

GROUP INVESTIGATION (GI) TO INCREASE STUDENT MATHEMATICS LEARNING OUTCOMES

Titin Faridatun Nisa¹, Jonas Villegas Cuevas²

¹Pendidikan Guru Pendidikan Anak Usia Dini Fakultas Keguruan dan Ilmu Pendidikan Universitas
Trunojoyo Madura

²Surigao State College of Technology, Philippines

E-mail: ¹⁾ titinfaridatunnisa@trunojoyo.ac.id

Abstract

This study aims to determine the increase in student learning outcomes at MTsN 3 Malang after the group investigation type cooperative learning model was applied. This study is a quantitative approach study. The population in this study were all students of class VII in MTsN 3 Malang as many as five classes, but as samples taken two classes, namely class VII/B as many as 20 students as the control class and class VII/E as many as 20 students as the experimental class. Meanwhile, data collection on the ability of students' mathematics learning outcomes using an instrument in the form of a test. The data processing used one-party t-test statistics. The findings reveal that by applying the group investigation (GI) type cooperative learning model, it can improve the mathematics learning outcomes of MTsN 3 Malang students, rather than the mathematics learning outcomes of students who are taught using the STAD learning model.

Keywords: *Group Investigation (GI), Cooperative Learning Model, Learning Outcomes*

1. INTRODUCTION

Mathematics learning teaches students how to think rationally, analytically, systematically, critically, and imaginatively, as well as how to collaborate. These competences are delivered so that students can acquire, handle, and apply information in order to solve problems. Mathematics learning success is heavily reliant upon students' participation in the teaching and learning process, but student success is not reliant upon educational facilities and infrastructure, as well as the curriculum. Nevertheless, teachers' participation in the learning process can also influence students' mathematical learning outcomes. The learning process can be successful if the teacher establishes dynamic, enjoyable learning conditions and students participate actively and passionately in the learning process.

Students gain the capacity to think rationally, analytically, systematically, critically, and creatively, as well as the ability to work in a collaborative environment with others when learning mathematics. These competences are provided in order for students to be able to collect, manage, and use knowledge in order to solve the challenges they encounter. The ability of pupils to respond to feedback and mastery of content or concepts are not the only factors that determine whether or not they will succeed in learning Mathematics in the classroom. Nonetheless, the teaching steps or techniques used by the teacher during the learning process can have an impact on the effectiveness of student learning as assessed by the presence or lack of an improvement in mathematics learning outcomes in the classroom. In order to address the challenges that arise, a solution must be found. Methods, media, and other tools are some of the solutions available.

According to Suprijono (2012) argue that, "Cooperative learning is a broader concept encompassing all types of group work including forms that are more teacher-led or teacher-directed". Cooperative learning model is a learning model in which students learn in small groups that have different levels of ability. In completing group assignments, each member cooperates with each other and helps to understand a learning material. Meanwhile, Group Investigation (GI) is a form of cooperative learning which was explained by John Dewey (1970), later expanded and improved upon by Sharan (1992) at Tel Aviv University, which is described as a common planning classroom setting in which students work in small groups using cooperative questions, group discussions, as well as cooperative planning and projects.

Furthermore, Slavin (2010) reveal the stages in implementing Group Investigation (GI) cooperative learning are as follows: (1) Grouping Stage; (2) Planning Phase; (3) Stage of Investigation; (4) Organizing Stage; (5) Presentation Stage; and (6) Stage of Evaluation. According to Rusman (2012) that the Group Investigation (GI) type of cooperative learning model is designed to help the division of responsibilities occur when students participate in learning and are oriented towards the formation of social human beings.

According to Harnidar (2014) argue that "through a cooperative example the GI type can increase student learning output in tube material at the 9th grade of Calang 1 Junior High School". Furthermore, Haffidianti (2011) highlight that by applying the example of class investigation learning in the main material of spatial construction, it could increase the learning output of class VIII F students of MTs Negeri 1 Semarang in the 2010-2011 academic year. This is shown in the increase in the final output of each cycle, namely in homogeneous-homogeneous pre-cycle learning output as much as 52,97 using 26,32% learning completeness, in homogeneous-homogeneous cycle 1 the student's learning output is higher as 57,89 using classical completeness 52,63%, while in the second cycle homogeneous-homogeneous student learning output is even higher reaching 74,90 using 91,89% classical completeness.

Khafid (2016) found that students who were taught using GI type cooperative learning scored significantly higher in geography than students who were taught conventionally. Moreover, Muntari (2016) reveal that the combination of cooperative models showed better results when compared to direct learning in students' algorithmic understanding of chemistry. Ratnaya (2013) also revealed that the application of group investigation learning strategies and portfolio assessments can improve student learning outcomes, can reduce learning constraints that cause learning processes and products that are less than optimal, and can accommodate an increase in student satisfaction levels represented by their positive responses to learning. Based on the foregoing description, the purpose of this study is to determine whether or not the group investigation type cooperative learning model was effective in improving student learning outcomes at MTsN 3 Malang.

2. RESEARCH METHOD

The type of approach used in this research is a quantitative approach. The population in this study were all students of class VII in MTsN 3 Malang as many as five classes, but as samples taken two classes, namely class VII/B as many as 20 students as the control class and class VII/E as many as 20 students as the experimental class. Meanwhile, data collection

on the ability of students' mathematics learning outcomes using an instrument in the form of a test. The data processing used one-party t-test statistics.

3. RESULT AND DISCUSSION

3.1. Research Result

Table 1 Pretest Results of Experiment Class and Control Class

No	Experiment Class	Pretest value	Control Class	Pretest value
1	RU	31	AS	30
2	SS	40	FY	35
3	RM	34	MH	47
4	WD	39	MS	43
5	ED	45	MN	22
6	RJ	37	PA	30
7	IS	30	DR	36
8	IH	36	KF	44
9	AD	60	SA	52
10	SJ	37	AB	36
11	KH	30	DM	45
12	FA	38	NZ	37
13	KG	30	NF	25
14	AM	41	RA	20
15	MZ	25	ZR	26
16	YR	22	TA	39
17	FD	39	HY	58
18	AP	54	CN	25
19	NA	55	QA	37
20	FA	47	MA	23

Table 2 Posttest Results of Experiment Class and Control Class

No	Experiment Class	<u>PostTest Value</u>	Control Class	Posttest value
1	RU	83	AS	70
2	SS	80	FY	40
3	RM	95	MH	63
4	WD	87	MS	69
5	ED	70	MN	50
6	RJ	87	PA	55
7	IS	73	DR	64
8	IH	79	KF	63
9	AD	90	SA	79
10	SJ	84	AB	80
11	KH	82	DM	67
12	FA	75	NZ	58
13	KG	80	NF	60
14	AM	95	RA	45
15	MZ	80	ZR	55
16	YR	60	TA	58
17	FD	79	HY	75
18	AP	89	CN	64
19	NA	90	QA	59
20	FA	85	MA	60

3.1.1. Experimental Class Posttest Normality Test

According to previous analyses, the mathematics learning outcomes of the experimental class students were $\bar{x} = 82,3$ with $s = 8,04$. Following that, it is important to establish the interval's boundaries.

Table 3 Posttest Normality Test Experiment Class

Score	Class Limit (x_i)	z-score	Area Boundary under the Curve Normal	Area	Expected Frequency (E_i)	Observation frequency (O_i)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	59,5	-2,86	0,4979			
60 – 65	65,5	-2,11	0,4826	0,0153	0,306	1
66 – 71	71,5	-1,37	0,4147	0,0679	1,358	1
72 – 77	77,5	-0,62	0,2324	0,1823	3,646	2
78 – 83	83,5	0,12	0,0478	0,1846	3,692	7
84 – 89	89,5	0,87	0,3078	0,26	5,2	5
90 - 95	95,5	1,62	0,4474	0,1396	2,792	4

With a significant level $\alpha = 0,05$ and class intervals $k = 6$. Hence, the degrees of freedom (dk) for the chi-square distribution are $dk = 6 - 1$ and the chi-square table is $\chi^2_{(1-\alpha)(k-1)} = \chi^2_{(0,95)(5)} = 11,1$. Because of $\chi^2_{\text{statistic}} < \chi^2_{\text{table}}$, which is $9,51 < 11,1$, it can be concluded that the posttest data from the experimental class is normally distributed.

3.1.2. Normality Test Posttest Control Class

Based on previous calculations, for the control class posttest data obtained $\bar{x} = 61,5$ with $s = 10,23$. Furthermore, it is necessary to determine the interval limits to calculate the area under the normal curve for each class of intervals.

Table 4 Posttest Normality Test for Control Class

Score	Class Limit (x_i)	z-score	Area Boundary under the Curve Normal	Area	Expected frequency (E_i)	Observation frequency (O_i)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	39,5	-2,16	0,4846			
40 – 46	46,5	-1,47	0,4292	0,0554	1,108	2
47 – 53	53,5	-0,79	0,2852	0,144	2,88	1
54 – 60	60,5	-0,10	0,0398	0,2454	4,908	7
61 – 67	67,5	0,58	0,219	0,1792	3,584	5
68 – 74	74,5	1,27	0,398	0,179	3,58	2

With a significant level $\alpha = 0,05$ and class intervals $k = 6$. Hence, the degrees of freedom (dk) for the chi-square distribution are $dk = k - 1 = 6 - 1 = 5$, then the chi-square table is $3^2_{(1-\alpha)(k-1)} = 3^2_{(0,95)(5)} = 11,1$. Because of $3^2_{\text{statistic}} < 3^2_{\text{table}}$ which is $5,51 < 11,1$, therefore it can be concluded that the data of the control class mathematics learning outcomes has a normal distribution.

3.1.3. Variance Homogeneity Test

The function of the homogeneity test is to determine whether this sample comes from a population with the same variance or not, if the sample has the same variance then the results of this study apply to the population.

Based on the posttest results of the experimental group and the control group, it was obtained ($x_1 = 82,3$), ($S_1^2 = 64,8$) for the experimental class. As for the control class ($x_2 = 61,55$) and ($S_2^2 = 104,58$).

Furthermore, the hypothesis to be tested at the significant level $\alpha = 0,05$, namely:

$$H_0 : \sigma_1^2 = \sigma_2^2$$

$$H_1 : \sigma_1^2 > \sigma_2^2$$

This test is a right-hand test, so the test criteria are: "Reject H_0 if $F \geq F_{\alpha (n_1 - 1, n_2 - 1)}$, in other cases, H_0 is accepted".

Based on the above calculations, to find the homogeneity of variance, the following formula can be used:

$$F = \frac{\text{the biggest variance}}{\text{the smallest variance}}$$

the smallest variance

$$F = \frac{10,5}{6,8} = 1,61$$

Based on the F distribution of data obtained:

$$\begin{aligned} F_{\alpha(n_1-1, n_2-1)} &= F_{0,05(20-1, 20-1)} \\ &= F_{0,05(19, 19)} \\ &= 2,12 \end{aligned}$$

It turns out that $F_{\text{statistic}} < F_{\text{table}}$ or $1.61 < 2.12$, hence H_0 is accepted, then it can be concluded that the two variances are homogeneous for the posttest value data.

3.1.4. Similarity Test of Two Averages

Before testing the similarity of the two averages of the two populations, first the data is distributed into the formula for the combined variance obtained

$$\begin{aligned} s^2 &= \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \\ &= \frac{(20 - 1)64,8 + (20 - 1)104,58}{20 + 20 - 2} \\ &= \frac{1231,2 + 1980,37}{38} \\ &= \frac{3211,57}{38} \end{aligned}$$

$$s^2 = 84,52$$

Based on the above calculations, obtained $S = 9,19$, then the value of can be calculated as follows:

$$\begin{aligned}
 t &= \frac{\bar{x}_1 - \bar{x}_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \\
 &= \frac{82,3 - 61,553}{9,19 \sqrt{\frac{1}{20} + \frac{1}{20}}} \\
 &= \frac{20,75}{9,19\sqrt{0,05 + 0,05}} \\
 &= \frac{20,57}{9,19\sqrt{0,1}} \\
 &= \frac{20,75}{2,94} \\
 &= 7,06
 \end{aligned}$$

The hypothesis testing data processing was carried out at the significance level $\alpha = 0,05$ and the degrees of freedom were $(n_1 + n_2 - 2) = (20 + 20 - 2) = 38$. From the t distribution table obtained value of $0,95 = 1,68$, so it is known that $t > t_{1-\alpha}$ which is $7,06 > 1,68$, then according to the test criteria of H_0 is rejected and H_1 is accepted. Hence, it can be concluded that, by applying the group investigation type cooperative learning model, it can improve the mathematics learning outcomes of the seventh-grade students of MTsN 3 Malang, rather than the mathematics learning outcomes of students who are taught by applying the STAD learning model.

3.2. Discussion

Based on the previous calculations, the highest pretest score for the experimental class was 70 while the lowest score was 22, while the control class had the highest score 58 and the lowest score was 20. The standard deviation for the experimental class was 9,08, while the control class was 10,82. The average value of the experimental class is 39 and the control class is 36,3. The samples come from two classes which are normally distributed and homogeneous. For the test of the average pretest of the experimental and control classes, the test carried out was the right-hand side test with a value of 0,84. Because the significant value is $0,84 < 1,68$, then H_0 is accepted. As a consequence, it can be concluded that the average value of the pretest of the experimental class is the same as the mean value of the pretest of the control class.

During the learning process using the group investigation type cooperative learning model on the operation sub-material, the students' groups tend to be more active, and try to solve their own problems. Meanwhile, the teacher only acts as a facilitator. The group investigation learning model creates more effective learning activities and makes students more creative, because in this model students together with group members can develop ideas and exchange knowledge in studying a material that has been assigned by the teacher. What distinguishes the group investigation type cooperative learning model with another learning model is "groups are formed by the students themselves with 2-6 members, each group is free to choose a sub-topic from the overall subject to be taught". In the learning process using the group investigation type cooperative learning model, the teacher explains

a general topic, then the students choose the sub-topics to be discussed. In this study, the researcher describes a topic, namely set operations. Subsequently, students choose 4 sub topics, namely slices, combinations, complements and differences. Furthermore, the teacher organizes students into groups according to the sub-topics that have been chosen heterogeneously. The selection of these sub-topics makes each group focus more on only one part.

After the learning process with two meetings, the researcher held a posttest to determine the students' mathematics learning outcomes after the learning process. The highest posttest score for the experimental class was 95, while the lowest score was 60. Meanwhile, for the control class the highest score was 80 and the lowest was 40. The standard deviation of the experimental class was 8,04 while the control class was 10,23. The average value of the experimental class is 82,3 and the control class is 61,55.

Before testing the hypothesis, the normality test and homogeneity test were first carried out. The normality test is a test of the normality of the data distribution. This test is carried out because the parametric statistical requirements are that the data must be normally distributed. Likewise, the homogeneity test in the final test was carried out to find out whether the data came from the same variance or not, so that it could be t-tested. Based on the results of the normality and homogeneity tests that have been described previously, it can be concluded that the posttest data are normally distributed and homogeneous.

Based on the hypothesis review using statistical analysis, the test criteria are accept H_0 if $t_{\text{statistic}} < t_{\text{table}}$ and reject H_0 if $t_{\text{statistic}} > t_{\text{table}}$. Because $t_{\text{statistic}} > t_{\text{table}}$ or $7,06 > 1,68$, then H_0 is rejected and H_1 is accepted. Hence, the hypothesis in this study states that by applying the group investigation type cooperative learning model, it can improve the mathematics learning outcomes of MTsN 3 Malang students, rather than the mathematics learning outcomes of students who are taught using the STAD learning model.

According to Abdul (2013) The overall goal of classroom management is to provide classroom facilities for a variety of teaching and learning activities in order to obtain the best possible results. Indeed, the specific purpose is to improve students' capacity to use learning materials, to create an environment conducive to work and learning, and to assist students in achieving the desired results.

The availability of learning tools that assist students in more readily comprehending the set operation content is one of the variables that contribute to teachers' effectiveness in controlling their students' learning. The success of teachers in managing learning is not only dependent on their mastery of the subject matter, but also on the availability of other resources and infrastructure that can aid in the success of the learning process.

4. CONCLUSION

Based on the explanation of the discussion, it can be concluded that according to hypothesis testing at a significant level $\alpha = 0.05$, based on the value of the t-distribution obtained value of $t_{\text{table}} = 1,68$ and $t_{\text{statistic}} = 7,06$, so that $t_{\text{statistic}} > t_{\text{table}}$ or $7,06 > 1,68$. Based on the decision-making criteria that have been determined, H_1 is accepted, namely: by applying the group investigation type cooperative learning model, it can improve the mathematics learning outcomes of MTsN 3 Malang students, rather than the mathematics learning outcomes of students who are taught using the STAD learning model.

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