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The Application of STEAM-Based Blended Learning in Increasing Understanding of Mathematical Concepts

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Abstract

Educators are expected to be able to adapt to the application of the Science, Technology, Engineering, Art and Mathematics (STEAM)-based Blended Learning model to increase understanding of concepts, especially in mathematics learning. This research aims to prove how the Blended Learning model is based on STEAM can improve understanding of mathematical concepts. This type of research is quasi-experimental research. This research involved 60 grade VIII students at the junior high school level. By using the cluster random sampling technique, class VIII-1 was obtained as the experimental class and class VIII-2 as the control class. The research instrument used is a matter of description test. Data were analyzed using the normality test, homogeneity test, linearity test and regression analysis test. The results of the analysis obtained that the average posttest score for the experimental class was 79.33 and for the control class was 72.03. Based on the hypothesis test obtained a significance value of 0.004, then *Sig*.<0.05 it can be concluded that the application of the Science, Technology, Engineering, Art and Mathematics (STEAM)-based Blended Learning learning model is able to improve understanding of mathematical concepts.

Keywords: blended learning, concept understanding, STEAM.

1 INTRODUCTION

One of the aspects contained in learning mathematics is the concep (Niam & Asikin, 2021; Tama, Rezeki, & Hikmah, 2020). It will be very difficult for students to go to a higher learning process if they do not understand the concept (Sugiarni et al., 2021). Therefore, the ability to understand mathematical concepts is an important goal in learning mathematics. By understanding, students can better understand the concept of the subject matter itself, not just memorize it.

However, in reality many students have difficulty understanding mathematical concepts. In fact, most of them are unable to redefine mathematics learning material in their own language and distinguish between examples and non-examples of a concept. Moreover, interpreting mathematics in a real form (Murizal, 2012).

Based on the results of observations made by researchers at one of the private junior high schools in Depok City, it is known that mathematics learning is still teacher-centered, this causes students' understanding of mathematical concepts to be still not optimal. The results of learning mathematics from students show that there are still some students who have a mastery score below the average. The low understanding of the concept in the sub-topic of flat-sided geometric shapes affects students' mathematics learning outcomes, namely only 41.93% achieve the minimum completeness criteria (KKM), namely 70 in that sub-topic.

The cause of the lack of understanding of students' mathematical concepts is influenced by several factors, including a less conducive classroom atmosphere, the

teacher still lacks a variety of methods and models in teaching so that students look bored in the learning process, the learning process that occurs takes place in one direction. So that students' conceptual understanding of the material being taught is not optimal.

The application of blended learning in schools is able to influence learning outcomes, motivation, mastery of concepts, reasoning, and critical thinking skills (Syahrawati et al, 2022). The blended learning model alone is not enough and several studies show that the learning approach is also very important. The learning approach is an important aspect to pay attention to considering the success of the teaching and learning process in the classroom depends on the learning approach applied by educators (Dhoruri, 2010). From the description of the problem it was found that appropriate learning models and approaches were needed to increase understanding of mathematical concepts. That is like the Blended Learning learning model based on STEAM approach. Where is the learning model of Science, Technology,

The purpose of this study was to determine the effect of the STEAM-based Blended Learning learning model on understanding mathematical concepts in the material of flat sided spaces for class VIII of junior high school.

2 RESEARCH METHODS

This study aims to find out how the application of the STEAM-based Blended Learning model in improving students' understanding of mathematical concepts. The method used in this research is descriptive quantitative research, with a quasi-experimental approach. Quasi experiment is an experimental research design that is tried in circumstances that do not allow controlling or manipulating all relevant variables. The research design used a posttest only control group. In this study, students were divided into two groups, namely the experimental group and the control group (Anggraeni et al., 2019). The experimental group will get learning with a blended learning model based on STEAM while the control group will only receive learning as usual that has been implemented at school. This research was conducted by testing and analyzing the data obtained and drawing conclusions.

The sample used in this study were 60 students from class VIII SMP Islam At-Tawwaabiin Depok, namely 30 students from class VIII-1 as the experimental class and 30 students from class VIII-2 as the control class. The sampling technique used in this study is random sampling clusters. Cluster random sampling is a sampling technique in which the researcher makes several clusters as a result of selecting some individuals who are part of the population and have homogeneous characteristics between one individual and another.

In this study, the researcher made a test instrument in the form of 6 questions of description. The question is then subjected to an instrument test to meet the prerequisites for a good test to then be used as a research question instrument. The test questions carried out are: validity test, reliability test and expert validator. After carrying out the instrument test to determine the research test questions, it is continued with the data analysis prerequisite test, namely the normality test to prove that the sample comes from a normally distributed population. The normality test used is the normality test with the liliefors test. After carrying out the normality test then carry out the homogeneity test. Homogeneity test is used to determine the similarities in each class or group. After the research data is known to be normally distributed and homogeneous, it is then carried out with a linearity test to find out whether the two variables have a significant linear relationship or not. Then proceed with the hypothesis test, namely the regression analysis test.

3 RESULTS AND DISCUSSION

The data to be analyzed in this study is an understanding of mathematical concepts after learning using the STEAM-based Blended Learning learning model. The data was obtained from 60 class VIII students at SMP Islam At-Tawwaabiin Cilangkap, Tapos-Depok. In accordance with the research problems, the process of data analysis and discussion of the results of this study focused on explaining the Effect of the STEAM-Based Blended Learning Model on Understanding Mathematical Concepts in the Material of Flat Sided Spaces in Class VIII of SMP Islam At-Tawwaabiin.

The data that has been collected through this study is tabulated according to the purposes of data analysis which aims to show an overview of the distribution or distribution of data. The description of the results and discussion consists of five sections, namely: instrument testing, normality testing, homogeneity testing, linearity testing and hypothesis testing.

3.1 Instrument Trial Results

The results of the instrument trials include validity, reliability and expert validator tests. The validity test was carried out on questions from the variable (conceptual understanding ability) on the flat sided geometric material. Based on the results of the calculations, 5 questions were valid and 1 question was dropped. The results of the reliability test based on the results of the calculations carried out obtained the calculation results of 0.50 with the category including questions with a sufficient level of reliability.

3.2 Data Analysis Prerequisite Test Results

The prerequisite test for data analysis in this study was the normality test using the Liliefors method, the homogeneity test using the Fisher method, the linearity test and the hypothesis testing using the regression analysis test.

3.2.1 Normality test

The results of testing the research sample are used to conclude whether the observed population is normally distributed or not. To find out whether the data is normally distributed or not, the Liliefors test is used with samples from each group to be tested for the null hypothesis (H_0) with the comparative hypothesis (H_1). With the following conditions: If $L_{count}<L_{table}$, then H_0 is accepted, so it can be concluded that the data is normally distributed. If $L_{count}>L_{table}$, then the data is not normally distributed. For the experimental class, the calculation of the Liliefors table can be $L_{count}=0.1443$ while the Ltable for $n=30$ with a significant level of 0.05 is 0.161. The decision H0 is accepted because $L_{count}>L_{table}$, it can be concluded that the data is normally distributed. As for the control class, the calculation of the liliefors table can be $L_{count}=0.1394$ while the L_{table} for $n=30$ with a significant level of 0.05 is 0.161. The decision H_0 is accepted because $L_{count}>L_{table}$, it can be concluded that the data is normally distributed.

Table 1. Experimental Class Normality Test

Class	*N*	α	L_{count}	L_{table}	Conclusion
Experiment	30	0.05	0.1443	0.161	Normal
Control	30	0.05	0.1394	0.161	Normal

Table 1 shows that the two classes data are normally distributed because both have $L_{count} <L_{table}$, therefore it can be concluded that H_0 is accepted and H_1 is rejected.

3.2.2 Homogeneity Test

The population homogeneity test for the two groups was carried out using Fisher's test. From the results of the homogeneity test, it was obtained that the variance of the

experimental class score was 132.579 and the control class score variance was 92.592, so by using the Fcount formula. From the calculation results, the F_{count} value is 1.431. The F_{count} value is then compared to F_{table} with the denominator dk_{n-1} and the numerator dk_{n-1}. Then the numerator *dk* is 29 and the denominator *dk* is 29 with α=0.05. Based on table *F*, the value of $F_{0.05(29.29)}$=1.86 and $F_{(0.95)(29.29)}$=0.54. Then F_{count} lies between the F_{table} values or 0.54<1.431<1.86. Thus it can be concluded that the variance of the data to be analyzed is homogeneous.

3.2.3 Linearity Test

Linearity test was conducted to find out whether the two variables have a significant linear relationship or not. This linearity test is a requirement before carrying out a linear regression analysis. From the calculation results obtained a Significant Value of 0.245. Then if the value of *Sig*.>0.05. it can be concluded that there is a significant linear relationship between the independent variables and the dependent variable.

3.2.4 Hypothesis testing

The hypothesis to be tested in this study aims to explain the effect of applying the Blended Learning model based on the STEAM approach to the ability to understand students' mathematical concepts in the material of Flat Sided Spaces in class VIII SMP Islam At-Tawwaabiin Depok. The process of testing the research hypothesis was carried out using a regression analysis test. A significant value of 0.004 is obtained. So if the *Sig*.<0.05. From the results of testing the hypothesis it can be concluded that there is an influence of applying the STEAM-based Blended Learning learning model to the understanding of students' mathematical concepts in the material of flat sided geometric shapes for class VIII SMP Islam At-Tawwaabiin.

4 CONCLUSION

From the calculation obtained a significant value of 0.004. Then the value of *Sig*.<0.05. With a value of 0.004 <0.05 from the results of hypothesis testing, it can be concluded that there is an influence of applying the STEAM-based Blended Learning model to students' understanding of mathematical concepts in class VIII Islamic Middle School flat sided geometric material At-Tawwaabiin. Thus the Blended Learning learning model based on STEAM can help improve students' understanding of mathematical concepts, especially in flat sided geometric material.

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