Development of E-Magazine Materials for Disaster Mitigation Outbreak to Increase Preparedness of High School Students

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Abstract

Indonesia is a disaster-prone area. In addition to causing material losses, post-natural disasters also increase the risk of infectious disease outbreaks. Community preparedness and mitigation are needed to minimize this. Disaster mitigation is the knowledge that students must have to have good preparedness behavior. Education related to disasters is usually based on theoretical knowledge so that it becomes less meaningful for students. Based on the results of observations in one high school in Bogor City, it was found that the level of student preparedness was still relatively low at 42%. For this reason, it is necessary to make efforts to increase the value of student preparedness with interesting learning resource, one of which is by developing an *e-magazine* of disease outbreak disaster mitigation materials to improve student preparedness. This study aims to determine the effect of *e-magazines* on disease outbreak disaster mitigation materials on increasing student preparedness, as well as to determine the effectiveness of *e-magazines* on disease outbreak disaster mitigation materials. The study was conducted using the Research and development method using the ADDIE model (*analyze, design, development, implementation, evaluation*). The population in this study were students of class X MIPA with a sample of 30 respondents. The results showed that the *e-magazine was* able to increase the student's preparedness score to 69.67% which was in the medium category. The effectiveness of learning media can be seen from the responses of students and teachers. The percentage of the average value of student responses is 89.5% with a very effective category. Based on the results of the teacher's response questionnaire, the percentage was 84.17% with a very effective category.

INTRODUCTION

Indonesia is located in the Pacific Ring of Fire, which is often hit by natural disasters. It is recorded in the information data of the National Disaster Management Agency (BNPB) that throughout 2019 there have been 3,721 natural disasters. As of May 18, 2020, at 10.00 WIB, 1,296 natural disasters were recorded as well as additional non-natural disasters, namely COVID-19. Common health risks after an earthquake include respiratory problems, re-emergence of infectious disease outbreaks such as

diarrhea, urinary tract infections, measles and meningitis. In meteorological disasters, common disease outbreaks include dengue fever and malaria. Hydrological disasters usually cause outbreaks of diseases such as skin infections, acute diarrhea and are followed by the incidence of acute respiratory infections which increase two weeks later (Chan, Man, and Lam 2019). The potential for co-occurrence with other natural disasters can exacerbate human losses and cause chaos.

After the occurrence of natural disasters, in addition to causing many casualties and damage to infrastructure, the threat of health risks becomes a serious problem. Especially the incidence of infectious diseases, several infectious diseases that usually occur after disasters include diarrhea, acute respiratory infections (ARI), dengue fever, malaria, measles, tetanus, leptospirosis, cholera and typhoid fever. In addition, natural disasters cause other side effects including displacement, poor sanitation, overcrowded spaces and limited supplies of medical equipment to increase the chance of outbreaks of infectious diseases. Public knowledge and awareness about health risks are one of the determinants of the occurrence of infectious diseases (Pascapurnama et al. 2018).

The number of fatalities indicates that community preparedness and mitigation against disasters are still poor (Hasanah, Wahyuni, and B 2016). For this reason, the community needs to have insight into mitigating disease outbreaks to increase preparedness. Disaster mitigation is actions taken to reduce the impact of disasters and efforts to reduce victims. The first step that needs to be taken in disaster mitigation is to recognize the disaster risk of the area (Retnowati et al. 2020).

Mitigation is an action taken to reduce a hazard so that losses can be minimized. Mitigation is also the efforts and activities carried out to reduce and minimize the consequences caused by disasters, including preparedness, vigilance and the ability to overcome them. Mitigation is oriented towards prevention and countermeasures. Preventive action is oriented to steps that can be taken before a disaster. Meanwhile, countermeasures are oriented towards post-disaster actions (Darmawan, Tidar, and Sukmawati 2019).

Disaster mitigation is a series of activities carried out before a disaster occurs and focuses on reducing the impact and readiness in an effort to minimize the impact of disasters in the long term. Disaster mitigation aims to improve community preparedness and reduce disaster risks such as reducing the number of fatalities (Hasanah et al, 2016)

Preparedness is a step taken before a disaster occurs. Disaster preparedness is carried out to reduce the impact of disasters. Preparedness measures consist of establishing disaster management, protecting resources and training personnel (Widjanarko and Minnafiah 2018). Preparedness is emphasized on efforts to prepare individuals to have emergency response capabilities quickly and accurately in disaster management efforts.

Preparedness aims to ensure that resources can respond to disasters when natural disasters occur. Disaster mitigation is needed in education in Indonesia, considering that Indonesia is a country prone to disasters. In disaster management activities, disaster mitigation is included in risk management in the pre-disaster phase which is educational. Individuals who do not have knowledge about disaster mitigation will have less preparedness behavior. Therefore, education about disaster mitigation can influence a person, including behavior that reflects preparedness in a disaster (Sajidah, Hasmunir, and Abdi 2017).

Education related to disasters is usually based on theoretical knowledge so that it becomes less meaningful for students (Ozkazanc and Yuksel 2015). Submission of knowledge about disaster and mitigation can be conveyed with the help of media that is attractive to students. Based on the results of observations in one high school in Bogor City, it was found that the level of student preparedness was still relatively low at 42%. Teachers have varied in using learning models, but in using learning media the teacher only develops power point slides so that it does not support learning. Efforts regarding disaster outbreak mitigation have also never been conveyed by teachers both inside and outside the classroom. The solution that can be done to overcome these problems is by utilizing technology. E-magazines are electronic magazines because they are based on electricity. The Learning resource e-magazine is one of the innovations or efforts to improve the quality of learning in the classroom.

Learning media has a very big role so it needs to be developed and managed in a systematic, quality and functional manner (Guniarti 2019).

This study aims to determine the effect of e-magazines on disaster mitigation materials for disease outbreaks, especially post-flood disease outbreaks, landslides, volcanic eruptions, earthquakes, tsunamis and forest and land fires on increasing student preparedness, as well as to determine the effectiveness of e-magazines on material. mitigation of disease outbreaks as an enrichment material for environmental changes.

METHOD

The study was conducted at a private high school in Bogor City, from June 2021 to July 2021. The population in this study were students of class X and the sample unit selected was class X MIPA 3, which consisted of 30 students. This research method is Research and Development. The research model used is ADDIE (Analyze, design, development, implementation, evaluation). Subjects were given a questionnaire after being given treatment.

The research began with the phase analyze by distributing questionnaires to class X Mathematics and Natural Sciences students and interviews with teachers in the field of Biology. This stage aims to find out whether enrichment material has been taught regarding post-natural disaster disease outbreak mitigation, the level of preparedness of students in dealing with post-natural disaster disease outbreaks, the situation and condition of both students and teachers during the learning process and to find out what models and media are used. commonly used in the process of teaching and learning activities. The next step is to adjust the material to be developed in the learning media with the 2013 curriculum syllabus.

The second step was design by making an initial draft of the structure of the content e-magazine. After the content structure is formed, it is continued by making the layout e-magazine. The initial product that has been compiled goes through the stage development first, which is validated by experts. The Content is an e-magazine validated by two experts, while the media is e-magazine validated by one expert. Validation aims to get criticism and suggestions so that the media deserves to be tested in the field. At this stage, the validation test of the research instrument was also carried out by distributing questionnaires to students who were not research subjects.

The fourth step was the implementation of products that have been perfected by criticism and suggestions from experts, tested in the field. The product was tested on 10th-grade students who were studying environmental change material.

The final step was evaluation. By distributing questionnaires to students after using e-magazines to determine the effect of learning media on increasing preparedness scores. The instrument used in the form of a questionnaire compiled based on disaster preparedness parameters according to the LIPI-UNESCO/ISDR research team. which consists of four aspects, namely knowledge of disaster risk, disaster preparedness plans, disaster warning systems, and resource mobilization. According to BNPB, BPS and UNFPA, to determine preparedness, calculations can be made using the following formula:

$$IKB = 35(PS)+15(RTD)+25(SPB)+15(MS)$$

Description:
IKB   : Disaster preparedness index
PS   : Knowledge and attitude
RTD   : Emergency Response Plan
SPB   : Disaster Warning System
MS   : Resource Mobilization

The data analysis method used is the descriptive percentage method. The percentage is calculated using the percentage descriptive formula, namely:

$$DP = \frac{n}{N} \times 100\%$$

Description:
DP : Descriptive Percentage
n : Empirical score (score obtained)
N : Ideal score (maximum score)

The results of the percentage of students' preparedness scores are then interpreted with the following criteria:

Table 1. Criteria for determining student preparedness

Score	Class
<60%	Low
60%-80%	Medium
>80%	High

(BNPB *et al*. 2013)

At the evaluation stage, student and teacher response questionnaires were also distributed to see the effectiveness of the media. Student response questionnaires were compiled based on parameters according to (Badan Standar Nasional Pendidikan 2007) which include graphics, media, content feasibility, language and usefulness. Calculation of the percentage of student responses can be calculated using the formula:

$$\text{Percentage of Student Responses} = \frac{A}{B} \times 100\%$$

Description:
A : Proportion of the number who voted
B : Number of students

The results obtained are then categorized based on the qualifications presented in table 2.

Table 2. Student response criteria

Nilai	Kategori
85 – 100%	Very good
75 – 84%	Good
65 – 74%	Pretty good
55 – 64%	Deficient
0 – 54%	Not good

(Arikunto 2013)

Teacher response questionnaires are compiled based on parameters according to (Badan Standar Nasional Pendidikan 2007) which include graphics, media, content feasibility, language and usefulness. The teacher's response questionnaire was calculated using the following formula:

$$P = \frac{\sum R}{N} \times 100\%$$

Description :
P   : Percentage score
R   : Total score of answers given by each respondent
N   : Total ideal score of one question item

The results obtained were then categorized based on the criteria for the practicality test. The practicality criteria are presented in the table 3.

Table 3. Teacher response criteria

Nilai	Kategori
85 – 100%	Very good
75 – 84%	Good
65 – 74%	Pretty good
55 – 64%	Deficient
0 – 54%	Not good

(Arikunto 2013)

RESULT AND DISCUSSION

Preparedness is an appropriate and effective action during a disaster or post-disaster that is important for individuals to be able to maintain themselves and anticipate disasters (Wulandari 2018). Research on the development of learning media for e-magazine disease outbreak disaster mitigation using the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The first stage of this research and development is the analysis of learning media with field studies and literature studies. The field study was conducted in a private high school in Bogor with observations and interviews, the results showed that student preparedness was still relatively low and teaching and learning activities were still oriented to using PowerPoint slides so that they did not support learning in the digital era. According to Mirnawati (2020) students tend to be interested in reading that has little writing and has a lot of pictures. Illustrated learning media can encourage students' interest, develop language skills, art activities, and creative statements in storytelling, dramatization, reading, writing, painting and drawing, as well as assisting students in interpreting and remembering the contents of reading materials and textbooks.

The second stage, namely design, begins with compiling the structure of the content. The content of the e-magazine contains an introduction to the mitigation of disease outbreaks, various natural disasters and the risks of disease outbreaks that arise, prevention and control measures for each disease outbreak, as well as management stress after natural disasters. The next stage is to arrange an attractive layout so that students have an interest in reading about disasters. Thee-magazine prepared is equipped with an info corner feature to add insight to students.

The learning media that were tested were first validated by experts, the results of the material expert validation can be seen in table 4.

Table 4. Results of Content Expert Validation

Validator	Aspects assessed		
	Feasibility of Content	Language	Presentation
1	9	17	7
2	11	16	8
Total Score	20	33	15
Maximum Score	24	40	16
Percentage	83%	83%	94%
Criteria	Very valid	Very valid	Very valid
Overall Score	$(68:80) \times 100\% = 85\%$		
Criteria	Very Valid (Very Eligible)		

The aspect assessed by media experts is about graphics which consists of 9 indicators. The results of the media expert validation can be seen in table 5.

Table 5. Results of media expert validation

Indicator	The score for each Indicator	Maximum Skor	Percentage	Criteria
Image in e-magazine	8	8	100%	Very Valid
Sentence usage	7	8	87,5%	Very Valid
Writing Size	8	8	100%	Very Valid
Image size	4	4	100%	Very Valid
Layout	3	4	87,5%	Very Valid
Image usage	4	4	100%	Very Valid
Typeface	3	4	87,5%	Very Valid
Combination of writing	3	4	87,5%	Very Valid
Color Match	4	4	100%	Very Valid
Overall Score	$(44 : 48) \times 100\% = 92\%$			
Criteria	Very Valid(Very Eligible)			

The third stage is development. After the draft is prepared, the next step is validation of learning media. The validation of learning media was carried out by three experts, two experts validating the material and one expert validating the media. The validation of learning media aims to get suggestions and criticisms so that the media is worthy of being tested in the field. The result of the percentage of material experts is 85%. Based on the results of media expert validation, the percentage obtained is 92%, which is in accordance with Arikunto (2013) opinion which states that learning media is said to be feasible if it has a qualification value above 80%. At this stage, validation of the research instruments used was also carried out. Validation of research instruments was analyzed using the formula Pearson product-moment, from the validation results obtained that all 30 research instruments were declared valid. The final results of the developed E-Magazine are as follows:
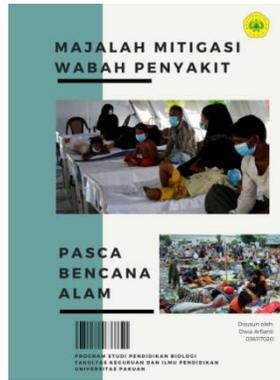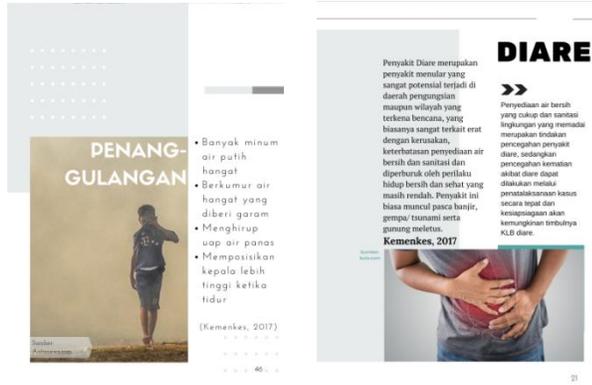
Figure 1. Cover depan e-magazine

Figure 2. Contents of the e-magazine

Figure 3. Back cover

To determine the value of student preparedness, an assessment is carried out using a questionnaire, here are the results of the student preparedness questionnaire:

Table 6. Results Student preparedness questionnaire

No	Aspects assessed	Total Score	Maximum Score	Percentage	Criteria
1	Knowledge and attitudes towards disaster risk	21770	29400	75,05%	Medium
2	Disaster preparedness plan	10875	16200	67,13%	Medium
3	Disaster warning systems	1725	3000	57,5%	Low
4	Mobilizing resources	15795	23400	67,5%	Medium
	Total Score	50165	72000		
	Overall Score		$(50165{:}72000) \times 100\% = 69{,}67$		
	Criteria		Medium		

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From table 6 it can be seen that the students' preparedness scores after using e-magazines are in the moderate criteria that is equal to 69.67%. The highest percentage is found in aspects of knowledge and attitudes towards disaster risk, which is 75.05%.

The fourth stage of this research and development is an implementation. Learning media that have been improved according to the suggestions and criticisms of experts are then tested in the field. The trial was conducted in a limited manner, namely in one class of 30 students. After using the learning media, students were given a preparedness questionnaire which was accessed online. The results obtained from the percentage of preparedness scores of 69.67% are included in the medium criteria. Based on the reference value of the preliminary research which has a percentage of 42% which is included in the low criteria, it means that there is an increase of 27.67%. According to Arifin et al., (2019) e-magazine is one of the interesting learning media with supporting features such as images and can be operated using a laptop or smartphone. So that the e-magazine can increase students' motivation and interest in learning. If students' learning motivation is high, it will help improve understanding and condense information (Marsiatun, 2016).

The highest percentage value was found in aspects of knowledge and attitudes towards disaster risk, which is 75.05%. Students are more interested in reading illustrated as stated in the e-magazine. E-magazines are able to increase student motivation so that it will have an impact on learning objectives. Learning motivation has a big role, to identify motivation as a driver, strengthen behavior and direction. Therefore, learning motivation has a great energy to move students to learn so that the ultimate goal can be achieved optimally (Nurlinah, Adnan, and Muhiddin 2018). Knowledge is the result of a person's sensing of an object through his senses, which include the senses of sight, hearing, smell, taste and touch. There are several factors that influence knowledge including education, age, occupation, interests, experience, surrounding environment and culture. The level of individual mid-teens has been able to make an assessment of behavior regarding post-natural disasters. Adolescents should be able to dig up information from various sources to increase their knowledge about disasters (Firmansyah, Rasni, and Rondhianto 2014).

The percentage value of the disaster preparedness plan aspect is 67.13% which is included in the medium category. This aspect is an important part of preparedness because it relates to evacuation, first aid and rescue so that victims can be minimized. This effort is crucial, especially before outside help arrives (Hidayati 2011). Based on the results of the study after using the learning media e-magazine, most students already have a plan in case of an emergency situation after a natural disaster. The low score is regarding first aid skills and the availability of maps or routes for families as evacuation sites. After conducting interviews with several students, this happened because there had never been any learning about first aid and most of the students lived in areas where disasters rarely occurred.

The third aspect in preparedness is the disaster warning system which has a percentage value of 57.5% which is included in the low category. By knowing emergency numbers, people can take appropriate action, especially to reduce casualties (Hidayati 2011). The results of the study are that there are still many students who do not know the emergency call numbers because most of them think that access can be obtained through the internet.

The fourth aspect is mobilizing resources which has a percentage of 67.5% which is included in the medium category. After using the learning media for e-magazine disease epidemic disaster mitigation, students realized the importance of taking action and mobilizing resources and maximizing infrastructure to minimize the risk of disease outbreaks after natural disasters. In anticipating disasters, individuals and families need to have adequate resources to improve preparedness. Other forms that need to be prepared are facilities and infrastructure, as well as funding (Lestari, Widya and Husna 2017). After conducting interviews with several students, most students stated that their families used to set aside funds for emergency needs, one of which was in the event of a disaster.

E-magazines for disaster mitigation materials for disease outbreaks are able to improve student preparedness behavior because this developed media it is able to increase students' motivation and interest in reading material about disasters which are often considered boring. This is in accordance with what was expressed by (Supriyadi, Hidayat, and Bahri 2014) that the use of innovative learning media can

increase interest, motivation and stimulation in teaching and learning activities so that it is very helpful for students to digest information. When students are interested and have the motivation and interest in an object, the learning objectives are easy to achieve. In accordance with (Ricardo and Meilani 2017) which states that motivation and interest in learning play an important role in achieving maximum learning.

The knowledge that students gain through e-magazines on disaster mitigation materials for disease outbreaks is able to shape students' preparedness behavior. The formation of behavior is divided into 3 according to the expected circumstances. The first is how to form behavior with habits, by getting used to behaving as desired. Second, the formation of behavior with understanding (insight). This method is based on cognitive learning theory, namely learning with understanding. Third, the formation of behavior using models or examples. In this study, preparedness behavior was formed using insight based on cognitive theory. The formation of new behaviors, especially in adults, begins with the cognitive domain. Individuals first know the stimulus to generate knowledge. Knowledge is one of the very important domains in shaping one's actions. Before an individual adopts a new behavior, a sequential process occurs within him. The formation of behavior requires a process that includes a) Awareness (individuals are aware of or know of a stimulus/object), b) Interest (people begin to be interested in the stimulus), c) Evaluation (weighing the good or bad of the stimulus for themselves), d) Trial (people start trying new behavior), and e) Adaption (people have behaved in a new way according to their knowledge, awareness, and attitude towards the stimulus). In this study, the process of forming new behavior reaches the stage of interest because students have not applied the newly acquired knowledge. For this reason, the level of student preparedness after reading the e-magazine is still in the moderate stage because it requires a process to get to higher criteria (Husen, 2018).

To determine the effectiveness of the learning media e-magazine, it can be seen through teacher response questionnaires and student response questionnaires after using the developed learning media. The results of the teacher response questionnaire can be seen in Figures 1.
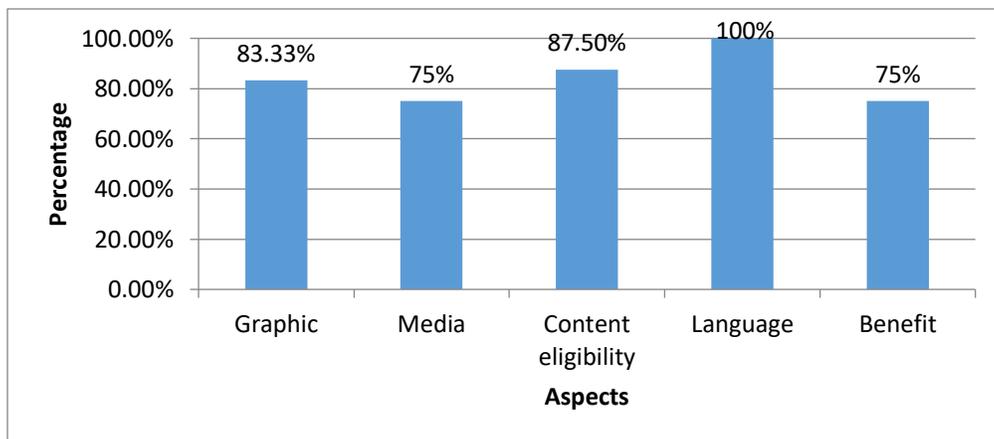

Figure 4. The results of the teacher response questionnaire

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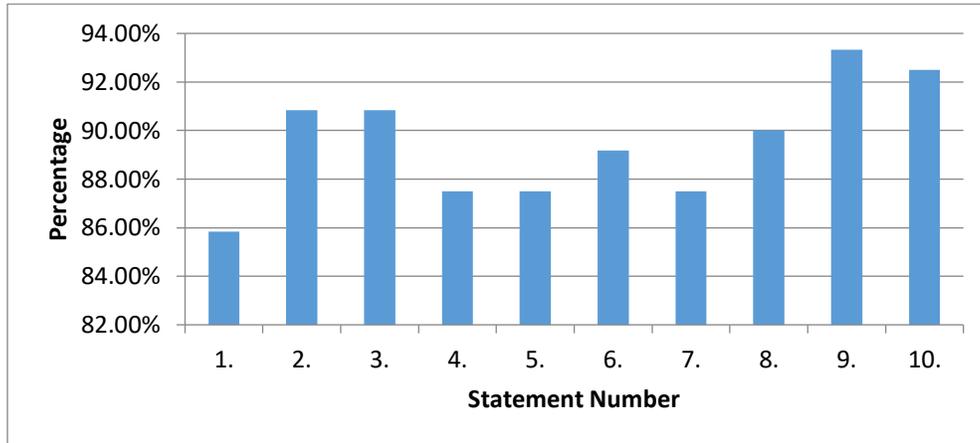The results of student responses can be seen in Figures 2.

Figure 5. The results of the student response questionnaire

The last stage in this research and development is the evaluation. This stage is reviewed by the student response questionnaire after using the learning media. The percentage of student response scores is 89.5% based on Arikunto (2013) he percentage which ranges from 81%-100% is included in the very practical criteria. This is in line with research (Nurlinah et al. 2018) that learning media e-magazine can attract students' attention and increase student motivation because there are additional features such as color images. Students consider the e-magazine developed to be easy to use and has an attractive display design that makes it easier for students to understand the material. Based on the results of the teacher's response questionnaire, a percentage of 84.17% was obtained with a very decent category.

CONCLUSION

The development of a learning media e-magazine that has been compiled and validated by media experts and material experts is categorized as very practical and effective as a learning medium. It can be seen from the teacher response questionnaire that got a percentage score of 84.17% and the student response questionnaire who got a percentage score of 89.5%

Based on the results of the study, it can be concluded that the learning media e-magazine in post-natural disaster mitigation materials is able to improve student preparedness behavior. The value of preparedness increased to 69.67% after using the learning media for e-magazine disease outbreak disaster mitigation materials in learning.

ACKNOWLEDGMENTS

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