Development of physics-based learning media for android integrated with earthquake disaster education

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Abstract. The aim of this research is to produce physics based learning media for Android integrated with earthquake disaster education. This study uses a 4D development model. Data collection instruments in the form of expert validation sheets which include media experts and material experts. The research data was collected through observation sheets, questionnaire sheets, and analyzed descriptively quantitatively. The result shows that the development of physics learning media based on android was carried out by the development procedures. Then, the result of expert validation shows that the physics learning media has been developed well. Moreover, the physics learning media is suitable for learning process.
Keywords: *android, disaster education, earthquake, media based learning*

1. Introduction

Indonesia is a country which located between the confluence of three large tectonic plates, namely the Indo Australian Plate, the Eurasian Plate, and the Pacific Plate. In the area where these plates meet, earthquakes, tsunamis, and landslides often occur. This is caused by the accumulation of energy which cannot be held back so that it is released into a natural disaster. Disaster is an event caused by natural / non-natural factors that endanger and disrupt the lives and livelihoods of the community which causes the loss of property, loss of life, damage to the environment and psychological impact of the community. The National Disaster Management Agency revealed that one of the natural disasters that still dominates in Indonesia is an earthquake. This fact is shown in table 1.

The number of fatalities and damage to infrastructure caused by earthquake disasters depends on shocks occurring on the surface of the earth. To overcome the high number of fatalities, community participation is needed in the face of an earthquake. A special subscription is needed so that people understand about natural disasters, know how to react to them, and can prevent and save. Community empowerment for disasters, one of which can be done through learning in schools, by integrating them into several subjects [1].

Table 1. Summary of Indonesia's disaster 2019.

Disaster type	Number of events	Fatalities	
		Died & Gone	Suffer & Displaced
Flood	466	291	784.495
Landslide	463	74	4.712
Floods and landslides	5	2	0
Abrasion	6	1	142
Whirlwind	656	18	22.038
Forest fires	70	1	0
Earthquakes	12	4	26.212
Volcanic eruption	4	0	659

Source: national disaster management agency [2]

Preparedness aims to plan how to respond if a disaster occurs, in other words, to save lives, minimize damage to property and reduce the negative effects of disasters [3]. Knowledge of disaster preparedness and mitigation has an important role in reducing high risks due to the impact of disasters, so knowledge about natural disasters needs to be taught early on [4], [5]. The large-scale preparedness approach can begin with disaster policy and educational aspects [6]. The integration of disaster education in schools in disaster-prone areas makes students have a good understanding of dealing with disasters and can foster scientific habits in students to increase children's success in receiving learning materials in schools [7]-[9]. Physics is one of the disciplines used as a medium to prevent disaster risks because physics is a science that learning about the universe and its causes [10]. Learning the concept of vibration can be integrated into the earthquake disaster with a learning model that is following the demands of the curriculum [11].

The development of technology in all fields requires many parties to pay special attention to it. The young generation must have mastery of technology [12]. The development of technology in the era of globalization is a demand to be used as a medium in learning process [13]. The development of science and technology brings a great change and influence in education field. The role of education is very important in improving the quality of human resources so it is necessary to improve the quality of education [1], [14], [15]. One of the development in science and technology that can be used as learning media is an Android based media. Android is the most interesting comprehensive *open-source platform* because it gives freedom for developers to create applications [16]. Android-based physics learning media have been developed in line with the development of the internet and technology. However, an Android-based physics learning media integrated with earthquake disaster education has never been developed.

This research discusses the results of the development of an integrated android based learning media for earthquake disaster education. Research and development carried out to determine the feasibility of developed learning media. Research by developing using *Android Studio, Photoshop,* and *Adobe Audition,* then it is imported with the extension (.apk). This media is operated offline in order to facilitate the necessity of teachers and students.

2. Research method

This study is a research and development (R&D) research that refers to the 4D (four-D) research and development model. According to Thiagarajan [17], the 4D research and development model consists of 4 main stages, namely *define, design, develop*, and *disseminate*. The 4D development model can be adapted to 4D namely: defining, designing, developing, and distributing.

2.1. Research procedure

Procedure development of instructional media in this study include: a) Define, b) Design, c) Development and d) Disseminate. This study is conducted in physics subject at SMAN 1 Depok. In this stage, data will be obtained in the form of a curriculum and syllabus to guide media developers. Besides, student characteristics data will be obtained as well as the use of media to be developed. In the planning stage, the material collected is designed in an Android based learning media. The design is adapted to the design of instructional media, including making storyboards, layouts learning media, compiling learning materials, making evaluation questions and the applying of earthquake disaster preparedness videos. In the development stage. Then, the design that has been done is developed using *Photoshop, Android Studio*, and *Adobe Audition.* After that, it is imported with the extension (.apk). Next, the media that have been developed is validated. Validation was carried out by two material expert lecturers and a media expert lecturer using a questionnaire assessment sheet, and at each stage of distribution, media that have been developed are then distributed to class X of SMAN 1 Depok.

The design of media development consists of two main stages, namely the development stage of an Android based learning media and the learning media trial phase. In this stage of development, the development model used in 4D.

2.2. Data analysis techniques

Analysis techniques which is used in this study is media feasibility analyzes based on expert validation. The media eligibility category is 1-5 Likert scale data and the analysis of the average score for each aspect of the assessment is calculated. The validation results that have been developed are analyzed using descriptive analysis. The average score ratings are calculated using the formula:

$$\bar{X} = \frac{\sum \bar{X}_i}{n}$$

Notes, $\bar{X}$ is mean (average), $\sum \bar{X}_i$ is number of X values and n the number of individuals .
Average obtained is converted to a scale of four with the following steps [18]:

- Finding the ideal mean ($\bar{X}_i$) and ideal standard deviation (SBi) in the following way:
  ($\bar{X}_i$) = ½ (max score ideal + ideal min score) SBi= 1/6 ideal max score + ideal min score)
- Convert scores to values with the criteria in table 2.

Table 2. Scoring criteria for four scale.

Interval	Category
$\bar{X}_i + 1{,}8\ SBx < \bar{X}$	Very good
$\bar{X}_i + 0{,}6\ SBx < \bar{X} \leq \bar{X}_i + 1{,}8\ SBx$	Good
$\bar{X}_i - 0{,}6\ SBx < \bar{X} \leq \bar{X}_i + 0{,}6\ SBx$	Fair
$\bar{X}_i - 1{,}8\ SBx < \bar{X} \leq \bar{X}_i - 0{,}6\ SBx$	Less
$\bar{X} \leq \bar{X}_i - 1{,}8\ SBx$	Very poor

Source: Widoyoko, 2009 [18]

3. Results and Discussion

This learning media was developed based on observations of the characteristics of tenth grade students where some students has difficulty in understanding the presented material. Most of the schools applied the following methods in their learning process. They are the method of discussion, lecture and group work so that learning does not arrive at the stated objectives. Besides, the use of Android technology in learning is underutilized.

Physics learning products are developed using *Photoshop, Android Studio,* and *Adobe Audition* featuring more visualizations (images and video animations) integrated in earthquake disaster education. Physics learning media with android assisted enable students to learn anywhere and anytime. The display of physics learning media integrated with earthquake disaster education (figure 1). Display of

the main menu of physics learning media (figure 2). Display of introductory menu (figure 3). Display of material menu (figure 4). Display of evaluation menu (figure 5). Display of disaster preparedness menu.

Figure 1. Display main menu of physics learning media.

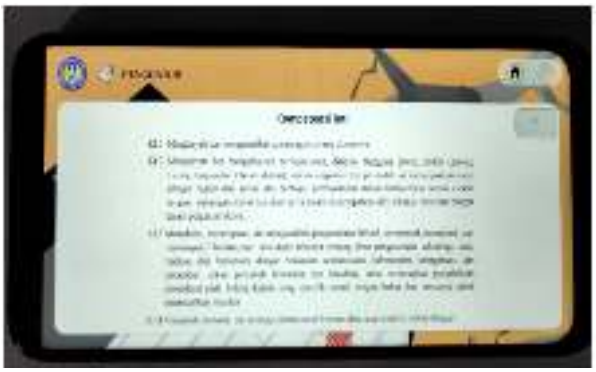

Figure 2. Display introductory menu.

Display of android based physics learning media integrated with earthquake disaster education in figure 1 displays the main display of media containing four menus (introductory menu, material menu, disaster preparedness menu, and evaluation menu), instruction menu, volume menu, developer profile and exit menu against the background of an earthquake (seismograph). Figure 2 displays an introduction of learning that will be contained in the learning media in the form of core competencies, basic competencies, the achievement of indicators and the learning objectives of the media.

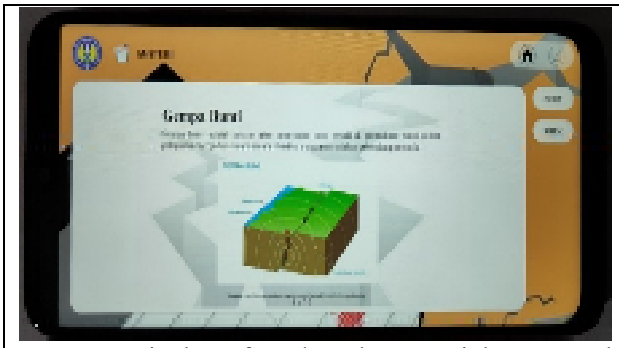

Figure 3. Display of earthquake material menu and simple harmonic motion.

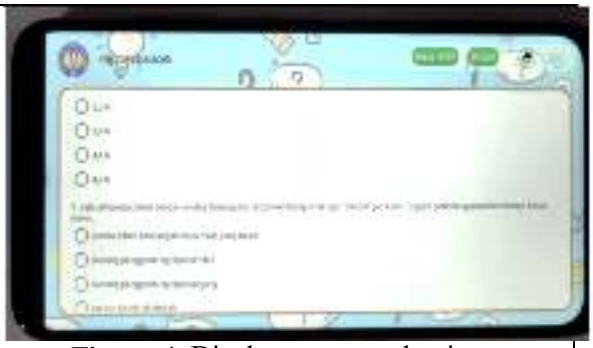

Figure 4. Display menu evaluation.

The second menu in this media is material menu that display containing earthquake disaster material, simple harmonic motion, and the relationship between simple harmonic motion with earthquake which is presented coherently and clearly as shown in figure 3. The fourth menu of instructional media physics based android is an evaluation of the learning that has been done. In this menu there are instructions for working on the problems and five multiple choice questions that must be done within 15 minutes as in figure 4.

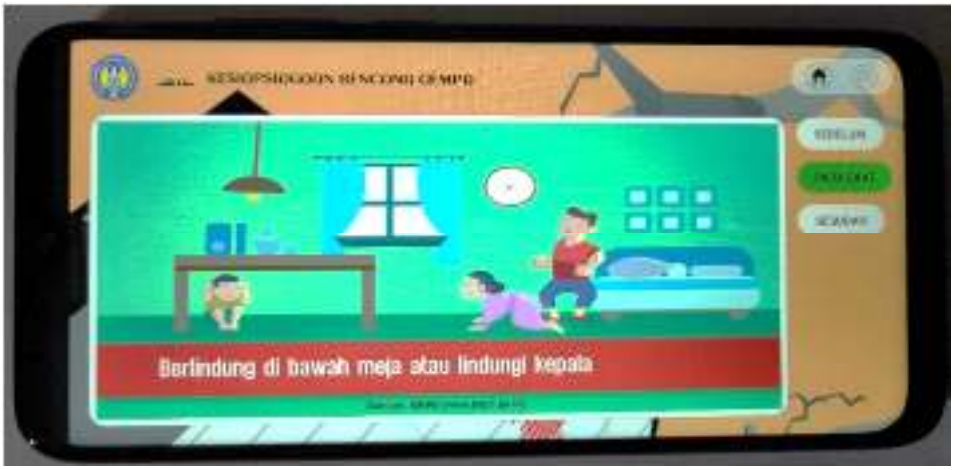

Figure 5. Display of the earthquake disaster preparedness menu.

The disaster preparedness submenu contained in Figure 5 contains a video of learning about what actions must do before an earthquake occurs when an earthquake occurs and after an earthquake occurs.

Validation is used as an evaluative assessment of a product that is developed and to assess whether the product development plan is feasible before the product is used. Validation is done by media experts and material experts. Validation scores obtained are in table 3:

Table 3. Media and material validation scores

Aspects	Sub-aspect	Score
Media	Audiovisual	4.2
	Software engineering	4.8
Material	Learning	4
	Material	4

Scores given by the validator are compared with the categorization in table 2. The average score of validation results from media experts obtained was 3.8 from a range of 0 to 4. Then, the score included in the category is very feasible, so the device is suitable for use in learning. While the results of validation from material experts 3.67 included in the category are very feasible.

Android based integrated learning media for disaster education developed are included in the appropriate category for use in learning. Integrating disaster material into physics can make learning more authentic, contextual and meaningful. This is in line with the results of previous studies stating that raising issues that are contextual and authentic in learning can increase student motivation [19] and can shape the character of students to alert for earthquake disasters and be able to increase the achievement of learning outcomes [12].

Learning media developed have interesting, practical, flexible visualizations that can be used wherever and whenever make it easier for students to repeat independently and improve memory of the material. The results of several previous studies state that the use of technology based learning media can increase learning motivation because the learning process is more attractive, enjoyable [20] and technology *mobile* provides convenience in contextual learning [21]. The new learning strategy using the integrated android earthquake disaster education provides the view that learning physics can be taken from the problems of daily life or through local and universal culture that is compatible with the material [22].

4. Conclusion

The physics learning media based on Android integrated with earthquake resistance education has been successfully developed and this media is included in the category of very feasible to be used as a learning media.

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