

## Development of Android-Based Edutainment Game Learning Media on Phytagoras Theorem for Junior High School Students

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### ABSTRACT

Distance learning during the COVID-19 pandemic caused students' learning motivation to decrease. For this reason, an interesting learning process is needed, one of which is by applying game-based learning. This study aims to develop and determine the feasibility of an Android-based edutainment game learning media on the Pythagorean theorem material for junior high school students. This type of research is Research and Development (R&D) using the ADDIE development model, namely Analyze, Design, Development, Implementation, and Evaluation. This research was conducted at MTs Muttaqien PSM Takeran in June 2021. The results of the research on the development of android-based edutainment game learning media include 1) Android-based edutainment game learning media meets the validity criteria with the combined validation average score by the media validator of 84.10% and is included in the fairly valid category, 2) Edutainment game learning media android-based meet the practicality criteria obtained from the average results of filling out student response questionnaires of 87.50% and is included in the very practical category, 3) Android-based edutainment game learning media meets the effectiveness criteria obtained from student learning outcomes tests with a score of N- The gain is 62.32% and is included in the medium category. Thus, it can be concluded that the Android-based edutainment game learning media is feasible to use in learning mathematics on the Pythagorean theorem material. The results of this study provide a contribution in the form of an Android-based edutainment game learning media that is used as an alternative in the learning process.

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## 1. INTRODUCTION

The COVID-19 pandemic that has occurred in almost all parts of the world has had a considerable impact on aspects of human life, as well as on the field of education (Susanti & Wulandari, 2021). One of the efforts made by the Indonesian government is to implement physical distancing for Indonesian citizens. The government through the Ministry of Education and Culture (Kemendikbud) issued Circular Letter Number 4 of 2020 concerning the Implementation of Educational Policies in the Emergency Period for the Spread of Corona Virus Disease (Covid-19). The circular stated that the safety of students, teachers, school principals, and all school members is a top priority in implementing education during the COVID-19 pandemic (Mendikbud, 2020). This is reinforced by Circular Letter Number 15 of 2020 concerning Guidelines for Organizing Learning From Home in an Emergency Period for the Spread of Corona Virus Disease (Covid-19). The purpose of implementing Learning From Home according to the circular is to ensure the fulfillment of students' rights to obtain educational services during the COVID-19 emergency, protect education unit residents from the adverse effects of COVID-19, prevent the spread and transmission of COVID-19 in education units and ensure compliance psychosocial support for educators, students and parents/guardians (Ministry of Education and Culture » Republic of Indonesia, nd).

The distance learning policy implemented by the government has caused many new problems, one of which is the motivation to learn in students who take online or online learning during the declining Covid-19 virus pandemic situation (Cahyani, Listiana, & Larasati, 2020). Although distance learning can be done through online media, most students are lazy to pay attention and tend to use smartphones to play games or play social media, even distance learning sometimes only contains assignments given by the teacher and then collected through online media (Hafida et al., 2020). The learning implemented by teachers during the COVID-19 pandemic mostly uses the assignment method with the help of learning media in the form of printed media such as textbooks, worksheets, and learning materials in the form of pdf files. Students are given the task of reading textbooks, doing questions, taking notes, and summarizing from textbooks. Many educators are less able to innovate in making learning media when learning is replaced with online learning (Hafida et al., 2020). This is what causes students to experience a decrease in motivation in learning. The decrease in student learning motivation will certainly affect increasing student learning outcomes.

Improving student learning outcomes is influenced by several factors, one of which is the use of learning media (Putri Pertiwi et al., 2019). Learning media is an intermediary that can be used to convey information in the teaching and learning process so that it can stimulate students' attention and interest in learning (Junaidi, 2019; Susanti, V. D., Krisdiana, I., Murtafiah, W., Setyansah, R. K., & Masfingatin, 2021). Learning media plays an important role in helping teachers in the form of communication to explain or convey messages to students so that they can provide meaningful experiences in the learning process (Pakpahan, A. F., Ardiana, D. P. Y., Mawati, A. T., Wagiu, E. B., Simarmata, J., Mansyur, M. Z., ... & Iskandar, 2020). During online learning, teachers try to use learning media in the form of print media such as textbooks, worksheets, learning videos from Youtube, or soft file materials. The learning media is considered less attractive to students, students feel less challenged in learning, causing a decrease in students' learning motivation. Therefore, the selection of the right learning media by current conditions is a determining factor for the implementation of an effective learning process.

The benefits of learning media can increase students' interest and motivation in the learning process, curiosity and enthusiasm of students increase and the interaction between students, educators, and learning resources becomes interactive (Abi Hamid, M., Ramadhani, R., Masrul, M., Juliana, J., Safitri, M., Munsarif, M., ... & Simarmata, 2020). The increasingly rapid development of science and technology encourages reform efforts in the use of technology in the learning process (Fu & Hwang, 2018). One of the uses of technology as a learning medium is the use of Android-based learning media through smartphones.

Smartphone is a cellular phone that uses several services such as a display, microprocessor, memory, and built-in modem that are sophisticated and highly capable like a computer (Kaceti & Klímová, 2019). Smartphone technology that can be used as a learning medium is an Android-based mobile learning application. Utilization of Android-based mobile learning as a learning medium can be used as a solution to solve problems in the learning process in the current COVID-19 pandemic conditions. The term mobile learning refers to handheld and mobile IT devices such as PDA (Personal Digital Assistants), cellular phones, laptops, tablet PC, and so on (Wahyono, 2019). Mobile learning or learning through mobile phones has become a trend among educators along with the rapid development of technology. The use of mobile learning in learning mathematics has several advantages, including 1) it can be operated anywhere and anytime, 2) it increases student motivation, and 3) improves learning according to student needs (Aini, Ayu, & Siswati, 2019; Setyadi, 2017).

Based on the results of observations and interviews conducted by researchers with teachers and students of MTs Muttaqien PSM Takeran, all students already have smartphones and during the COVID-19 pandemic learning was carried out using an online system. The teacher explains that mathematics learning is carried out through smartphones by using learning media in the form of print media such as student worksheets or learning materials in the form of pdf files which are distributed to students. The teacher provides learning instructions through online media in the form of WhatsApp Group. Learning through print media does not get a good response from students. Most students complain that they do not understand the material being studied because it is not explained directly by the teacher. In addition, online learning that is carried out continuously and with learning that seems monotonous makes students feel bored and feel less challenged in learning. The data on daily math test scores shows that only 26.7% meet the Minimum Completeness Criteria.

Android-based learning media in the form of edutainment games are learning media that are applied to mobile devices that contain elements of education and entertainment so that they are very suitable to be used to create a fun learning process. Setyaningrum dan Waryanto (2018) explain that edutainment media is a media that combines education and entertainment in a harmonious way with audio, visual and animation facilities which are intended to increase students' learning motivation.

Based on research that has been done previously related to the development of learning media in the form of edutainment games conducted by Dewi Purnama Sari in 2018 got a very good response from teachers and students. In addition, there was also research conducted by Mahfi, Marzal, and Saharudin in 2020 and it was found that the development of learning media was able to improve student learning outcomes. In a study conducted by Mahiroh and Wintarti in 2019, it was found that the learning media developed received a positive response from both teachers and students, so based on these studies, researchers also wanted to develop learning media in the form of an Android-based edutainment game. The learning media that developed by the researcher uses android-based learning media by adding edutainment elements packaged in the form of games into the learning media. It is hoped that by adding an element of edutainment students can be more motivated to learn while studying from home because the learning process is packaged in the form of games and entertainment so that it can improve student achievement.

This android-based edutainment game learning media was developed using Unity 3D software. One of the advantages of Unity 3d software is that it can create 3D and 2D based games so that it can make it easier to make games that can increase student enthusiasm. In today's conditions, games using smartphones are increasingly popular with young people and children. On the other hand, during the learning process from home, it was found that the students of MTs Muttaqien PSM Takeran already had their own smartphones.

## 2. METHODS

The type of research used in this research is research and development. According to Sugiyono (2017) the research and development method is defined as a scientific way to research, design, produce and test the validity of the products that have been produced. The development model used

in this research is the ADDIE development model. According to I Made Tegeh, I Nyoman Jambel, dan Ketut Pudjawan the ADDIE development model consists of five steps, namely analysis, design, development, implementation, and evaluation (Salas-Rueda, Salas-Rueda, & Salas-Rueda, 2020; Widyastuti & Susiana, 2019). This research was carried out at MTs Muttaqien PSM Takeran Magetan in the even semester of the 2020/2021 academic year.

Based on the development procedure carried out by the researcher using the ADDIE development model, there are five steps which are discussed below.

#### ***Stage of Analysis***

In the analysis phase, the researcher analyzes the potential and problems that exist in the research area such as curriculum analysis, instructional analysis of learning, student analysis. This stage is carried out in the first month for 2 weeks.

#### ***Stage of Design***

At the design stage, the researcher prepares the initial materials for learning devices used, such as the preparation of instruments and the design of learning media. This stage is carried out for one month in the second month.

#### ***Development Stage***

The next stage in this research is the development stage with the following sequence of activities: Design Validation. This stage is carried out for 2 months.

#### ***Implementation Phase***

At the implementation stage, the first step taken by the researcher was a small class trial by taking 1 class using learning media. The researcher will ask for feedback by filling out a questionnaire after the student can use the developed android-based edutainment game learning media. Feedback from students will be used as a reference to improve the learning media for Android-based edutainment games developed. This stage is carried out for 1 months.

#### ***Evaluation Stage***

At the evaluation stage, the first step taken by the researcher was a class tryout by taking 2 VIII grades at MTs Muttaqien PSM Takeran. This stage is carried out for 2 weeks in the last month.

#### ***Learning Media Data Analysis***

##### ***Analysis of the validity of learning media***

The analysis of the validity of the learning media is used to determine the level of validity of the learning media for the developed android-based edutainment game. The formula used to process the data from the validation results by the validators is as follows (Akbar, 2013):

$$V = \frac{TS_e}{TS_h} \times 100 \%$$

Information:

V = Percentage Validity

TSe = Total empirical score (sum of score assessment by validator)

TSh = Total expected score (maximum total score)

In this learning media development research, 3 validators (media experts, material experts, mathematics teachers) are involved, so to find out the overall percentage, you can use the average formula as follows (Akbar, 2013):

$$V = \frac{V_1 + V_2 + V_3}{3} = \dots \%$$

Information:

V = Percentage Validity

V1 = Number of 1st validator values

V2 = Number of 2nd validator values

V3 = Number of 3rd validator values

This validity test was carried out using a validity sheet made by the researcher and analyzed using the validity criteria. To determine the level of validity of the developed learning media, the validity criteria will be used according to Akbar (2013) which is shown in table 1 below.

Tabel 1 Validity Criteria

Validity Criteria	Validity Level
85,01% –100,00%	Very valid, or can be used without revision.
70,01% –85,00%	Fairly valid, or usable but needs minor revision.
50,01% –70,00%	Less valid, it is recommended not to use it because it needs major revision.
01,00% –50,00%	Invalid, or should not be used.

This study refers to the criteria above by setting a minimum limit for the validity of learning media, which is in the range of 70.01% - 85.00%.

#### *Analysis of the practicality of learning media*

Analysis of the practicality of learning media is used to determine the level of practicality of learning media for edutainment games developed through student response questionnaires. The scale used on the student response questionnaire sheet is the Guttman scale with the checklist method (Ismail & AlBahri, 2019; Sandjaja & Purnamasari, 2017). The final results of the student response questionnaire scores will then be percentage using the following formula (Akbar, 2013):

$$Vp = \frac{TSEp}{S - max} \times 100 \%$$

Information:

Vp = Practicality Validity

TSEp = Total Practicality Empirical Score

S – max = Maximum expected score

To describe the practical results of the developed learning media, the practicality criteria presented in table 2 below will be used.

Tabel 2. The Practicality Criteria

Criteria	Information
80,01% –100%	Very practical, can be used without revision.
60,01% –80,00%	Practical enough to use but needs minor revisions.
40,01% –60,00%	Less practical, it is recommended not to use.
20,01% –40,00%	Impractical, unusable.
00,00% –20,00%	Very impractical, unusable.

This study refers to the criteria above by setting the minimum practicality of learning media in the range of 60.01% - 80.00%.

#### *Analysis of the effectiveness of learning media*

Analysis of the effectiveness of learning media is used to determine the level of effectiveness of learning media developed through multiple choice test questions in the learning media. The test of the effectiveness of learning media is carried out using the following formula (Situmorang, Muhibbuddin, & Khairil, 2015):

$$N - Gain = \frac{Skor Posttest - Skor Pretest}{Skor Maks - Skor Pretest} \times 100\%$$

This study refers to the above categories by setting a minimum limit for the effectiveness of learning media, which is in the range of 30 N-Gain 70.

### 3. FINDINGS AND DISCUSSION

#### 3.1 Stage of Analysis

The analysis stage is the initial stage in the ADDIE development model which aims to determine the potential and problems needed in the development of learning media. The analysis carried out includes curriculum analysis, learning analysis, student analysis, and situation analysis.

The curriculum used in the 2013 curriculum is based on basic competencies, namely using the Pythagorean theorem to determine the lengths of the sides of a right triangle and solve various problems related to the Pythagorean theorem.

Instructional analysis of learning is carried out to analyze indicators of competency achievement, namely proving the Pythagorean theorem, calculating the length of the side of a right triangle if the other two sides are known, writing down three numbers measuring the length of the side of a right triangle (Pythagorean Triple) and using the Pythagorean theorem to solve various problems in the wake up flat and in everyday life.

Student analysis was carried out by conducting interviews with teachers and students through chat messages and observations by visiting the homes of several students. This stage shows that students still find it difficult to understand the Pythagorean theorem material, 70%h Student learning outcomes are still low, students tend to be lazy in learning and are busier with other activities during distance learning and students prefer to play smartphones for other purposes.

#### 3.2 Stage of Design

At the design stage, the instruments are arranged, the selection of learning media, and the initial design of the learning media are carried out. The results of the design stage are as follows:

##### Instrument Arrangement

The research instrument consists of several instruments which are described in detail as follows.

##### *Media Validation Sheet*

The Android-based edutainment game learning media validation sheet that has been compiled consists of 13 statements for media experts, 14 statements for material experts, and 14 statements for practitioners (teachers).

##### *Student Response Questionnaire*

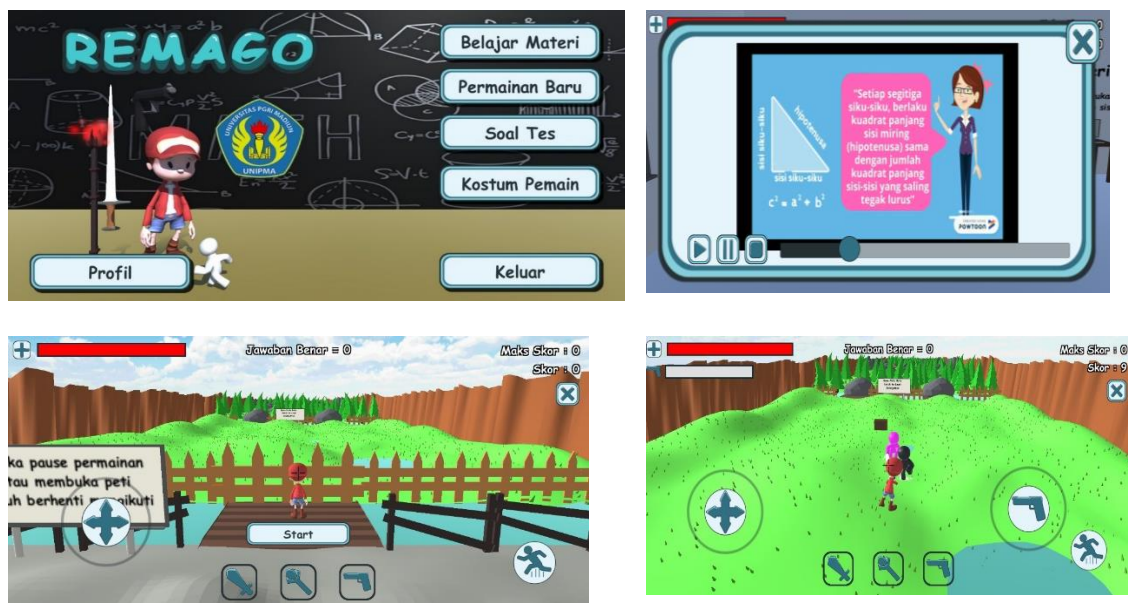
The student response questionnaire sheet consists of 6 negative statements and 6 positive statements are used to assess several aspects including understanding, pleasure, enthusiasm, interest, activeness, and attention of students in using Android-based edutainment game learning media.

##### *Learning Outcome Test Question Sheet*

The learning outcomes test question sheet consists of 5 questions in the form of essay questions to measure the achievement of the success of learning activities using android-based edutainment game learning media.

##### *Initial Design of Learning Media*

The design of the Android-based edutainment game learning media can be seen in the following figure 1.



In full, learning media for Android-based edutainment games can be downloaded at the "[https://drive.google.com/file/d/15LfejMOzLMR9mbAGAf8dMex\\_kmpx98K9/view?usp=sharing](https://drive.google.com/file/d/15LfejMOzLMR9mbAGAf8dMex_kmpx98K9/view?usp=sharing)" page.

### 3.3 Development Stage

At the development stage, the design validation and stage I revision were carried out on the Android-based edutainment game learning media. Activities at the development stage are described as follows.

#### Validation of Learning Media Design

The results of the validation of the Android-based edutainment game learning media are presented in table 1 below.

Table 3. Learning Media Validation Results

Result Validation	Validator		
	I	II	III
Total empirical score (TSe)	47	64	62
Total expected score (TSh)	65	70	70
Validation Percentage (V)	72,31%	91,43%	88,57%
Combined Percentage	84,10%		

Based on the analysis from table 1, shows that the Android-based edutainment game learning media developed has a validity percentage of 84.10% so it gets a fairly valid category.

### 3.4 Implementation Phase

At the implementation stage, a small class trial was carried out, and stage II revision of the Android-based edutainment game learning media. A small class trial was conducted at MTs Muttaqien PSM Takeran involving one class VIII. To find out the practicality of learning media, students were asked to fill out a student response questionnaire via google form after the learning process using android-based edutainment game learning media was completed. The results of the analysis of the practicality of learning media at the small class trial stage are presented in table 2 below.

Table 4 Results of Practical Analysis of Learning Media

Result	Respondents					
	I	II	III	IV	V	VI
Total Empirical Score (TSEp)	10	10	9	11	11	12
Total Ideal Score (S-max)	12	12	12	12	12	12
Practicality Percentage (F)	83,33%	83,33%	75%	91,67%	91,67%	100%
Combined Percentage (Vp)	87,50%					

Based on table 2, it can be concluded that the android-based edutainment game learning media that was developed met the practicality criteria of 87.50% in a small class trial with a very practical category and can be used without revision.

After filling out the questionnaire, students were asked to work on learning outcomes test questions via google form to determine the effectiveness of the learning media.

The results of the analysis of the effectiveness of learning media at the small class trial stage are presented in Table 3 below.

Table 5 Results of Learning Media Effectiveness Analysis

			Statistic	Std. Error
NGAINSCOREUCKK	Mean		62,78	10,68
	95% Confidence Interval for Mean	Lower Bound	35,33	
		Upper Bound	90,23	
	5% Trimmed Mean		62,71	
	Median		62,32	
	Variance		684,16	
	Std. Deviation		26,16	
	Minimum		26,83	
	Maximum		100,00	
	Range		73,17	
	Interquartile Range		45,54	
	Skewness		0,078	0,845
	Kurtosis		-0,55	1,74

Based on Table 3, it can be concluded that the Android-based edutainment game learning media that was developed got an average percentage of effectiveness of 62.78% in small class trials so that the effectiveness of learning media can be categorized as moderate (Situmorang et al., 2015).

### 3.5 Evaluation Phase

At the evaluation stage, large class trials and data analysis were carried out on the Android-based edutainment game learning media.

A large class trial was conducted at MTs Muttaqien PSM Takeran involving 2 class VIII as research subjects. The results of the analysis of the practicality of learning media are presented in table 4 below.

Table 6 Results of Practical Analysis of Learning Media

Total Empirical Score (TSEp)	210
Total Ideal Score (S-max)	240
Practicality Validity (Vp)	87,50%



The results of filling out student response questionnaires in large class trials based on table 4.8 show the number 87.50% so it can be concluded that the android-based edutainment game learning media developed meets the practicality criteria with a very practical category and can be used without revision.

The effectiveness of the Android-based edutainment game learning media is obtained from the results of the analysis of learning outcomes test questions by calculating the N-Gain score pretest score (daily test score) with the post-test value (study result test score) using the SPSS application. The results of the analysis of the effectiveness of learning media at the large class trial stage are presented in Table 4 below.

Table 7 Results of Learning Media Effectiveness Analysis

				Statistic	Std. Error
NGAINSCOREUCKK	Mean			62,32	5,83
	95% Confidence Interval for Mean	Lower Bound		50,12	
		Upper Bound		74,52	
	5% Trimmed Mean			62,29	
	Median			57,94	
	Variance			679,65	
	Std. Deviation			26,07	
	Minimum			25,00	
	Maximum			100,00	
	Range			75,00	
	Interquartile Range			53,72	
	Skewness			0,33	0,51
	Kurtosis			-1,12	0,99

Based on the results of the analysis using SPSS software in Table 4, it can be concluded that the learning media for Android-based edutainment games developed has an average percentage of effectiveness of 62.32% in large class trials so that the effectiveness of learning media can be categorized as moderate (Susanti, Adamura, Lusiana, & Andari, 2019; Wahab, Junaedi, & Azhar, 2021).

In general, the results of the implementation of this research are expected to add discussion and reference to learning media in the form of Android-based edutainment games on the Pythagorean theorem material. Meanwhile, for students, it can help increase students' motivation and learning achievement and obtain a more interesting, effective, and efficient way of learning. In addition, with this research, teachers can add insight about learning media that can support the learning process and can further increase teacher motivation to use interesting learning media during the learning process.

#### 4. CONCLUSION

Based on the research conducted by the developers of android-based edutainment game learning media, it can be concluded that the developed android-based edutainment game learning media is feasible to use and can help the mathematics learning process. Android-based edutainment game learning media on the Pythagorean theorem material meets the validity criteria with the average percentage results obtained from expert validators of 84.10% and is included in the "fairly valid" category. Android-based edutainment game learning media on the Pythagorean theorem material meets the practicality criteria with the average percentage results obtained from filling out student response questionnaires of 87.50% and is included in the "very practical" category. Android-based

edutainment game learning media on the Pythagorean theorem material meets the effectiveness criteria with the average results obtained from student learning outcomes tests with an N-Gain score of 62.32% and is included in the "medium" category.

The limitations of this research, not all cellphones can support this application, so there are some students who lend other friends' cellphones so that learning is not conducive, besides that this application can only be accessed offline, it cannot be used online. For further research, it is hoped that researchers can develop this application so that it can be accessed online.

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