Analysis of student preparedness levels in facing flood disasters for development of high school physics digital books (e-books) with flood theme

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Abstract. West Sumatra is a potentially large flood area, where the city of Padang is one of the cities in West Sumatra that has a number of sub-districts with high flood vulnerability. To reduce the risk of flooding that occurs in Padang required a good level of preparedness from the community in facing flood disasters. Preparedness faces the problem of flooding can be improved through education in schools. The aim of this research to describe the extent to which students' preparedness in facing flood disasters and the results of research analysis will be a reference in the development of the High School Physics e-book with flood theme. The method used in the research is descriptive method with collecting data in the form of student questionnaires consist of five indicators of flood disaster preparedness. The results of the analysis show that the level of preparedness of students in facing floods is relatively low. These results indicate that the development of the high school Physics e-book flood theme needs to be done.

1. Introduction

Indonesian territory is on the equator with many islands, causing the potential for hydrometeorological disasters to be quite high. The National Disaster Management Agency (BNPB) noted that from January to October 2019 more than 80% of the disasters that occurred in Indonesia were hydrometeorological disasters, especially tornadoes, landslides and floods\cite{1}. This flood is partly occurring in the region of West Sumatra.

West Sumatra is a potentially large flood area due to the high rainfall in West Sumatra, especially in the December-January and April-May periods. The potential for flooding is spread in nineteen districts in West Sumatra where Padang is one of the cities with medium to high flood potential\cite{2}. Five subdistricts in Padang city had a high vulnerability to flooding, namely West Padang District, North Padang District, Nanggalo District, East Padang District, and Lubuk Begalung District and two other subdistricts namely Padang Selatan District and Kuranji District were in medium vulnerability\cite{3}.

High vulnerability to flooding in several areas in Padang is caused by many factors. Some of the main factors are: 1) Poor urban drainage systems, 2) In the drainage system there is a blockage of waste, 3) There are a number of land uses in some places that cause reduced catchment areas, 4) Location of buildings in the watershed, and 5) High rainfall is closely related to deforestation and global warming.
Assessment of the causes of flooding is needed with the aim of finding solutions to prevention and reduction of flood risk because the losses incurred are not small. Based on some of the causes mentioned above, it can be said that the prevention and reduction of flood risk in the city of Padang can be overcome by involving the intervention of the local government in synergy with the community. Local governments play a major role in improving drainage systems and land use policy, while the level of community understanding and preparedness in facing flood disasters will also affect risk reduction.

Framework for risk reduction from various disasters emphasizes the importance of cross-sectoral cooperation and partnerships between stakeholders ranging from local, national to regional or global levels so that disaster risk reduction programs can be implemented [5]. Indonesia along with 167 other countries are part of the ratification of the Hyogo Framework for Action (HFA) with a commitment to reduce disaster risk. One of HFA’s disaster risk reduction priority programs is to use knowledge, education and innovation to build a safety culture at all levels, meaning that disaster preparedness including flooding at all levels of education [6]. This can be done by providing education to the general public, especially to students in schools as a preventive measure facing flood disasters, because in the current disaster management there a paradigm shift from reactive responsive when a disaster event becomes proactive, preventive, and anticipatory before the occurrence disasters including floods.

Schools are educational institutions with a crucial role in flood disaster risk reduction activities because schools are an effective means of changing people's mindsets and behavior through students. Integration of education on natural disaster risk in the school curriculum is in line with Government Regulation 32/2013 which explains that each education unit must have a curriculum structure with local content that contains regional potential and local uniqueness [7]. Disaster mitigation education can be integrated into subjects for schools in areas with high disaster potential. Integration of disaster mitigation education is expected to be able to shape the character of disaster prepared students [8]. For some schools in the city of Padang which are located in areas prone to flooding, flood disaster mitigation education should be integrated into subjects, especially subjects that are closely related to natural events and community culture.

Every teacher who teaches subjects is given a wide opportunity to develop material according to local wisdom. The teacher can add regional disaster material to them subjects especially for geography and natural knowledge teachers [9]. Learning material can be developed through the creation of teaching materials. Many types of teaching materials can be developed for learning purposes in schools, one of which is digital books, better known as e-books. E-book is a book in electronic form that utilizes digital technology. The selection of digital books due to technological advances has also penetrated into education. The advantages of e-books are more practical, simple, durable, more portable, easily duplicated, easily distributed and environmentally friendly [10].

The development of integrated e-books for floods aims to improve students' preparedness in facing floods which in the end are expected to have an impact on the community around students. To develop this e-book it is necessary to do an initial analysis of the level of preparedness of students in the face of floods. According to Law Number 27 of 2007 concerning Disaster Management, preparedness is a series of activities carried out as an effort to anticipate disasters through effective and efficient actions before, during and after a disaster [11]. Information about the Preparedness Level of students facing floods is important as a consideration for further research in the development of e-books.

2. Research Method

The type of research used is descriptive research. Descriptive research is research that describes a symptom or event that occurs now [12]. The problem of the actual problem when the research takes place becomes the focus in descriptive research. In this type of research, the attention of the researcher is focused on describing the symptom or event that is being studied without giving special treatment to the symptom or event. Through descriptive research the value of the independent variable can be known without having to look at the relationship or comparison of these variables with other variables [13].

Descriptive research method is a research method whose data collection process allows researchers to generate descriptions of the events under study. Through descriptive data, researchers are able to
identify why, what and how a phenomenon or event occurs. Descriptive research methods have steps that begin with the formulation of the problem, determining the type of information needed, data collection, data processing and conclusion drawing [14]. The data collection instrument used in this study was a questionnaire with students as respondents. The type of questionnaire used is a closed questionnaire where answers are provided so that the respondent cannot give answers freely. Questionnaires are arranged in the form of a checklist that contains a number of questions to describe the level of preparedness of students facing floods. The respondent will give a check (√) to each question item by selecting one of the four criteria used. The criteria are arranged according to the modified Likert scale from Riduwan, which is very agree, agree, disagree, and disagree [15].

This research was conducted at SMAN 16 Padang in June 2019. Class XI students of SMAN 16 Padang in the 2018/2019 academic year consisting of ten classes constituted the population in this study where the sample of the study was class XI MIA 2 students, amounting to 30 people. Sampling was obtained through cluster random sampling techniques. Data analysis techniques in the study were carried out quantitatively based on the results of questionnaire calculations previously filled out by students. Questionnaires consisting of five indicators of preparedness for students facing floods are based on disaster preparedness issued by BNPB namely understanding flood hazards in the surrounding environment, understanding the local early warning system and knowing evacuation routes and evacuation plans in the event of a flood, having plans for anticipating floods for themselves and family, have the skills to evaluate the situation quickly and take actions to protect themselves in the event of a flood and reduce the effects of flood hazards through training and mitigation exercises [16]. These five indicators are then translated into fifty-three question items.

Quantitative data analysis of questionnaires begins with determining the highest score of each indicator. Then proceed with calculating the number of scores given by all participants in the sample for each indicator. The next step is to calculate the percentage value of each indicator with the formula as follows:

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\text{Percentage of Value} = \left( \frac{\text{total score}}{\text{highest score}} \right) \times 100\% 
\]

(1)

Then the percentage of values obtained from processing data was analyzed using categories presented by the Ministry of Education and Culture [17]. This category can be seen in table 1.

| No | Categories  | Value (%) |
|----|-------------|-----------|
| 1  | Very Good   | 80-100    |
| 2  | Good        | 70-79     |
| 3  | Simply      | 60-69     |
| 4  | Less        | < 60      |

3. Result and Discussion

The research results obtained are in the form of data on the level of preparedness of students facing floods that can be used as a reference in the development of digital books (e-books) on flood themes. This questionnaire is given to students at high school 16 Padang because this school is on a hillside surrounded by a small river. Deforestation for the purpose of housing next to the top of the school resulted in a small river overflowing in the event of heavy rain and water inundating the school yard. If logging continues then the risk of flooding in this school will increase. For this reason, students must be equipped with knowledge and skills in flood disaster mitigation so that students can improve their preparedness in facing floods both before, during and after the flood

Questionnaire for preparedness of students facing flood disaster consists of five indicators which are then described in fifty-three items of questions. Questionnaires that have been filled out by students produce data such as the graph below.
Figure 1. Graph of Student Preparedness Levels

Figure 1 shows the level of preparedness of students in facing with floods. There are five indicators of flood preparedness, namely: 1) understanding the danger of flooding in the surrounding environment, 2) understanding the local early warning system and knowing evacuation routes and evacuation plans in the event of a flood, 3) having a flood anticipation plan for self and family, 4) have the skills to evaluate the situation quickly and take action to protect themselves when floods occur, and 5) reduce the impact of hazards through training and mitigation exercises. Each indicator will be included in one of four categories: very good with a value (91-100)%; good with a value (76-90)%; enough with a value (61-75)% and less with a value (0-60)%. From the five indicators, two of them are in the enough category and three other indicators are in the less category. Two indicators that are in the sufficient category are the first indicator with a percentage value of 62.81 and the fourth indicator with a percentage of values of 62.10. Three indicators with less categories are the second indicator with a percentage value of 54.64, the third indicator with a percentage value of 56.31 and the fifth indicator with a percentage of values of 59.17. Overall the level of preparedness of students in facing with floods is in the less category with a percentage of 59.00.

This data illustrates the level of student preparedness in the facing flood disasters, especially at high school 16 Padang, which is still low. While looking at the current topography of high school 16 Padang with deforestation, the risk of flooding when high rainfall increases. Besides that, some of the students at SMAN 16 Padang lived in the area around the Kuranji River which often experienced flash floods. Therefore, to reduce the impact of flooding, good preparedness from students and the general public is needed.

To shape the character of students who are prepared to flood, one way that can be done is to integrate flood material into subjects of natural knowledge, especially physics. This is in accordance with one of the activities programmed by BNPB and the Ministry of Education and Culture in disaster safe education schools in the form of integration of disaster risk reduction in various subjects [18]. This integration is done by adding flood disaster material to teaching materials. At present the making of teaching materials using digital technology is very necessary because technology can no longer be separated from the daily activities of students. One of the digital teaching materials that can be developed is an e-book. E-books that are integrated with flood material will be able to improve students’ understanding and will further shape students’ preparedness characters both before, during and after a flood.
4. Conclusions

Based on the explanation of results and discussion, it can be concluded that the level of preparedness of students in the face of flood disasters at high school 16 Padang is still relatively low. To improve this preparedness, the theme of the flood high school physics e-book is needed.

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