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Development of Android-based landslide disaster mitigation learning media for disabilities elementary school

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ABSTRACT

The Klaten Regency area is included as a disaster-prone area. One of the disasters that often hit this district are landslides. This increases the risk that human safety is threatened, especially for people with disabilities. This condition will get worse if they do not have education about disaster mitigation. This study aims to develop an Android-based landslide disaster mitigation medium for elementary school disabilities. This media uses three types of software: Kodular to create Android applications, Blender to create 3D animations, construct to make games, and FlipPDF to create e-books. This study used the Research and Development (R&D), research method in conjunction with a waterfall process development model. To get the feasibility results, this medium was tested on experts and users, the first being tested on two media experts, with a percentage result of 88.8%, so that it was declared very feasible. The second was tested on two e-book material experts with a percentage of 98.5%, so it was declared very feasible. The third was tested on two video material experts with a percentage of 98.94%, so it was declared very feasible. The fourth was tested on users and got a percentage result of 78.4%, so it was stated that this medium was appropriate.

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INTRODUCTION

Geographically, the Republic of Indonesia is a country located between the Asian and Australian continents and the Indian and Pacific oceans. While astronomically the Unitary State of the Republic of Indonesia is located right on the equator where in this case the position is based on latitude 6º LU (North latitude) - 11 º LS (South latitude). Geographical and astronomical location is what causes the impact of climate change in Indonesia. The location of Indonesia which is on the equator causes Indonesia to have a tropical climate. The negative impact of the condition of Indonesia's territory makes Indonesia vulnerable to geological disasters such as volcanic eruptions, floods, landslides, etc. (Aini & Daniah, 2020).

Based on the 2013 Indonesian Disaster Risk Index (IRBI) released by the National Disaster Management Agency (BNBP) shows that Klaten Regency has a high disaster risk index for natural disasters, one of which is landslides. According to one of the Klaten BPBD officers, areas that are vulnerable to landslides in Klaten Regency include the Bayat, Ganwarno, Cawas and Wedi sub-

districts. The geographical location of Klaten Regency is on the slopes of Mount Merapi which has quite high slopes. In terms of percentage, the slope ranges from 5% to >45%, and the slopes are classified as gentle to very steep, making it possible for landslides to occur. In addition, according to (Priyono et al., 2015) said that people in the Klaten district carry out mining activities where most of these activities are carried out manually and do not meet safety standards. This activity causes the base of the slope to be eroded and the impact is landslides.

This risk poses a threat to human safety, especially disaster-prone groups. One of the disaster-prone groups is people with disabilities/ disabilities (Siregar & Wibowo, 2019) Based on Law Number 19 of 2011 Concerning Legalization of the Rights of Persons with Disabilities, it is stated that a disability is a person who has physical, mental, intellectual or sensory limitations for a long period of time where interacting with the environment and attitudes of society can encounter obstacles that make it difficult to participate fully and effectively on the basis of equal rights.

Persons with disabilities are one of the groups that are vulnerable to natural disasters, especially when they lose their family, assistive devices and mobility devices which hinder access to information (Hayati et al., 2021). This condition will get worse if persons with disabilities do not have knowledge about disaster mitigation. The findings from a survey conducted by The United Nations Office for Disaster Risk Reduction (UNDRR) in 2013 stated that 70% of persons with disabilities who participated did not receive a personal preparation plan and only 17% knew about disaster management plans in their respective communities. This proves that information about disasters and mitigation training for persons with disabilities is still lacking.

Based on DTKS (social welfare integrated data, ed) there are 11,661 people with disabilities in Klaten. This means that in every region persons with disabilities have problems facing disasters (Santoso et al., 2015). Then according to Klaten Regent Regulation No. 6 of 2014 concerning Disaster Guidelines for Klaten Regency, it is stated that Klaten Regency has implemented disaster preparedness schools from the lowest school level, namely early childhood education programs to Senior High School, but this implementation does not include learning for children with special needs.

Based on the results of interviews and observations conducted at 13 SLB elementary schools in Klaten Regency, it was found that education about landslide disaster mitigation in schools is still lacking. Learning media for landslide natural disaster mitigation in schools is also still minimal. Several schools have provided disaster mitigation education through outreach and disaster mitigation simulations for disabilities, while others have not provided disaster mitigation materials for disabilities in schools.

The Android platform was chosen because in terms of technology this platform has developed rapidly and there are many choices of devices, so many people choose to use this platform. In addition, the Android platform has many advantages such as easy use, easy to carry anywhere, providing convenience, multi-tasking, etc. In addition, based on interviews with several SLB teachers in Klaten Regency, they said that Android devices were more practical and comfortable to use as learning tools. Users with disabilities also find it easier to operate Android by using a feature found on Android, namely "talkback".

METHOD

This research was conducted in 13 elementary schools in Klaten District using the Research and Development (R&D) method. The research development model was designed using the Waterfall Process Model Development model. According to (Pressman, 2005) this model consists of 5 steps, namely: (1) Communication; (2) Planning; (3) Modeling; (4) Construction; (5) Deployment as shown in Figure 1.

The first stage is communication, in this stage information is collected about user needs. The activities carried out are user needs analysis, software requirements analysis and literature study. Researchers collected user needs analysis data by distributing questionnaires to several parties, namely teachers and elementary school students in Klaten Regency in order to find out what kind of learning media they wanted. The results of this needs analysis can be used to proceed to the second

stage, namely Planning to plan application development, an explanation of the product to be produced and planning a schedule of activities. Next is the Modeling stage, at this stage the overall system design is carried out, starting from the data structure design, system workflow, system interface display. After the system design is made, the next stage is the Construction stage, namely the coding process. In developing this application researchers use codular software as shown in Figure 1.

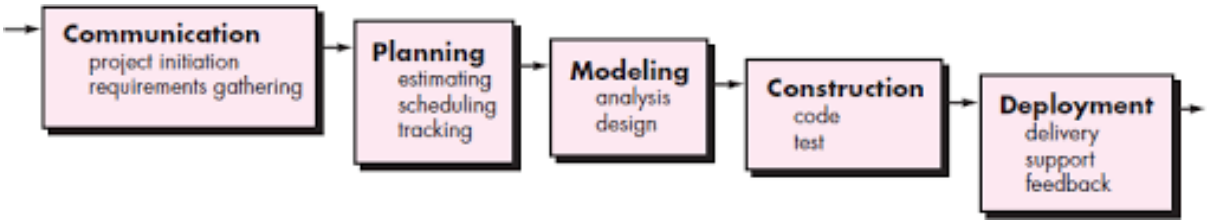

Figure 1. Waterfall Process Model by (Pressman, 2005)

The last stage is Deployment, the application that has been made will be tested to get feedback. This test is done to ensure the application is appropriate or not. In addition, another goal is to determine the feasibility of this developed application. This test is carried out using expert testing methods in Figure 2 as follows:

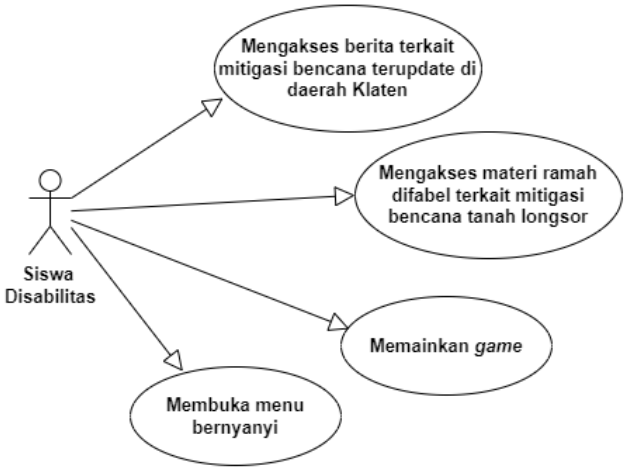

Figure 2. Use Case Application Diagram

RESULT AND DISCUSSION

Result

This research develops a product intended for persons with disabilities in order to gain knowledge about Android-based landslide disaster mitigation. This media was developed using 3 software, namely, Kodular Creator to make the main application, Blender to make 3D animated videos and Construct to make the game. This media was developed based on the analysis of user needs to match what they want. Needs analysis was obtained by distributing questionnaires to respondents, namely teachers and elementary school students in Klaten Regency.

As many as 57.5% of teachers have used learning media, meaning that more than half of the total SLB teachers in Klaten Regency have used learning media. The learning media used mostly is learning videos (53.5%). Then according to them as much as 58.3% of teachers are more comfortable using smartphones as teaching aids because they are more convenient and practical. Then as many as 59.8% of SLB teachers in Klaten Regency have used interactive learning media, according to them (61.1%) the media is effective. Furthermore, as many as 99.2% of SLB teachers in Klaten Regency agreed that an Android application would be developed as a learning medium for disaster mitigation. The results of the questionnaire can be shown in Figure 3.

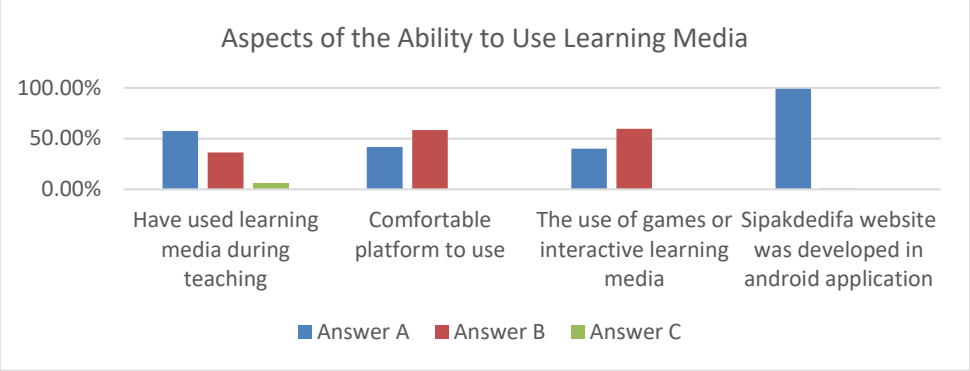

Figure 3. Aspects of the Ability to Use Learning Media

After that, as many as 62% of teachers and 50.3% of students said that e-books were not available for persons with disabilities, meaning that there was still little availability of e-books for persons with disabilities. Furthermore, as many as 51.2% of teachers and 54% of students said that the landslide e-book was inadequate. Then as many as 99.2% of teachers and 100% of students said the landslide mitigation e-book needed to be developed. The result can be seen in Figure 4.

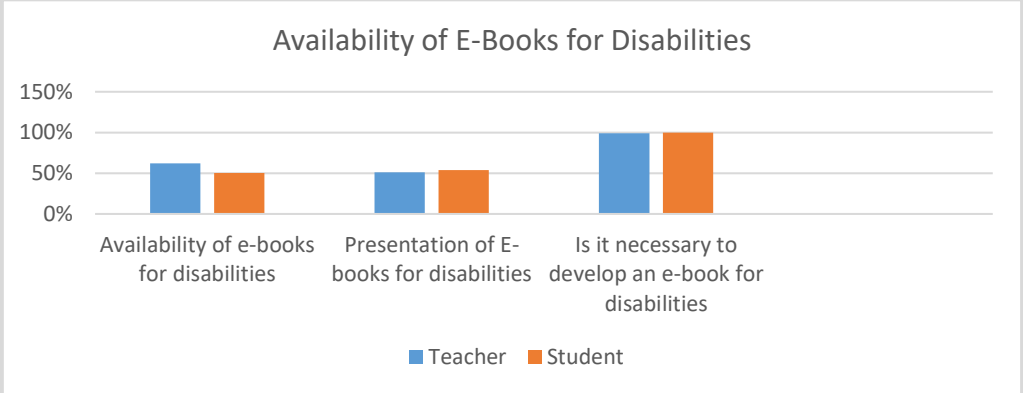

Figure 4. Aspects of the Need for E-Books

In addition, as many as 63% of teachers and 48.6% of students said that disaster mitigation videos for disabilities were not available. Then as many as 98.3% of teachers and 99.3% of students said that disaster mitigation videos needed to be developed. The developed media contains material in the form of e-books and animated videos. Based on the results of the analysis of the needs of the e-books and videos along with the specifications of the videos and e-books developed, the result can be seen in Figure 5.

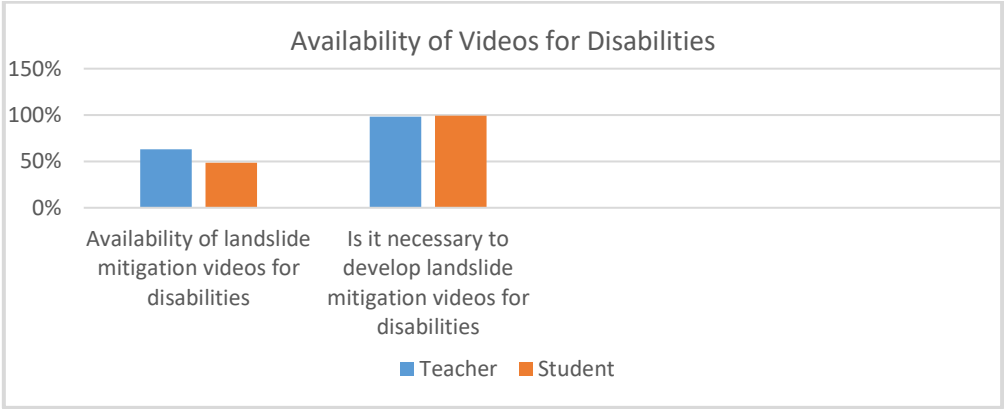

Figure 5. Aspect of Video Requirements

Furthermore, the result of the analysis aspect of video requirements as shown in Figure 5., it is found that there is a need for the development of disaster mitigation videos, which include media in the form of e-books and animated videos. The contents contained in the e-book and animated video can be seen in Table 1.

Table 1. Specifications for E-Books and Animated Videos

E-Book	Video
a. Presentation of material that has to do with the area around	a. The mitigation video contains learning objectives
b. Learning objectives are written clearly after the original	b. Detailed and clear video presentation
c. There are instructions for using the module	c. There is an introduction/opening video
d. The module display criteria are lots of interesting info about landslide disaster mitigation and lots of pictures	d. The video contains material in animated form accompanied by examples
e. There are quizzes, interesting info and facts	e. There is sign language
f. At the end of the e-book there are evaluation questions	f. The language style used is communicative
g. Image presentation is full color with HD quality	g. Use of language that is easy to understand
h. The presentation of the material is brief accompanied by examples	h. Presentation of material in the form of visual audio with text
i. The style of language used is using language that is easy to understand	i. The video display is balanced between material and simulation
j. The criteria for using language are a mixed style, polite and easy to understand	j. Free music theme
k. The appearance of the e-book cover is full color and the images represent the contents of the book	k. Free video display color
l. Author customized e-book design	l. Video duration is 5-10 minutes
m. A4 book size	
n. n. The font is adjusted by the author	

Learning media can be accessed via Android so that it is more practical. This media has 4 main menus, namely news update menu, learning menu, playing menu and singing menu. Products that have been developed by researchers have been tested to determine the feasibility of the products that have been made. This test was carried out by distributing questionnaires to respondents.

Media Eligibility Test

The media test was carried out on 2 lecturers of Informatics Engineering Education (FKIP) Muhammadiyah University of Surakarta using a Likert scale. According to (Sugiyono, 2019) the Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena with the following scale options in Table 2 as follow:

Table 2. Likert Scale

Scale	Interpretation
1	Very Not Good
2	Not Good
3	Pretty God
4	Good
5	Very Good

The results of this test get a score of 222 out of a maximum score of 250. The score obtained is the sum of the scores given by the experts, while the maximum score is obtained from the total maximum rating score. The following are the results of the tests carried out as shown in Table 3.

Table 3. Media Test Result

Question Code	Expert 1	Expert 2	Question Code	Expert 1	Expert 2
1	4	5	14	5	5
2	4	5	15	4	5
3	5	5	16	5	5
4	5	4	17	4	4
5	4	4	18	5	5
6	4	4	19	4	5
7	5	5	20	5	5
8	4	4	21	3	4
9	5	4	22	4	4
10	5	4	23	4	4
11	5	4	24	5	4
12	4	4	25	4	5
13	5	4			
Total Score			222		
Maximum Score			250		

$$\textit{Eligibility presentation}\ (\%) = \frac{Total\ score}{Maximum\ score} \text{ x } 100\% \qquad (1)$$

$$\textit{Eligibility presentation}\ (\%) = \frac{222}{250} \text{ x } 100\% = 88{,}8\%$$

The results of the media feasibility calculation get a percentage is 88.8% as shown in Formula 1. Based on the feasibility percentage in Formula 1 it shows that the developed media is very feasible as shown in Table 4.

Table 4. Likert Scale of Media Eligibility Percentage

Eligibility Presentation	Interpretation
81%-100%	Very feasible
61%-80%	Feasible
41%-60%	Enough
21%-40%	Not worth it
1%-20%	Not Feasible

Feasibility Test of E-Book Material

The material test was carried out on experts, namely one member of the BPBD of Klaten Regency and one of the SLB SD teachers in Klaten Regency. Feasibility testing by material experts was carried out by calculating the Likert scale and obtaining a score of 197 out of a maximum score of 200. The following are the results of the tests that have been carried out and can be shown in Table 5.

Table 5. E-Book Material Test Result

Question Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
Expert 1	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	93
Expert 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	95
Total Score																				188
Maximum Score																				190

Feasibility Test for Video Animation Material

The results of the media feasibility calculation get a percentage of 98.5%. Based on the feasibility percentage table using the Likert scale, it shows that the media developed is very feasible.

The material test was carried out on experts, namely one member of the ULD-PB of Klaten Regency and one of the SLB SD teachers in Klaten Regency. Feasibility testing by material experts gets a score of 188 from a maximum score of 190. The result can be shown in Table 6.

Table 6. Video Animation Material Test Result

Question Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
Expert 1	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	93
Expert 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	95
Total Score																				188
Maximum Score																				190

The results of the media feasibility calculation get a percentage of 98.94%. Based on the feasibility percentage table using the Likert scale, it shows that the media developed is very feasible.

User Test

The user test was carried out by representatives of 50 elementary school students in Klaten Regency. This test is calculated using the Guttman scale. The results of the questionnaires that have been filled in by students are then included in the percentage scale range with the following calculations in Formula 2 and Formula 3.

Answer "Yes" : 1 x average / 100%
: 1 x 0,784 x 100%
: 78,4% (2)

Answer "no" : 0 x 100% / 0%
: 0 x average / 100%
: 1 x 0,216 x 100%
: 0% (3)

So, it can be described on a Formula 4 as follows:

0%----------50%----------78,4%----------100% (4)

From the Guttman Scale analysis in Formula 4, the suitability point is above 50%, namely 78.4%, so it can be said that the media is close to being suitable. The conclusion is that the media approaches the percentage of 78.4%.

Discussion

After finishing developing the animated video, the following views are obtained. The first display in this video animation is the Splash page and main menu display in Figure 6.

Figure 6. Splash Page and Main Menu Display

In this view several main menus are presented namely the news update menu, the learning menu, the play menu and the singing menu. The news update menu is a menu that contains the latest

news regarding the activities or potential of persons with disabilities in Klaten. The learning menu is a menu that presents material on landslide disaster mitigation. The game menu is a menu that presents games. Then sing menu is a menu that presents audio sing.

This media animation provides an e-book which contains material on disaster mitigation for persons with disabilities in Klaten Regency. This page presents landslide mitigation material in the form of an electronic book. This e-book is equipped with a sign language trainer to help the deaf and mute with disabilities. In addition, this e-book is also equipped with audio to help blind people with disabilities. There is also a game menu that makes it interesting, which contains some buttons, namely the button simulation before the disaster, during the disaster, and after the disaster. These menus can be seen in Figure 7.

Figure 7. Display of E-Book, Video Content, and Game Pages

In the initial appearance of the game page, it is presented in the form of cases or simulations of landslides. This display encourages people with disabilities to do the right thing when an avalanche occurs. After finishing reading the instructions or questions, then we will be directed to the landslide disaster simulation view. Presented conditions where there are a lot of goods before the landslide occurred. In this game, the user is asked to put the items needed in the event of a landslide into a disaster prepared bag. If the item is entered correctly, the user will get a score of 10 and if it is wrong, the score will be reduced by 5. The display can be seen in Figure 8.

Figure 8. Game Simulation before Disaster

The other display in this learning media, there is of the “during disaster” play page. This page is one of the games provided in this application. In this game the user is asked to follow the evacuation route to find a gathering point and is given 1 minute to challenge this game. If the time runs out it will be game over. This game has the intention of simulating when a landslide occurs, all you have to do is go out following the evacuation route to the assembly point. The page is illustrated in Figure 9.

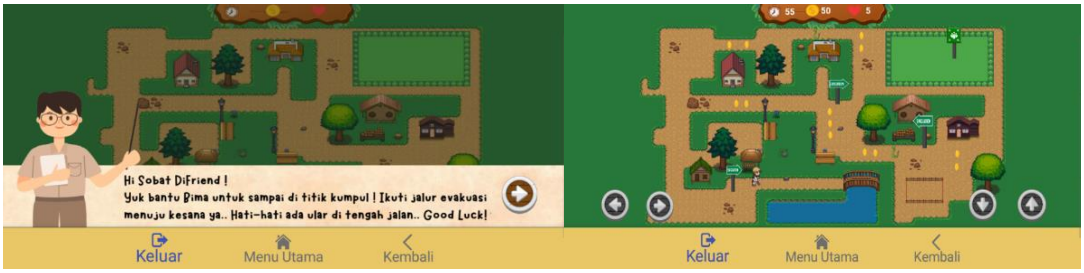

Figure 9. Game Simulation during Disaster

In the last one, there is “after disaster” game, which means the user is asked to choose the correct action after a landslide disaster occurs by pressing the numbers on the game screen that is presented. The user is given 1 minute to choose the answer provided. If the answer chosen is correct, a tick notification will appear indicating that the answer chosen is correct and 25 points will be awarded, whereas if the answer chosen is incorrect, a cross notification will appear indicating that the answer is wrong and points will be reduced by 15. The display can be shown in Figure 10.

Figure 10. Game Simulation after the Disaster

Furthermore, in this learning media, there is the last menu which name sing menu. This is the menu which contain of simulation when the disaster is coming. This page contains song lyrics as well as play and pause buttons. The play button functions to start singing, here the application will make a singing sound, while the pause button functions to pause singing, here the application will stop the singing sound. In addition, this page provides back and exit navigation buttons. The back button functions to return to the previous page or home page, while the exit button functions to exit the application. The lyric is illustrated in Figure 11.

Figure 11. Sing Page Display

CONCLUSION

Based on the test results and discussion in this study, it can be concluded that the product developed in this study is an Android application which includes material on landslide disaster mitigation for persons with disabilities. This media presents 2 forms of material, namely 3D animated videos and also e-books. In addition, this media provides a simple game to find out how much users understand after using the application and also provides information on the latest disaster news in Klaten Regency. This media is equipped with audio and sign language demonstrations to make it easier for persons with disabilities. The media that has been developed by this writer is classified as very feasible. This is evidenced by the results of the media expert, material expert and user questionnaire calculations.

ACKNOWLEDGEMENT

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