

The Effect of Game Based Learning Method Utilizing the Quiziz Application on Class X Learning Outcomes in the Subject Fundamentals of Electronic Engineering

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Abstract - This study explores the issue of the current educational approach being ineffective in actively engaging students in the learning process. The research aims to evaluate the effect of implementing game-based learning with the Quizizz application on basic concepts in electronic engineering. Two classes were selected for the study, with one serving as the experimental group and the other as the control group. The participants included students from class X TAV 1 and class X TAV 2 at SMKN 1 Sutera. The sample consisted of 17 students from class X TAV 1, the experimental group, and 17 students from class X TAV 2, the control group. Data collection was done using a 25-item multiple-choice test, and the analysis was performed with Statistical Product and Service Solutions (SPSS) software. The findings revealed that the average score for students using game-based learning was 49.56, compared to 40.25 for those in the traditional learning group. The decision to accept or reject the null hypothesis (Ho) or the alternative hypothesis (Ha) was based on the following criteria: Ho is accepted if the Sig. (2-tailed) value exceeds 0.05, while Ha is accepted if it is below 0.05. The study concluded that students who engaged in game-based learning achieved higher average learning outcomes than those in the traditional learning group, demonstrating that the Quizizz application has a positive effect on learning outcomes in Basic Electronic Engineering for class X TAV students at SMK Negeri 1 Sutera

Keywords— Game-Based Learning, Quizizz, Fundamentals of Electronics, Conventional and Learning Outcomes.

I. INTRODUCTION

Education is vital in shaping human life, making it essential to enhance human resources by improving knowledge, skills, attitudes, and values to help individuals adapt to their surroundings [1]. Effective application of learning methods can have a positive impact on students by converting those who were previously passive into active participants in the educational process, and enhancing their understanding of the material delivered by teachers [2].

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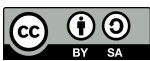
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One of the factors contributing to students' limited understanding of the material is the teaching method employed by the teacher, such as using a traditional approach that positions students as passive listeners during the learning process. Another reason for the low performance in math is the lack of student interest in participating in the lessons [3]. A learning method is a strategy that facilitates the easy acquisition of knowledge, which can then be applied and conceptualized to facilitate the attainment of educational goals. The principles guiding learning methods are technical, tactical, and practical, designed for educators to implement with their students [4]. The success of a school's education can be gauged by the learning outcomes that students achieve. These outcomes serve as a reflection of the students' learning efforts. Ideally, the greater the effort put into learning, the better the outcomes they will attain. Learning outcomes serve as a crucial metric for assessing the effectiveness of the educational process experienced by students [5]. Vocational High Schools (SMKs) focus on equipping students with the skills needed for specific types of employment. The electronics engineering department is one of the departments in SMK Negeri 1 Sutera in an independent program, class X electronics engineering subjects include the basics of electronics engineering at SMKN 1 Sutera the learning system already uses an independent curriculum.

In the basic subjects of electronic engineering, Educators also find many students who cheat when conducting

conventional learning evaluations (using paper), so educators cannot find out how much the ability of students. At SMK N 1 Sutera, the author found problems such as: evaluation tools used by educators of basic subjects in basic electronic engineering when conducting evaluation assessments still use paper, which is considered impractical because it requires a lot of equipment and educators still need time to calculate students' scores manually. The author finds that during the evaluation process, many students feel less interested, bored, and less motivated so that the value of basic basic electronic engineering subjects obtained by many students is below the KKTP (Criteria for Achieving Learning Objectives). According to the test results, the scores of the students who are below KKTP is more than students whose scores are above KKTP. This data indicates that the complexity of teaching has not run according to process standards.

In the era of Industry 5.0, various educational tools are available to address challenges in the learning process, Games are a form of interactive and engaging learning media that promote collaboration, communication, and encourage student interaction. These games are characterized by their ability to create motivation in learning, driven by elements such as fantasy, challenges, and curiosity [6]. Games or play are competitions that involve interaction among players, following established rules to achieve a specific goal [7]. including game-based learning. This approach involves integrating games into the educational system, allowing instructors to use games to enhance cognitive engagement and boost students' motivation to learn [8]. The researchers employed digital game-based learning through utilizing the Quizizz application, an educational tool that incorporates game elements. Quizizz introduces multiplayer activities into the classroom, making exercises both interactive and enjoyable [9]. Employing Quizizz as an educational tool is an attempt to address the challenges of utilizing learning media in Indonesia, especially when conventional methods cannot be effectively implemented alongside other Information Technology and Computer-based learning tools [10]. Quizizz can be used by teachers as a practice question at the beginning of learning and at the end of learning, as well as monitoring the results of students' activities. Teachers can set the time on quiz questions that are tested to students so that they can train students to answer accurately, but quickly [11].

Given this context, the researcher is motivated to carry out a study titled "The Effect of Using the Game-Based Learning Method Utilizing the Quizizz Application on the Learning Outcomes of Class X students in the Basics of Electronic Engineering Subject at SMK Negeri 1 SUTERA.

II. RESEARCH METHODS

A. Research Design

Quantitative research methods can be categorized into two types: data collection through experiments and survey approaches. This study utilized a quasi-experimental approach with a posttest-only control design. While quasi-experimental research involves a control group, it does not entirely account for all external factors that could impact the experiment [12]. Two randomly selected groups were

administered a pretest. Following this, both the experimental group and the control group received posttest treatment. The aim of the study was to assess the differences in learning outcomes for the Basics of Electronic Engineering subject using the Quizizz media application at SMK Negeri 1 Sutera. The study population comprised two classes, totaling 34 students.

Table 1.
Draft Research Design

Group	Pre Test	Treatment	Post Test
Experiment	O ₁	X	O ₂
Control	O ₁	-	O ₂

Description:

O₁ : Pre-test before treatment

O₂ : Post test after treatment

X : Treatment of the experimental group in the form of additional learning using the game-based learning method utilizing the Quizizz application.

B. Research Variables

1. Independent Variables

In this research, the independent variable is the intervention applied to the research sample, particularly the Electronics Engineering X class. This intervention involves implementing game-based learning methods using the Quizizz application in the experimental class, while the control class does not employ this learning approach.

2. Dependent Variable

This variable is often referred to as the result, criterion, or outcome variable. In this study, student learning outcomes are designated as the dependent variable.

C. Research Procedure

Typically, the research process involves three stages: preparation, execution, and conclusion

1. Preparation Stage

This stage begins with determining the location and schedule of the research and preparing everything related to the research.

2. Implementation Stage

Before beginning the teaching and learning process, an initial assessment (pretest) was administered. In the experimental group, the Quizizz application was implemented as part of the game-based learning model during the treatment phase. Subsequently, a posttest was conducted to evaluate student performance. This phase of implementation was repeated multiple times in the experimental class with the same material, according to the lesson plan. Conversely, the control group participated in the teaching and learning process without the use of any learning media, followed by a posttest to evaluate student capabilities.

3. Final Stage

At this point, the researcher processes the data to draw conclusions from the analysis that has been performed.

D. Data Analysis

Data collection involves two types of tests: standardized tests, which are required to meet specific reliability and validity standards, and non-standardized tests, which may not adhere to these established criteria for reliability and validity.

1. Validity

To assess item validity using Pearson correlation, the item score is compared to the total score, which is the aggregate of all items for a specific variable. A significance test is performed using the r table at a 0.05 significance level with a two-tailed test. An item is classified as valid if the r count exceeds the r table value, whereas it is deemed invalid if the r count is below the r table value [13].

$$Y_{pbi} = \frac{M_p - M_t}{SD_t} \sqrt{\frac{p}{q}}$$

Description:

Y_{pbi} = biserial correlation coefficient

M_p = Mean score of the responses given correctly for the item being evaluated for validity

M_t = Average total score

S_t = Standard deviation

p = Percentage of students who answered correctly

2. Normality Test

To determine if the data distribution is normal, a normality test must be performed.

3. Homogeneity Test

The homogeneity test is conducted to determine if the variance is uniform between the two research groups (experimental and control).

4. Normalized Gain

Normality testing and hypothesis testing were conducted on the N-Gain data. The initial test, normality testing, is intended to determine if the N-Gain value data follows a normal distribution.

5. Hypothesis Test

Mean difference testing is employed to assess whether there is a significant difference between the average scores of the experimental and control classes. This hypothesis testing method is specifically aimed at comparing differences in means

H_a : The use of the Quizizz application for game-based learning has an impact on student learning outcomes.

H_0 : The use of the Quizizz application for game-based learning does not influence student learning outcomes.

6. Reliability Test

The instrument can be said to be reliable when the same instrument can be used several times which is used to measure an object with the condition that it can still give

the same results. Cronbach's Alpha coefficient is the most commonly used reliability measure because it reflects the variation among items, whether in true/false formats or others. Therefore, Cronbach's Alpha is widely regarded as the standard for assessing internal consistency [14].

$$a = \left(\frac{K}{K-1} \right) \left(\frac{s_t^2 - \sum s_i^2}{s_x^2} \right)$$

Keterangan:

a = Cronbach's alpha reliability coefficient

K = Many questions

s_t^2 = Problem Variance

s_x^2 = All items K

E. Determining the Magnitude of Influence

To measure the extent of the influence of student learning outcomes, it can be calculated using certain formulas

$$pengaruh = \frac{X_1 - X_2}{X_2} \times 100\%$$

Description:

X_1 = Average experimental class score

X_2 = Average control class score

III. RESULTS AND DISCUSSION

A. Results

The data from the pretest and posttest results for the control and experimental classes X TAV 1 and X TAV 2 in the basic electronic engineering course are presented in the table below.:

Table 2.

Data on pretest and posttest results of control class and experimental class

Data Centering and Spread	Control Class		Experiment Class	
	Pretest Score	Posttest Score	Pretest Score	Posttest Score
Lowest Value	18	24	20	29
Highest Value	45	62	40	64
Average	27.9412	40.25	29.6667	49.5625
Median	26.5	35.5	30	51
Mode	30	22	25	53
Standard Deviation	7.41174	11.48622	6.23932	10.1913

Table 2 illustrates that both the control and experimental classes showed improvements after receiving different treatments. The control class, which employed Quizizz for learning, experienced an improvement in learning outcomes, with the largest gap between pretest and posttest scores being 4.00. On the other hand, the experimental class, which used augmented reality-based learning media, showed a maximum

difference of 12.00. This data indicates that the experimental class experienced a more substantial increase in learning outcomes compared to the control class, which used conventional methods. Overall, the discussion indicates that the findings uphold the hypothesis (Ha) and reveal a significant impact between the pretest and post-test result.

B. Data analysis

1. Pre-test Validity Test

TABLE 3
PRE-TEST VALIDITY TEST
Correlations

		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	-.425
	Sig. (2-tailed)		.009
	N	17	17
VAR00002	Pearson Correlation	-.425	1
	Sig. (2-tailed)	.009	
	N	17	17

The validity test results show that the pre-test variable is valid and significant.

2. Post-test Validity Test

TABLE 4
POST-TEST VALIDITY TEST
Correlations

		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	.023
	Sig. (2-tailed)		.032
	N	17	17
VAR00002	Pearson Correlation	.023	1
	Sig. (2-tailed)	.032	
	N	17	17

The validity test results show that the post test variable is valid and significant.

3. Homogeneity Test

The preliminary test evaluates the homogeneity of two sample groups: the control and the experimental classes. This assessment is performed to check if the two classes are similar in terms of their characteristics.

TABLE 5
Homogeneity Test

Statistics	Control Class		Experiment Class	
	Pretest Score	Posttest Score	Pretest Score	Posttest Score
Sig	0.218		0.159	
Sig level	0.05			
Conclusion	Data is normally distributed	Data is normally distributed	Data is normally distributed	Data is normally distributed

The homogeneity test results showed values of 0.218 for the pretest and 0.159 for the post-test. As both values are above the 0.05 significance level (P-value > 0.05), this suggests that the two classes in the study are homogeneous.

4. Normality Test

Normality testing is performed to assess if the data follows a normal distribution. The outcomes of this test also help in deciding whether to use parametric or non-parametric statistical methods for further analysis.

TABLE 6
Normality Test

Statistics	Control Class		Experiment Class	
	Pretest Score	Posttest Score	Pretest Score	Posttest Score
Sig	0.218	0.241	0.381	0.344
Sig level	0.05			
Conclusion	Data is normally distributed	Data is normally distributed	Data is normally distributed	Data is normally distributed

The normality test results indicated values of 0.128 for the control group and 0.241 for the experimental group in the pretest data. For the posttest data, the control group had a value of 0.381, and the experimental group had a value of 0.344. Since these values are above the 0.05 significance level (P-value > 0.05), it implies that the pretest data for both groups are normally distributed.

5. Normalize Gain Test

The N-Gain test is frequently employed to assess how effective a learning intervention is in enhancing students' academic performance. It serves as a robust tool for determining the degree to which a learning program has improved learners' comprehension [15]. In the N-Gain data, normality testing and hypothesis testing were carried out. The first test is normality testing, This test is designed to assess whether the N-Gain value data follows a normal distribution.

$$G = \frac{(\text{skor post test} - \text{skor pre test})}{(\text{Skor maksimum} - \text{skor pre test})} \times 100\%$$

$$= 27.82\%$$

From the results of the analysis above, it shows that the level of students' pre and post tests is 27.82%. this indicates that students must evaluate themselves to get maximum results.

6. Hypothesis Test

Prerequisite tests for statistical analysis indicated that both the pretest and posttest data were normally distributed and had equal variances. Consequently, a parametric test, namely the t-test, was employed for hypothesis testing, with SPSS software used for analysis. The criteria for accepting or rejecting the null hypothesis (Ho) or the alternative hypothesis (Ha) were as follows: Ho was accepted if the Sig. (2-tailed) value exceeded 0.05, while Ha was accepted if the Sig. (2-tailed) value fell below 0.05

TABLE 7
Hypothesis Test

		Paired Samples Test							
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Before the exam - after the exam	1.29412	15.63556	3.79218	-6.74494	9.33318	.341	17	.037

To decide whether to accept or reject the null hypothesis (H₀), examine the value in the sig (2-tailed) column with a significance level set at 5%. In a paired t-test, the criteria are: if the sig (2-tailed) value is less than α , then H₀ is rejected in favor of H₁. The table displays a sig (2-tailed) value of 0.037, which results in rejecting H₀ and accepting H₁.

7. Reliability Test

To assess the instrument's reliability, the researcher utilized SPSS software, which calculates results using the Cronbach's Alpha method. The analysis revealed that the Cronbach's Alpha values for all variables were above 0.60, suggesting that these variables are reliable and appropriate for use as measurement tools

Determining the Magnitude of Influence

The experimental class achieved an average posttest score of 49.56, while the control class scored an average of 40.25. The percentage impact on learning outcomes is as follows:

$$\text{pengaruh} = \frac{X_1 - X_2}{X_2} \times 100 \%$$

$$\text{pengaruh} = \frac{49.56 - 40.25}{40.25} \times 100 \%$$

$$\text{pengaruh} = 23.13 \%$$

Keterangan:

$$\frac{X_1}{X_2} = \text{Average experimental class score}$$

$$\frac{X_2}{X_2} = \text{Average control class score}$$

C. DISCUSSION

This analysis highlights the positive effects of utilizing Game-Based Learning strategies, specifically through the Quizizz application, on students' learning outcomes in technical subjects like Fundamentals of Electronic Engineering. It underscores the need for adapting technology and preparing for new teaching methods within educational settings. The study aims to evaluate how Game-Based Learning affects the learning achievements of students in the Basic Electronics Engineering course for class X.

Game-Based Learning is a teaching approach that integrates game elements to boost student engagement and motivation. In this research, an experimental design involving two groups was used: one experimental and one control. Both groups completed a pretest before receiving different instructional treatments. The control group's average pretest score was 29.37, with a highest score of 50, while the experimental group had an average score of 29.66, with a highest score of 40, showing the control group performed better initially. Following the instructional interventions, the control group had an average posttest score of 40.25 and a highest score of 62, whereas the experimental group scored an average of 49.56 with a highest score of 64. This suggests that Game-Based Learning using Quizizz has a more favorable impact on learning outcomes compared to traditional methods.

To determine whether to approve or dismiss the null hypothesis (H₀) after testing, the value in the sig (2-tailed) column was reviewed. With a significance level of 5%, if sig (2-tailed) < α , H₀ is rejected in favor of H_a. The findings showed a sig (2-tailed) value of 0.037, leading to the rejection of H₀ and acceptance of H_a. The enhancement in learning outcomes is demonstrated by an N-Gain of 27% and an effect size of 23.13%. This indicates that implementing game-based learning methods with Quizizz positively impacts the learning achievements of class X Electronics Engineering students at SMK Negeri 1 Sutera.

IV. CONCLUSIONS

The data analysis shows that H₀ is rejected and H_a is accepted, which signifies that using the Quizizz application for Game-Based Learning affects the learning outcomes in Basic Electronics Engineering for class X TAV at SMK Negeri 1 Sutera.. This effect is also evident from the average scores: students using the Game-Based Learning method with Quizizz achieved an average score of 49.56, while those using only LKPD media had an average score of 40.25.

The effect size of these variables is 23.13%, demonstrating that the implementation of the Quizizz-based Game-Based Learning method resulted in better learning outcomes compared to the conventional methods used in the control class.

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