The Flipped Classroom Strategy using Learning Video: Applied toward the Ability to Understand Mathematical Concept

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Abstract. This article aimed to determine the effect of flipped classroom learning models using interactive video on understanding mathematical concepts in students. This type of research was quantitative research. The technique of data collection used was random class technique. The data analysis technique used was the Anava 2 way hypothesis test, but first, a normality and homogenity test was carried out. From the results of the study, there are differences in mathematics learning outcome of students who use the Flipped Classroom model using learning videos with those using conventional method. Furthermore, the results of the ability to understand the concepts of students using the Flipped Classroom model using video learning was better than using conventional methods. Based on the conclusions, the researcher suggested that the teachers have to use the Flipped Classroom method using learning video to improve students' ability to understand concepts. Based on this, it can be concluded that the Flipped Classroom model with learning videos and student learning style can influence students' mathematical reasoning abilities.

1. Introduction

Education is a means to lead to the growth and development of the nation. Education is also a long-term investment in human resources that have strategic value for the continuity of human civilization in the world [1-3]. So from that education becomes one of the important capital to advance a nation because the welfare and progress of a nation can be seen from the level of education. Education plays an important role in creating quality individuals [4]. This causes the world of education to require innovations that are in accordance with the advancement of science and technology without ignoring human values. Education is also seen as a means to give birth to people who are intelligent, creative, skilled, responsible, productive and have noble character. One education that can develop abilities and creativity in mathematics education which means there are mathematics lessons in it [5-6].

Mathematics is one of the subjects that have great benefit in life [7]. Mathematics provides opportunities for students to train mentally and will influence their intellectual development. Through mathematics, students will be able to learn to acquire knowledge systematically. One of the objectives of mathematics learning is that students can apply mathematics appropriately in everyday life as well as in various sciences, to prepare and improve the quality of human resource [8-9]. Studying mathematics does not only understand the concept or procedure, but many things can arise from the results of the mathematics learning process [10-11]. Regarding the explanation, it is necessary to have a structured learning in mathematics learning with the aim of increasing understanding of the concept in mathematics learning itself.

The ability to understand the concept is very important for students because the mathematical concept with each other are interrelated so that to study them must be structured and sustainable [12-13]. But in
reality, the ability to understand the concept of students is still not encouraging. This condition is supported by statements expressed by previous research that the level of understanding of students' concept is still very low. Not only students in school, but the problem of the ability to understand mathematical concept also occurs in students as explained by [14], [15]. This problem is caused by a model of learning that is less appropriate in learning mathematics [16-18]. In line with what was revealed by [12,19] that the learning model used will affect the ability to diversify the mathematical concept of students. Allegedly, the Flipped Classroom model is able to overcome problems in understanding mathematical concepts.

Flipped Classroom is the process of learning to learn subject matter at home before class starts and teaching-learning activities in the classroom in the form of doing the assignment, discussing material or problems that students have not understood [20]. The results of previous studies revealed that learning Flipped Classroom model can improve student learning outcomes. In addition, research conducted by [20] resulted that the Flipped Classroom model can increase the sense of responsibility and improve students' critical thinking skills in learning mathematics. Whereas [21-22] in his study revealed that a large influence on the students' high learning independence by learning using the Flipped Classroom model was found. Because basically the concept of the Flipped Classroom model is learning carried out in the classroom but carried out by participants at home so that students can learn more independently. Based on previous research that has been described above, then in overcoming the problem of the ability to understand the existing concept, the authors are interested in conducting a study using the Flipped Classroom model.

This research will be different from previous research, namely on the assistance used. If the research described above, the Flipped Classroom model is synergized with a learning method, but in this study, the author used the help of a learning video with the aim of increasing the understanding of students' mathematical concepts by repeating the interactive video provided.

2. Research method

The research method used in this study was to use experimental research. Experiment carried out was divided into three classes, namely the experimental class 1 (the class was treated with the Flipped Classroom model with the learning video), the experimental class 2 (the class that received the conventional model treatment with the learning video) and the Control class (the class with the conventional model). The technique of collecting data used a mathematics learning outcomes test instrument. This test is used to obtain data about student learning outcomes. Before testing hypotheses, a prerequisite analysis was carried out on the initial abilities of students from each class taken from the odd semester examination score for the balance test with a significance level of 0.05. Analysis prerequisite test was normality test and homogeneity test. If the results are normal and homogeneous, then the statistical hypothesis is tested using one-way Anava.

3. Results and discussion

After the data from the test results of the students' understanding of the concept of understanding were gathered both from the experimental class 1, experiment 2 and the control class, it is obtained that:

| Table 1 Description of observation data ability to understand a mathematical concept |
|---------------------------------|----------------|----------------|----------------|----------------|
| Class | $X_{\text{max}}$ | $X_{\text{min}}$ | $\bar{X}$ | $\text{Me}$ | $\text{Md}$ |
|-------|----------------|----------------|--------|--------|--------|
| Experiment 1 | 90 | 45 | 71,50 | 75 | 75 |
| Experiment 2 | 95 | 25 | 60,66 | 70 | 65 |
| Kontrol | 90 | 20 | 54,28 | 60 | 55 |
Then the prerequisite test was carried out, namely the normality test and homogeneity test. The following are the results of recapitulation of the results of the normality test of the ability to understand the concept of the experiment class 1, experiment 2 and the experiment class 3.

| Class      | $X^2$   | S    | $L_{count}$ | $L_{table}$ | Test Result |
|------------|---------|------|-------------|-------------|-------------|
| Experiment 1 | 71.5    | 12.53| 0.140       | 0.161       | Normal      |
| Experiment 2 | 60.66   | 17.74| 0.078       | 0.161       | Normal      |
| Control     | 54.28   | 17.70| 0.091       | 0.149       | Normal      |

Based on table 2, the results of the normality test of the ability to understand the mathematical concepts of students can be seen from experiment class 1, experiment 2 and Control class that at the significance level $\alpha = 0.05$ and $L_{count} < L_{table}$, so $H_0$ is accepted which means that the data obtained from each normal distribution class.

Based on the homogeneity test of variance test the ability to understand the mathematical concept of students was obtained $\chi^2_{tobs} = 2.254$ and $\chi^2_{critic}=5.591$ with this means that at a significant 0.05 it showed $\chi^2_{tobs} < \chi^2_{critic}$, thus it can be concluded that $H_0$ is accepted or the sample comes from the same variant.

Then the analysis of variance (anava) is carried out with one cell with no observational data on the results of a test of the ability to understand a mathematical concept, the calculation results can be seen in table 3.

| Class      | $\chi^2_{count}$ | $\chi^2_{table}$ | Conclusion |
|------------|-------------------|-------------------|------------|
| Experiment 1 | 3.44              | 9.137             | $H_0$ rejected |
| Experiment 2 |                  |                   |            |
| Control     |                  |                   |            |

The result of the one-way anava test of the ability to understand the concepts of students shows $\chi^2_{count} < \chi^2_{table}$ so that in the calculation $H_0$ is rejected. This shows that there is a difference in the average ability to understand mathematical concepts of students who get Flipped Classroom learning with learning videos with those who get learning with conventional learning model or in other words it can be concluded that the Flipped Classroom learning method uses learning video and conventional method have different effects on students' mathematical problem-solving ability. Because there is a difference in the ability to understand the concept of students in each group (class), further testing (multiple comparison tests) is conducted to see the most significant influence among groups. The recapitulation results from the further test can be seen in table 4.

| Comparison | $F_{count}$ | $F_{table}$ | $\alpha$ |
|------------|-------------|-------------|-----------|
| $F_{1-2}$  | 6.650       |             |           |
| $F_{1-3}$  | 18.085      | 6.88        | 0.05      |
| $F_{2-3}$  | 2.417       |             |           |

Based on table 4, by comparing $F_{count}$ and $F_{table}$, it appears that a significant difference is among $\mu_1$ and $\mu_2$, $\mu_1$ and $\mu_3$ and $\mu_2$ and $\mu_3$. It can be concluded that:

1. There is no difference in the ability to understand the mathematical concepts of students between the application of the Flipped Classroom model using learning videos with the application of conventional model using learning video.
2. There is a significant difference, namely the ability to understand the mathematical concept of students with the application of the Flipped Classroom model using video learning is better than the application of the conventional model.

3. There is no difference in the ability to understand the mathematical concepts of students between the application of the conventional model using learning videos with the application of the conventional model.

The results of this study are the same as the results of previous studies that Flipped Classroom models using interactive videos can improve students' conceptual comprehension ability [23]. In addition, by using this model the teacher is more varied in the learning process of mathematics so that students are more involved in mathematics learning so that the mathematics learning outcomes of students are in accordance with what is expected by teachers in school [24].

4. Conclusion and Suggestion

Based on the results of analysis and processing of data and referring to the formulation of the problem that has been described, it can be concluded that there are differences in the mathematics learning outcomes of students using the Flipped Classroom model using learning video using conventional method. Furthermore, the results of the ability to understand the concepts of students using the Flipped Classroom model using video learning is better than the ability to understand the mathematical concept of participants using the conventional method. Based on the conclusion, the researcher suggested that the teacher must use the Flipped Classroom method using learning video to improve students' ability to understand the concept.

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