THE INFLUENCE OF *FLIPPED* LEARNING MODELS USING THE BRAINSTORMING METHOD TO THE MATHEMATICAL PROBLEM SOLVING ABILITY

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Abstrak

Tujuan penelitian ini untuk mengetahui pengaruh model pembelajaran flipped classroom type traditional flipped dengan menggunakan metode brainstorming terhadap kemampuan pemecahan masalah matematika pada materi transformasi geometri. Populasi dalam penelitian ini adalah seluruh siswa kelas XI SMAN 1 Taman Sidoarjo. Dari teknik purposive sampling diperoleh sampel kelas XI IPA 1 dan XI IPA 2. Metode pengumpulan data dalam penelitian ini adalah metode tes dan dokumentasi. Analisis data menggunakan uji normalitas, homogenitas, serta uji-t. Dengan analisis data menggunakan uji-t diperoleh $t_{hitung} = 6,25$ dengan taraf signifikan 0,05. Hal tersebut menunjukkan t_{hitung} lebih besar dari nilai t_{tabel}, maka kesimpulannya ada pengaruh model pembelajaran flipped classroom type traditional flipped dengan menggunakan metode brainstorming terhadap kemampuan pemecahan masalah matematika pada materi transformasi geometri di kelas XI SMAN 1 Taman Sidoarjo.

Kata kunci: Brainstorming; Kemampuan Pemecahan Masalah Matematika; Model Flipped Classroom

Abstract

The purpose of this study is to determine the influence of flipped classroom learning models using the brainstorming method on mathematical problem solving ability in geometry transformation materials. The population in this study was all class XI students of SMAN 1 Taman Sidoarjo. Dari teknik purposive sampling obtained samples of class XI IPA 1 and XI IPA 2. The data collection method in this study is the test and documentation method. Data analysis using normality, homogeneity, and t-tests. By data analysis using t-test obtained $t_{count} = 6,25$ with a significant level of 0.05. This shows that it is greater t_{count} than the value t_{tablel}, so in conclusion there is an influence of the traditional flipped classroom type flipped learning model using the brainstorming method on the ability to solve mathematical problems in geometry transformation material in class XI SMAN 1 Taman Sidoarjo.

Keywords: Brainstorming; Math Problem Solving Ability; Flipped Classroom Model

INTRODUCTION

Mathematics is a part of science that is beneficial in aspects of human life. Based (Nurohmah, 2021) said that students must learn mathematics to develop students' minds in the ability to solve problems and mathematics. Beforethe pandemic, problem solving skills were still low, making it difficult for students to understand a math problem solving. This can be seen from the results of the PISA OCED 2016 survey (Umaymah & Wiratomo, 2019) although there was an increase in 2015, namely in 2012 with an average score of mathematical ability of 386. In fact, the value is still relatively low from the PISA provision is 500. Problems will occur if students have not been able to overcome the gap between the situation during this pandemic and the goals to be achieved.

Based on the results of researchers' observations on November 12, 2021 and information from class XI mathematics teachers of SMAN 1 Taman Sidoarjo, data was obtained that mathematics learning at SMAN 1 Taman Sidoarjo schools is still centered on teachers. In addition, the pandemic period made the learning process at SMAN 1 Taman Sidoarjo use an online and face-to-face system. As in learning geometry transformation material during online learning, teachers only share video links from Youtube containing material and practice questions as assignments. Meanwhile, during face-to-face learning, teachers only use the available time to collect assignments and ask which materials are not understood. This proves that even though students have been trained to learn independently through videos, students still don't look active and kritis so that in solving math problems, students ' abilities are still relatively low. The results of these observations are in line with (Tuarita et al., 2019) saying that students are still not used to understanding math problems so that the ability to solve mathematical problems is still difficult and relatively low. According to (Yusri, 2018) it is necessary to choose a problem solving strategyto solve mathematical problems. Menurut (Anugraheni, 2019) argues that mathematics needs systematics in solving a problem. According to (Hamimah, 2019) Polya divides four steps in solving a mathematical problem, including (1) understanding a problem, (2) compiling a problem, (3) carrying out a drafting plan in solving a problem. (4) re-examine the

entire structure of a problem. Thus, one of the alternatives to make students actively participate and kritis and improve students ' ability to solve aproblemand mathematics is to use the flipped classroom learning model.

The flipped classroom Learning model includes learning with a reverse system. According to (Susanti & Hamama Pitra, 2019) the flipped classroom learning model does not change pedagogic concepts but, only changes the role of passive students to be active in classroom learning. According to (Widodo et al., 2021) the flipped classroom learning model can be characterized in subject matter that is usually completed face-to-face, can be learned at school, while group assignments that are usually carried out outside the classroom, can be applied during face-to-face with cooperation between students. In simple terms, the flipped classroom learning model is a type of learning that exchanges conventional learning and presents a learning display on the web in the form of videos outside the classroom. Duringface-to-face learning in class, students will be given questions in the form of tests to be discussed further. The flipped classroom learning model is divided into two types, namely: 1) The traditional flipped type learning model , which is a type of model that is often used by teachers andhas never usedthe traditional flipped learning model before. 2) The flipped peer instruction learning model is student centered learning that is better at helping students who are still less focused on learning. Therefore, from the two kinds of flipped classroom learning models in this study chose type traditional flipped because in this review the teacher belum completely applied the flipped classroom learning model.

When optimizing the application of the traditional flipped classroom type flipped learning model , it needs to be combined with learning methods. So this study applies the brainstorming method. According to (Hidayati, 2019) states that the application of the brainstorming method to the learning process, makes students motivated in learning mathematics. In addition, students will be encouraged to find creative ideas in solving various kinds of math problems. Meanwhile, (Rosalina, E, 2020) means that the brainstorming method is a method developed from the discussion method. According to (Rachman, 2018) said that in providing learning

material or learning skills is to apply the discussion method, then the teacher divides the students to form a study group in training skills, in developing students' understanding of the subject matter, then forming a discussion group to make a focus on thinking about the subject matter. In line with the opinion (Irhadtanto, 2019) said that students participate in group activities in mastering mathematical concepts and developing skills in learning mathematics.

The choice of the brainstorming method combined with the traditional flipped classroom type learning model makes students know the solution in the widest possible solution to convey ideas, appreciate what is conveyed so that students' thinking continues to develop in solving mathematical problems. Therefore, giving treatment to apply the flipped classroom learning model type traditional flipped with the brainstorming method compares the flipped classroom type traditional flipped learning model with the discussion method to see whether or not there is an influence of the flipped classroom type traditional flipped learning model by applying the brainstorming method is able to increase the ability students in solving a mathematical problem. In addition, students are expected to be able to re-energize and not feel bored again during the learning process. Because, the teaching materialpresented by the researcher is packaged in the form of a video. Similar studies were also conducted (Utami, 2017) both used flipped classrooms but in this study used flipped classroom type traditional flipped and (Dari, T. U, 2020) stated that with the help of braintroming methods experienced a significant influence on mathematical problem solving ability.

Based on the explanation above, researchers are interested in conducting research with the title "The Influence of Flipped Classroom Learning Models Using the Brainstorming Method on Mathematical Problem Solving Ability" on geometry transformation material in class XI of SMAN 1 Taman Sidoarjo. So it is useful to add insight and help mathematics learning to improve mathematical problem solving skills through a traditional flipped classroom learning model using the brainstroming method.

METHOD

Jenis the research used is quantitative using quasi experimental design with Post-test Only Control Group Design. Experimental classes and control classes are not randomly selected in this design, but both experimental classes and control classes arecarried out based on consideration. The experimental class gets treatment while the control class gets no treatment. In simple terms, the post-test only control group design image can be shown in figure 1, namely:
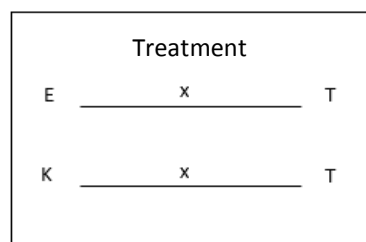
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┌─────────────────────────────────┐
│            Treatment            │
│                                 │
│    E  _____ x _____  T     │
│                                 │
│    K  _____ x _____  T     │
│                                 │
└─────────────────────────────────┘
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Figure 1. Post-test Only Control Group Design

Information:

E: The treatment in class XI IPA 1 applies the flipped classroom learning model of traditional flipped type using the brainstorming method.

K: The treatment in class XI IPA 2 applies the flipped classroom learning model of traditional flipped type using the discussion method.

Q : Final test (Posttest)

In research (Bella, 2019) population has the conditions for choosing a subject related to the object of study. Theopulation of this research is that all students come from class XI of SMAN 1 Taman Sidoarjo which consists of five classes, namely XI IPA 1, XI IPA 2, XI IPA 3, XI IPA 4 and XI IPA 5.

Sampel is taken using certain means from the sebagian of the existing population. Sample classes were taken on a purposive sampling basis on the grounds that school licensing did not allow researchers to create new classes to be used as experimental classes or control classes. Thus, the selectionof control classes and experiments is based on recommendations from mathematics teachers and seen from the average UTS scores that have almost the same ability. From this explanation, the researchers applied samples from the experimental class, namely

class XI science 1 students as many as 35 students and samples from the control class, namely class XI science 2 students as many as 3 3 students.

This research instrument uses five description questions. The five description questions are based on the results of question validation and question reability which shows that the five questions are suitable for use in students' ability to solve mathematical problems. The following is the form of description questions carried out by a written test in the form of post test questions, namely:

Table 1. Post Test Question

Category	Problem Number	Problem Form	Question
C4	2	Description	It is known that the equation of the line is $3x - 2y - 9 = 0$ reflected against the axis then the shadow equation is.....$y = -x$
	5		It is known that Rana and Reno's houses are located at the coordinates of the point and . A power pole will be installed all the way on the Y axis. Look for the minimum point where the power pole is located so that the wire used to connect the Rana and Reno houses is....$A(10,2)B(2,8)$
	4		Known points $D(-2,-1)$ are dilated with scale factors followed by dilatation of scale factors to the center point . The result of point dilation is... $.\frac{1}{2} - 6(0,-1)D$
C5	1		The parabola $y = x^2 - 7x + 7$ is shifted left by 7 units in the direction of the X axis and shifted up by 5 units. If the resulting parabola of this shift intersects the X axis in and then the value of is....$x_1 x_2 x_1 - x_2$
	3		Bagas ran around the ceremonial field. If the field is depicted on the coordinate plane then it is located at the point and the position of Bagas is now at the finish at the point . Bagas ran around the field as far as counterclockwise. If Bagas starts running in front of the flagpole then the location of the flagpole point is.....$(6,4)(2,7)90^o$

The research at SMAN 1 Taman Sidoarjo was conducted from November 18, 2021 to November 27, 2021. In its implementation, researchers conducted one instrument test, one question validity test, two meetings to hold learning or treat the flipped classroom learning model type traditional flipped using the

brainstorming method and two meetings for the flipped classroom learning model type traditional flipped using the discussion method.

After the post-test was carried out, the research continued in three stages of data analysis tests, namely, normality test, homogeneity test and hypothesis test. Normality testing uses a chi squared table whereas, hypothesis testing uses a t test with a degree of significance . $\alpha = 0,05$

RESULT AND DISCUSSION

In this case, the researcher presents and describes sequentially according to the data collected from the research that has been carried out, namely:

Results of validity and reability

The following is thevalidation test result of the test questions , namely:

Table 2. Question Validity Results

No	Validity	Information
1	0,582	Valid
2	0,611	Valid
3	0,775	Valid
4	0,753	Valid
5	0,719	Valid

Based on the above table it is said to be valid all causes $r_{count} \geq r_{table}$ i.e. $r_{count} \geq 0.344$. Meanwhile, reliability calculation is used to determine the degree of consistency of measurement results. According to (Nurohmah, 2021) the criteria for the correlation coefficient of reliability of the test instrument is considered good if the reliability is ≥0.6. Based on the results of the reliability calculation on the five questions, a figure of 0.663 was obtained. Based on this explanation, the oal that will be tested as a post-test consists of five questions describing the transformation material and from these questions all questions meet the criteria so that they can be used.

Post-test results

The post-test which was carried out on November 27, 2021 in class XI IPA 1 (experiment) and XI IPA 2 (control) was carried out before data analysis. The following are the results of the *post-test* recapitulation, namely:

Table 3. Posttest Recapitulation

No	Category	Information	
		Experiment	Control
1	High tvalue	96	82
2	Low-grade t	50	36
3	Average value	80,34	63,34
4	Deviation bme	9,7	12,44

From table 3, the average post-test value in XI IPA 1 (experiment) was 80.34 greater than the average *post-test* result in XI IPA 2 (control) which was 63.34.

Normality Test

The first stage in this data analysis test, the researcher uses calculations using the Chi-Squared table (x^2). The following is the result of the chi squared table XI IPA 1 (experiment) namely:

Table 4. Chi Squared Table XI IPA 1 (experiment)

Interval Class	f_0	Edge of the class (X_i)	Z_i	$F(Z_i)$	L_i	f_h	$\dfrac{(f_0 - f_h)}{f_h}$
		49.5	-3,18	0,0007			
50-57	1				0,0087	0,30	1,63
		57,5	-2,35	0,0094			
58-65	1				0,0536	1,88	0,41
		65,5	-1,53	0,0630			
66-73	4				0,1697	5,94	0,63
		73,5	-0,71	0,2327			
74-81	12				0,3151	11,03	0,09
		81,5	0,12	0,5478			
82-89	10				0,2786	8,70	0,19
		89,5	0,94	0,8264			
90-97	7				0,1352	4,73	1,09
		97,5	1,77	0,9616			
Sum	35						4,04

Based on table 4 it is known if then the value of the degree of freedom , with , $n = 35 dk = k − 1 k =$ class total for and $a = 0,05 dk = 6 − 1$ obtained so that . Thus, the data shows rejected while being accepted produces normal data. $X^2_{table} = 11,07 X^2_{count} = 4,04 < X^2_{table} = 11,07 H_1 H_0$

Table 5. Chi Squared Table XI IPA 2 (controls)

Interval Class	f_0	Edge of the class (X_i)	Z_i	$F(Z_i)$	L_i	f_h	$\dfrac{(f_0 − f_h)^2}{f_h}$
		35,5	-2,26	0,119			
36-43	3				0,0407	1,34	2,06
		43,5	-1,62	0,0526			
44-51	4				0,1109	3,66	0,03
		51,5	-0,98	0,1635			
52-59	2				0,2072	6,84	3,42
		59,5	-0,33	0,3707			
60-67	9				0,251	8,28	0,06
		67,5	0,31	0,6217			
68-75	8				0,2081	6,87	0,19
		75,5	0,95	0,8289			
76-83	7				0,1163	3,84	2,60
		83,5	1,6	0,9452			
Sum	33						8,36

Based on table 5 it is known if then the value of the degree of freedom , with , $n = 33 dk = k − 1 k =$ class total for and $a = 0,05 dk = 6 − 1$ obtained so that . Thus, the data shows rejected while being accepted produces normal data. $X^2_{table} = 11,07 X^2_{count} = 8,36 < X^2_{table} = 11,07 H_1 H_0$

Homogeneity Test

The second stage of this data analysis test is to use the F-Test in calculating the comparison of variances on two variables. The results of this test, that is, with , and , are obtained and because . Thus, the data shows $F_{table} \propto = 0,05 dk_1 = 34 dk_2 = 32 F_{table} = 1,78 F_{count} = 1,65 < F_{table} = 1,78$ that both variables produce homogeneous variances where H_0 accepted and rejected H_1. Furthermore, t-test can be performed.

Hypothesis Test

The third stage of this data analysis test, namely calculating the t-test to determine whether or not there is an influence on the application of the traditional flipped classroom type flipped learning model using the barinstorming method on students' mathematical problem solving ability on geometry transformation material in class XI SMAN 1 Taman Sidoarjo. Thus, generating a t-test, being in the rejection area with the results then, the resulting data of rejected is accepted. Based on the statement, the conclusion can be drawn "There are differences in mathematical problem solving ability among students who apply the flipped classroom learning model of traditional flipped type using the $t_{count}H_0 t_{count} = 6{,}25 > t_{table} = 1{,}977H_0H_1$ brainstorming method compared to   the flipped classroom learning model of traditional flipped type using the discussion method".

The results of data calculations and analysis tests that have been used show that there is a significant difference between the post-test class XI IPA 2 getting an average of 63.64 while class XI-IPA 1 getting an average of 80.34. In addition, on the F-test obtained , signifying accepted and rejected with the t-test obtained then accepted   and   rejected $F_{count} = 1{,}65 < F_{table} = 1{,}78H_0H_1 t_{count} = 6{,}25 < t_{table} = 1{,}977H_1H_0$. In the study (Pratiwi et al, 2017) obtained the results of the influence of the flipped classroom learning model of 29.96% on self-confidence and shisaw learning outcomes were 27.04%. Meanwhile, the research (Walidah et al, 2020) the advantage of the flipped classroom learning model is that students can find their own ideas about the topic and understanding by looking at the learning videos provided by the teacher.

Thus, there is a difference between the ability of students' average scores in solving mathematical problems that apply the flipped classroom learning model of the traditional flipped type using the brainstorming method compared to the ability of students' average scores in solving mathematical problems using the learning model flipped classroom type traditional flipped using discussion method.

CONCLUSION

Based on the average post-test score, geometry transformation material in mathematics lessons obtained mathematical problem solving skills with the flipped classroom learning model type traditional flipped brainstorming method and flipped classroom learning model type traditional flipped The discussion method shows a difference and based on the results of the t-test analysis, t_{count} greater than the t_{table} . It is rejected H_0. So it can be concluded that there is an influence of Flipped Classroom Learning Model on the Ability to Solve Mathematical Problems in the Geometry Transformation material in class XI of SMAN 1 Taman Sidoarjo".

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