

The Effectiveness of Game-Based Learning in The Media Android-Based Artificial Vegetative Plant Propagation Based on Natural Science Subject

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Abstract: The objectives of this study were to 1) analyze the effect of online learning on the learning motivation of Science; 2) to analyze the effect of learning the learning model of RQA on the motivation to learn science; 3) to analyze the effect of online learning on outcomes. learning science; 4) analyzing the RQA model of learning science; 5) analyzing the influence of learning motivation on science learning outcome; 6) analyzing the effects of online learning and a model of RQA on motivation through science learning outcomes as an intervening variable. Methodology: quantitative with the type of "ex post facto", while the variables of this research are online learning, RQA model learning, learning outcomes are given symbols (Y1) and learning motivation. data mining techniques using questionnaires and documents, prerequisite test using validity test, reliability test, linearity test, homogeneity test, normality test and data analysis techniques using regression analysis. The results : 1) There is an effect of online learning on the motivation to learn Natural Science Class IV Elementary Schools, Bonang District, Demak Regency; 2) There is an effect of learning the RQA model on the motivation to learn Science Class IV Elementary Schools, Bonang District, Demak Regency; 3) There is online learning of Class IV Science learning outcomes in Elementary Schools, Bonang District, Demak Regency; 4) There is an effect of learning the RQA model on the learning outcomes of Class IV Science in Elementary Schools, Bonang District, Demak Regency; 5) There is an effect of learning motivation on science learning outcomes for Class IV Elementary Schools in Bonang District, Demak Regency; 6) There is an effect of online learning and the RQA model on science learning outcomes through motivation as an intervening variable in Class IV Elementary Schools, Bonang District, Demak Regency.

Keywords: Android, games-based, elementary school, natural science

1. Introduction

Science and technology have a significant role in the lives of today's students, as they choose to interact with content and visuals on devices instead of books and paper (Deng et al., 2019). The development of current technological advances, more and more resources can be used to deliver education (Allsop & Jesse, 2015). Educating can be delivered outside the school classroom, with today's technology it can be through the use of games (Bano et al., 2018). Learning through games is one of the oldest and most effective pedagogical concepts that has been used throughout human existence (Ferreira et al., 2016). Furthermore, technological developments increase student learning needs (Wardoyo et al., 2020). Modern education faces a complex set of challenges related to technological developments and social composition (Lindgren, 2018). When entering the era of technology, almost everything changes, learning not only in school, but also outside of school. Especially during the Covid-19 pandemic which requires learning to be done remotely. Teachers are required to be creative in carrying out learning even during the Covid-19 pandemic. One of the teacher's roles is in determining the type of learning media, such as text formats, educational audio/video, multimedia, teaching aids, and so on according to the learning method used (Circular Letter No. 15 of 2020 Concerning Guidelines for Organizing Home-Based Learning During an Emergency Period for the Spread of Covid-19, 2020).

Learning media is a tool that can aid in the teaching and learning process by clarifying the meaning of the message (Sutjipto, 2013). Creative and innovative learning media can increase student interest in learning and student achievement (Utaminingsih et al., 2019; Bintoro, Zaenuri, & Wardono, 2021). This is also supported by the opinion (Murtono et al., 2020) that teachers should use interesting learning media so that children's learning motivation and learning will run more effectively. Media is anything that is able to carry information between the source and recipient of the message (Heinich et al., 2012). The opinion that states that learning media is in the form of learning process aids to deliver subject matter (Minister of Education and Culture Regulation Number 22 of 2016 concerning Primary and Secondary Education Process Standards, 15 (2016). Learning media is hardware or software containing subject matter that makes it easier for students to understand the lesson. The importance of studying media are as follows: 1) teaching materials will have a clearer meaning, allowing learners to understand them and master teaching objectives; 2) teaching methods will be more varied; and 3) students will interact in more learning activities (Nugraha et al., 2012).

1.1 Conceptual Framework

In education, games are rule-bound and goal-oriented forms of play that have a high value for the capacity to facilitate teaching and learning (Bagheri et al., 2019). Education is a process carried out by a person to find his identity, which is done by observing and learning which then gives birth to actions and behavior (Fithri & Setiawan, 2017). Today's games not only function as entertainment but also educational aids called educational games (Salman et al., 2013). Learning media in the form of educational games that are integrated into learning can be used in the strategy for using technology in learning (Adita et al., 2018). The more people play the game, the more content is needed for the game. One of them is a game that contains educational content.

Educational games are games that specifically have learning content and are intended to improve the player's ability to learn a material (Wibawanto, 2020). Games are able to provoke interest in learning from players, resulting in new experiences such as feelings of pleasure in the end the material to be conveyed can be easily accepted by game players. Educational games are games that are designed to learn, but can still offer play and fun (Prensky, 2012). Educational games are one of the game themes that try to give the value of the game initially only working as a medium, eventually it can be used as a learning or training medium (Sari et al., 2019). The game is designed to find a balance between the subject matter and the player's helps to retain and apply the learning content in the real world (Noemí & Máximo, 2014). The advantage of educational games compared to educational methods lies in the visualization of real problems (Vitianingsih, 2016). There are many kinds of learning media, one of which uses internet technology, computers and even cellphones or smartphones (Taurusta et al., 2019). The Android operating system is a liaison system between smartphones and users, so users can operate and run applications on smartphones (Saputro et al., 2020). Smartphones with the Android operating system can be used as devices to execute educational games (Pramuditya et al., 2018).

1.2 Research Objectives

The purpose of this study is to assess the efficacy of learning media educational games artificial vegetative plant propagation android in elementary science learning.

2. Methodology

2.1 Research Design

Research is oriented towards developing learning media educational games artificial vegetative plant propagation android based. This research is research and development using Waterfall design (Pressman, 2010). The steps of the Waterfall model can be seen in Figure 1.

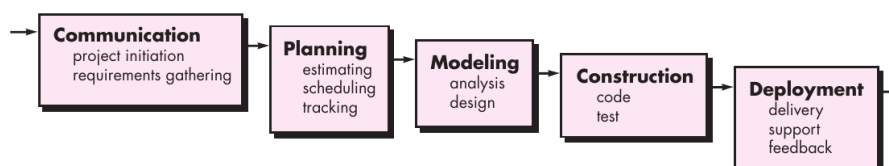


Figure 1. Research design

The study was conducted in the first semester of March-August 2021 at the district elementary school in Kudus for the academic year 2021/2022. The study was conducted on 60 students in grade 6th, 30 students as the experimental group and 30 students as the control group. Primary School No. 1 Burikan, Primary School No. 2 Burikan, and Primary School No. 2 Kaliputu as the experimental group and Primary School No. 1 Wergu Kulon and Primary School Kramat as the control group. The two groups carried out learning activities through pre-test and post-test activities, namely pre-test. This activity is used to determine the basic abilities of students in science learning before learning is held, while the post-test is used to learn student learning outcomes after learning. Group experiments during the learning process using the

help of android-based educational game media, while the control group learning was conventional (Khotima & Pratama, 2022). The effectiveness of knowing the experimental group's and control group's achievement of learning outcomes was tested by comparing their pre-test and post-test scores.

Data collection methods include questionnaires, tests, observations, and documentation. Pre- and post-testing, the N-gain formula is used to analyze data from the experiment and control groups:

$$n - gain = \frac{[posttest\ score - pretest\ score]}{[maximum\ score - pretest\ score]} \quad (1)$$

Data on the feasibility of learning media educational games was collected in the form of an assessment score. Android-based artificial vegetative plant propagation based on elementary science learning.

3. Findings and Discussion

In the experimental group, the teacher applied learning media for vegetative reproduction educational games based on android-based plants in science learning. In the control group the teacher applied conventional learning (Azizah et al., 2022). The pre-test and post-test descriptions of the control and experimental groups included the mean, median, mode, standard deviation, maximum, and minimum. The description of the pre-test and post-test of the control and experimental groups can be seen in Table 1.

Table 1. Description of data

		Pre-test Control Group	Pre-test Experimental Group	Post-test Control Group	Post-test Experimental Group
N	Valid	30	30	30	30
	Missing	90	90	90	90
Mean		65.70	59.80	70.43	83.53
Median		67.00	60.00	70.00	83.50
Mode		67	60	67	80
Std. Deviation		12.177	12.837	10.931	9.549
Minimum		33	33	53	67
Maximum		87	87	93	100

The results of the normality test of the control group and experimental group data can be seen in Table 2.

Table 2. Normality test

		Kolmogorov-Smirnov ^a		
Kelas		Statistic	df	Sig.
Student learning outcomes	Pre-Test Experimental	.143	30	.123
	Post-Test Experimental	.130	30	.200*
	Pre-Test Control	.140	30	.141
	Post-Test Control	.144	30	.112

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Because the significance value in the table above is greater than 0.05, it can be concluded that the data is normally distributed and meets the requirements for the Independent Sample Test stage.

The homogeneity test aims to determine whether there are similarities in the variance of the experimental group and the control group. The homogeneity test was carried out using the Levene test assisted by SPSS 24. The results of the homogeneity test of the control group and the experimental group can be seen in Table 3.

Table 3. Homogeneity test of variances

<i>Student Learning Outcome</i>			
Levene Statistic	df1	df2	Sig.
.475	1	58	.493

The variance of the scores is 0.493 at the significance level = 0.05, as shown in Table 3. As a result, the calculated score is greater than 0.05. This demonstrates that the experimental and control groups are members of the same variant class.

N-gain was used to examine the increase in student learning outcomes. Table 4 summarizes the results of the n-gain analysis of student learning outcomes.

Table 4. Recapitulation of the N-Gain analysis

Group	Mean		n-gain	Category
	Pre-Test	Post-Test		
Experimental group	58.80	83.53	0.5724	Medium
Control group	65.70	70.43	0.1158	Low

According to the table above, the experimental group received an average Gain score of 0.5724 in the medium category, while the control group received an average Gain score of 0.1158 in the low category. As a result, the increase was greater in the experimental group. Based on the n-gain 0.30 effectiveness criterion, learning using android-based educational game learning media is concluded to be effective in improving student learning outcomes.

Paired sample t-test to determine the effect of android-based educational game learning media on student learning outcomes. Meanwhile, the independent sample t test was used to determine the difference between the learning outcomes of the control group and the experimental group.

Table 5. Paired samples test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
					Lower	Upper			
Experiment	Pre-Test	-4.733	9.139	1.668	-8.146	-1.321	-	29	.008
	Post-Test						2.837		
Control	Pre-Test	-	14.049	2.565	-28.979	-	-	29	.000
	Post-Test	23.733			18.487		9.253		

Based on the results of the experimental group pair in Table 4.10 above, the value of $t_{\text{count}} = 2.837 > t_{\text{table}} = 1.701$ and the value of Sig. (2-tailed) of $0.008 < 0.05$, it can be concluded that there is a difference in the average student learning outcomes for the experimental group's pre-test and post-test.

Table 6. Independent samples test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Result	Equal variances assumed	.022	.884	7.290	58	.000	.45667	.06264	.33127	.58206
	Equal variances not assumed			7.290	57.99	.000	.45667	.06264	.33127	.58206

Based on the output of Table above, the value of $t_{\text{count}} = 7,290 > t_{\text{table}} = 1,701$ and the value of sig. (2-tailed) of $0.000 < 0.05$. It is possible to conclude that there is a difference in average learning outcomes among students who use visual learning aids for Android-based game - based learning and those who have not.

Android-based educational games are better than picture media, picture media are no better than no media, and Android-based educational games are the most effective among picture media and without media (Yudha, 2018). Android-based educational games are effective in improving student learning outcomes on the material of the solar

system. Student learning outcomes increased with the results of the calculation of the n-Gain test in the pre-test and post-test experimental class got an increase of 0.71 (high increase) and 0.13 control class (low increase) (Alfaris, 2018). In line with the research of (Oktavia, 2021) Game Science Adventure media was stated to be very effective with the acquisition of a percentage score of 90% learning completeness and an increase of 0.48 in the medium category. Research by (Kidi et al., 2017) states that the test results obtained by Android-based Indonesian information culture educational games can be accepted or captured by players and are considered useful for player learning. Furthermore, the research conducted (Hadi et al., 2019) entitled "Developing Theme Based Learning Through Power Spring HTML 5 of Android to Deradicalize The Attitude of Primary School Students" shows the effectiveness of android-based thematic learning through Power Spring Html 5 for deradicalization attitudes of elementary school students. One effect of educational games is on the development of students' multiple intelligences, namely taking logical-mathematical intelligence (Li, Ma & Ma, 2012). In this study, educational games also had a positive effect on students, but on a different aspect, namely the results of science learning for class VI on vegetative propagation materials made by plants. The learning media developed in this study assists students in the vegetative propagation procedure of artificial plants. While plants are part of nature itself. In addition, the educational game media creates a pleasant condition in learning science for elementary school students (Roslan et al., 2021). By creating a pleasant atmosphere in learning, so that the use of learning media based on Android educational games in the experimental group is more effective than the control group using conventional learning.

4. Conclusions and Recommendations

Based on the results of the experimental group pair, the value of $t_{\text{count}} = 7.290 > t_{\text{table}} = 1.701$ and the value of sig. (2-tailed) of $0.000 < 0.05$. It can be concluded that there is a difference in the average student learning outcomes of the experimental group and the control group. The N-Gain of the experimental group was 0.5724 indicating more than 0.3, so it was in the medium category. Based on the N-Gain value, the experimental group showed that the media developed was effective for the experimental group students.

Learning media should be able to increase student interest and response in learning. Students should take advantage of the product developed, namely the Android-based educational game learning media in science learning. Teachers can take advantage of Android-based educational game learning media products in science learning.

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Conflict of Interest

The authors declare no conflicts of interest.

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