

Development of Android Based Educational Games to Enhance Elementary School Student Interests in Learning Mathematics

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Abstract—The use of technology can make the students interested in getting more involved in teaching and learning process. Encouraging technology utilization in learning is supported to influence the student interests in learning. This study aims to develop android based educational games to enhance elementary school student interests in learning mathematics. The method used in this study is ADDIE (Analyze, Design, Development, Implement, Evaluation) model to develop the product. The effectiveness of the product developed in this study was tested through experimental research using posttest only control group design. The results of Kolmogorov-Smirnov test show that significance value reaching 0.200 larger than 0.05 confirming that experimental and control group are normally distributed. Test of variance homogeneity shows that significance arrives at 0.547 meaning that the data are homogeneous. Independent sample test reveals that the significance attaining 0.001 less than 0.05 expressing that H_0 is rejected. The conclusion drawn from this research is that android based educational games are proven to increase the interest in learning mathematics for sixth grade elementary school students in Matraman District, East Jakarta, Indonesia.

Keywords—android based educational games, student interests, learning mathematics

1 Introduction

Technology, Information, and Communication are developing very rapidly in all sectors of social life including the education sector. These developments make the learning process a fun activity when learning media related to technology is used. It can be said to be fun because students who are from alpha generation are familiar with using technology. Advances in Technology, Information, and Communication have led to software development [1]. This can be used as motivation by teachers in developing appropriate strategies in their learning activities. As it is currently popular,

games are used as a medium in accelerating material absorption by the students, especially in learning mathematics which is less attractive for most students.

Several previous studies stated that the progress of a country depends on the advancement of technology particularly in an effective Mathematics education system [2]. The promising method for teachers to reach active student participation in learning Mathematics is game-based learning [3]. This proves that it is a very appropriate strategy to be applied to increase students' interest in learning mathematics.

The students are most interested in using mobile phones and playing games. The development of interactive learning media makes games effective for student learning [4]. Educational games are games in which there are elements of education and learning [5]. The content in the game is in the form of teaching materials and evaluation packaged in such a way attracting the attention of students in studying Mathematics.

The use of android based educational games on smartphone devices can make it easier to be accessed by the students [6]. The students get used to using mobile phones and games. Mobile phones can have a positive impact on the academic field if used properly. Likewise with the games that are in it, apart from being entertaining material, games at this time can also be used as a medium in accelerating the absorption of teaching material. Utilization of technology is very vital in teaching learning process [7]. Therefore, the use of technology can motivate the students to get involved in learning and raise learning efficiency. Experience is also an important factor to influence problem-solving ability [8]. It takes habituation or repetition to develop these abilities. Learning needs to be prepared as well and as early as possible in order to form the character of the students who are critical, independent, creative and able to work together [9]. It is hoped that these good characters can increase superior human resources.

Mathematics lessons, especially at the elementary school level, tend to use numbers in the learning process. Accuracy is needed with clear and rational thoughts through interpretation as a result of cognitive construction in working on problems. If there is any mistake in the problem-solving process, the results will be less precise [10-11]. When student interest in learning has decreased, it is even feared that it will affect student learning outcomes. Moreover, there are many other things from mathematics that can be used as reasons by students not to like this lesson.

Some subjects are not fun for students because it is difficult to learn [12]. The students should be motivated to solve the problems [13]. Learning approach with learner centered can make the students to work together with other students on difficult problems. The final result is not the only thing that is most important in solving problems, but also the student thinking process having value added in this learning. In addition to being given an understanding, the media in learning also needs to be made in such a way to attract the students.

Teaching mathematics must be started by increasing student interest. Through this, it is hoped that other aspects can also be improved. The impact of the development of sophisticated technology and the demand for online learning requires students and teachers to master technology supporting learning systems [14]. In previous studies, educational games were focused on improving learning outcomes. The resulting game is not yet based on Android. It can be seen that interest in learning is the most im-

portant thing in the learning process. The absorption of material will be more effective if student interest in learning is high. This will be directly proportional to student motivation and learning outcomes.

The main question in this research is "will elementary school student interest in learning mathematics increase with the development of android-based educational games?". This research is also an endeavor to answer the following problems:

- a) How to develop android-based educational games?
- b) Is there an effect of android-based educational games on elementary school student interests in learning mathematics?

This study aims to make the development of educational games to be a solution in increasing student interest in learning mathematics at the elementary school level. It is hoped that the high interest in student learning will have a positive effect on student motivation, learning outcomes, and so on.

1.1 Android based educational games

Advances of Information, Communication, and Technology (ICT) have had a major impact on various orders of social life. In many developed countries, many have prepared for the development and utilization that demands a link between advances of ICT with human resources [15-16]. It can be a big challenge to make the best use of ICT advances. No exception for educators who dedicate themselves to the advancement of the quality of education in their country.

The development and utilization of the field of ICT in the world of education can occur in various sectors. ICT also plays an important role in facilitating students. Its application has a major impact on the quality of learning [17-18]. Moreover, education in this century requires transformation in terms of infrastructure, knowledge and teaching strategies [19]. Therefore, teachers must prepare themselves in facing the changes happening especially for mastery in the field of ICT.

In the world of education, the rapid progress of ICT has spurred the emergence of various learning media innovations [20-21]. One of the learning media that is in line with the rapid development of the ICT world is educational games [22]. The development of educational games is designed to assist students in facilitating the absorption of material, increasing student thinking power, and even being useful for increasing student interest in learning. This is especially true for mathematics that some students hardly like because they think mathematics is difficult and unpleasant subject.

In previous studies, it has been found that using educational games in learning is a very practical and useful thing. These studies show a positive response to the enthusiasm, interest, and motivation of students in learning mathematics [23-24]. This is in line with the initial goal of developing educational games to increase student interest in learning mathematics. Student interest is essential to improve student learning outcomes. Educational games can also enhance student thinking when combined with problem-based learning. It can also improve student skill and performance [25-27]. Further, the game is said to be successful in the world of education if the game can

integrate the subject matter into its components and utilize the functions of the left brain.

1.2 Interest in learning mathematics of elementary school students

Interest in learning is the most important factor in learning condition [28]. Without a high interest in learning, it will affect other things, such as decreased learning outcomes. Interest is also the strength of motivation to be willing or willing to do something [29]. It is conceivable that if students are not interested in learning, there will be no motivation to learn. Moreover, mathematics is a complicated subject. One of the biggest challenges for mathematics teachers is when their students say Mathematics is the most difficult subject [30]. Many students think that some subjects are boring. This is a big challenge for teachers to break the stigma that has already spread among students. Utilization of technology can contribute to enhancement of student academic achievement [31-32].

Mathematics is one of the subjects that some students are less interested in. The use of technology in learning can improve student engagement in learning [33]. Mathematics anxiety is a pessimistic emotional attitude towards mathematics that has a negative impact on learning mathematics [34-36]. This can even affect other learning performances since mathematics is the basis of science.

Generally, students face learning difficulties since elementary school gradually increasing to middle level until high level. Some lessons are difficult to understand for elementary school level because it is boring, too formal, and theoretical. Some learning is book-based and the students have uniqueness in the way to learn [37-38]. It is feasible that if students have been anxious about some subjects since elementary education, it will have a bad impact in the future and also affect other learning. Digitized learning implementation can make student diversity is respected and contain inclusive learning in the learning process.

Another thing that can be used as a reason why some subjects are difficult and unpleasant subject for students because teachers have not mastered various fun learning media [39-40]. One of the cognitive tools or learning media minimizing this issue is to make student interested in learning subjects. In line with the existing problems, this research developed an android-based educational game to increase interest in learning Mathematics for elementary school students. It is hoped that the development of educational games and the results of this research can be a solution in dealing with existing problems, especially for the low interest in learning Mathematics.

2 Method

The method used in this research is the Research and Development with ADDIE (Analyze, Design, Development, Implement, Evaluation) model to develop the product of android-based educational game. Testing of the effectiveness of android-based educational game developed used experimental research. This research was conducted

for 130 sixth grade elementary school students in Matraman District, East Jakarta, Indonesia.

2.1 Design of research

Research design used in this study is posttest only control group design. In this study, there are two groups chosen randomly, namely the experimental group and the control group. It can be seen in Table 1, the experimental group received treatment of using android-based educational games, while the control group did not receive treatment. After being treated in the experimental group, the two groups were measured using the Posttest.

Table 1. Experimental design of Android-based educational game research to increase interest in learning

Group	Type of treatment	Posttest
E	X	O1
C	-	O2

Notes :

E = Experimental group

C = Control group

O1 = Posttest of experimental group

O2 = Posttest of control group

X = Android-based educational game

2.2 Population and sample

The population in this study were elementary school students in Matraman District, East Jakarta, Indonesia. This study took a random sample involving 130 students for each experimental group and control group.

2.3 Research instruments

This study used a posttest instrument related to student cognitive including the level of student learning outcomes. After giving treatment to the experimental group, posttest was given to both groups. The control group can be used as a comparison for the experimental group. The comparison between the posttest of the two groups shows the effect of the treatment given.

2.4 Data analysis

The data analysis technique in this study was carried out with a normality test using the Kolmogorov Smirnov test. Levene's test is used to test the homogeneity, and

the t-test to test the hypothesis. Conclusions from the hypothesis are made using criteria with a significance level of 0.05.

3 Results

3.1 Android based educational games development

Here are some descriptions of the media that the researchers developed. The educational game developed is based on android in order that the students can use it easily. This game feature is made interestingly so that the students are excited to learn and play it at the same time. Figure 1 is the cover of the educational game that the researcher developed. There will be a back sound, and then the word and two children will move around. If seven seconds have passed, it will go to the next screen.

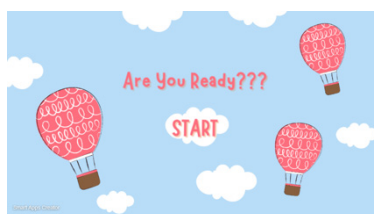


Fig. 1. Cover of game

Figure 2 is the second display after the cover. In this view, there will be a follow-up back sound from the cover display and the word along with two children will move around too. This game presents exercises for summation material in mathematics. There are three levels that you can try, namely easy, medium, and hard levels. If you click on the desired option it will go to the next screen.



Fig. 2. Level type

Figure 3 shows the start of the game that if you click on any level, it will ask you that question. This means that the game will start as soon as possible. Click the start, then the next screen will show the game that must be completed.



Fig. 3. The start of game

Figure 4 is an example of the questions of the game. The image shows that the game is in progress in the first step. The questions are packaged attractively as well as challenging, so the students are interested in solving them. The maximum points for each question are 5. Marked with 5 balloons that must be completed. At each level there are 10 questions with a duration of 10 minutes. At the end of the game, the score will come out according to the student abilities.

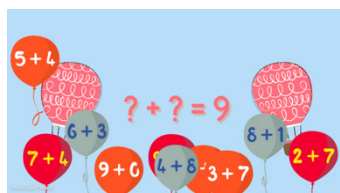


Fig. 4. The questions of the game

3.2 The effect of android based educational games on student learning outcomes

In measuring the effectiveness of android based educational games, several trials were carried out involving the Kolmogorov-Smirnov test, Levene test, and t-test.

Table 2 is an overview of the Kolmogorov-Smirnov test. The test is carried out to find out whether a population has a certain distribution of data or not. In this case, it is concluded that the population of this research data is normal because the significance value arrives at 0.200 greater than 0.05. Table 3 is a description of the homogeneity test to find out about the variance in the population. The results show that Levene Statistics attain 0.365 with significances of 0,547 more than 0.05 indicating that the data is homogeneous.

Table 2. The results of the normality test

Group	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Experimental Group	.065	65	.200
Control Group	.200	65	.200

Table 3. The results of homogeneity of variances test

Levene Statistics	df1	df2	Sig.
.365	1	128	.547

Based on the results of independent samples test shown in Table 4, t-statistics reach 5.090 with significances (2-tailed) achieving 0.001 less than 0.05. It can be interpreted that Ho is rejected and Ha is accepted. This means that android-based educational games can have an effect on increasing interest in learning mathematics for elementary school students in Matraman District. These results prove that the use of learning media related to technology can be useful in augmenting student interests in learning mathematics. Although mathematics is one of the subjects that some students avoid, by utilizing technology it can be avoided. Moreover, in everyday life students are very closely related to the use of technology.

Table 4. Independent samples test

Mean	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Lower	Upper			
6.662	1.309	4.072	9.251	5.090	128	.001

4 Discussion

It can be highlighted in this study that android-based educational games can improve elementary school student interests in learning Mathematics. This is in accordance with previous research stating that ICT plays an important role in facilitating and bringing good influence for students in learning [41-42]. In line with the previous study declaring that development of ICT which also has an impact on the world of education. Android-based educational games have a big influence on learning media, especially in upgrading student interest in learning Mathematics. This is in line with previous research explaining that making use of technology can improve student engagement in learning [43-44]. This is a challenge for teachers to package learning as well as possible so that students are interested in learning, especially for learning mathematics. Using android-based educational games can be considered to raise interest in learning mathematics for elementary school students.

5 Conclusion

The conclusion that can be drawn from this research is that android-based educational games are proven to enlarge elementary school student interests in learning mathematics. Researchers prioritize interest in learning compared to other things because in the beginning someone is motivated in learning based on their interests. Interest in learning is very important especially for mathematics which is one of the subjects considered difficult by most of students. The negative stigma against mathe-

matics is like a culture. If the students are not interested in learning mathematics at the elementary school, it will have a negative impact on them in the future. We need something that can break the stigma, one of which is by linking learning media with technological advances. Teachers as learning companions must be able to choose interesting learning media so that the students are interested in learning the material provided. One of the right solutions is to link learning media with games. It is hoped that the increase of student interest in learning mathematics can improve their performances of other things.

In this study, researchers have developed learning media related to technology and games in the form of an android-based educational game. The game is called "Numbers Game". Some of the imperfections in the application are that there is only addition material. It is hoped that further research or development can improve what has not been realized. Researchers also have high hopes for the results of this research so that it can be a solution in order to enhance elementary school student interests in learning Mathematics.

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