiyatmoko A 2013 Unnes Sci. Educ. J. 2 245–53
[7] Pambudi D I 2015 Elem. Sch. J. Pendidik. dan Pembelajaran ke-SD-an 2 22-36
[8] Sugiyono S 2010 Statistika untuk penelitian (Bandung: Alfabeta)
[9] Arikunto S 2006 Metode Penelitian Kualitatif (Jakarta: Bumi Aksara)
[10] Widoyoko E P 2014 Teknik penyusunan instrumen penelitian (Yogyakarta: Pustaka Pelajar)