THE INFLUENCE OF STUDENT PERCEPTION ON MATHEMATICS LEARNING OUTCOMES THROUGH IMPLEMENTATION OF GROUP INVESTIGATION LEARNING MODEL

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Abstract:
The assumption is that mathematics is a complex subject, and many obstacles still cause low student learning outcomes in implementation. The results of observations that were done in Class XI BDP 1 SMK Negeri 1 Bungo on January 5, 2022, obtained information that during the mathematics learning process, students paid less attention to the teacher when explaining, and students were less enthusiastic. Students lacked the initiative to do practice questions. This study aimed to determine the effect of student perceptions about the application of the Group Investigation cooperative learning model on the mathematics learning outcomes of class X1 BDP 1 SMK Negeri 1 Bungo. This research was pre-experimental with One-Shot Case Study research design. This study's population was all class X1 of SMK Negeri 1, totalling 179, with a sample of class X1 BDP 1 students of SMK Negeri 1 Bungo totalling 22 students. The data analysis technique in this research is descriptive analysis and inferential statistical analysis. Based on the data analysis, it was obtained that t_{count} = 6,440 and t_{table} = 1,725, which means $t_{count} > t_{table}$, then reject the H_0 at a significant level of 0.05 so that it can be concluded that there was an influence on student learning outcomes. That could be seen from the final test that the average score of students exceeds the KKM limit.

Keywords: Mathematics, Cooperative, Group Investigation

INTRODUCTION

Mathematics learning will have meaning if it is correlated with daily life so that between teachers and students, a good communication system will be established because mathematics is a concrete and abstract science (Chairani, 2015). The use of mathematics is found in various fields of fundamental science (mathematics, physics, chemistry, biology, and astronomy), areas of application (medicine, pharmacy, agriculture, and industry), branches of engineering, and the fields of trade, administration, and military (Mumcu, 2018). The goal of learning mathematics in school is to prepare students to face a changing environment and the world that continues to develop by carrying out exercises that based on logical, critical, wise, rational, honest, effective, and efficient thinking so that the

implementation of Mathematics subjects in everyday life and education can be useful (Wahyuni, 2014). Identification and integration can be made with learning mathematics through schemes, formulas, visualization, and patterns to an everyday problem (Rosa & Orey, 2016).

Achieving the goals of learning mathematics began through efforts made by the government, from compiling an appropriate curriculum, improving the quality of teachers, and preparing reference modules and teacher guidelines to completing educational facilities and infrastructure (Andini et al., 2021). One of the most frequently encountered factors is the large number of students who think mathematics is complex, gloomy, and useless so that it becomes a subject that is disliked and less desirable (Ambarsari et al., 2022; Handayani et al., 2022; Sun et al., 2021). This way of thinking always makes students uninterested in studying mathematics because they believe it is monotonous and requires memorizing many formulas and symbols (Mawardini & Ningsih, 2022). That causes mathematics subjects to get negative perceptions from students (Rambe, 2022). W., 2022). According to Gani (2015) states that there are significant differences in mathematics learning outcomes between students with positive perceptions and students with negative perceptions of mathematics. That means the better the student's perception of the subject, the higher the learning outcomes. The results of the data analysis in this study indicate that students who have positive perceptions tend to have better learning outcomes than students who have negative perceptions.

There were many students' negative assumptions that mathematics was a complex subject. In its implementation, various obstacles caused low learning outcomes obtained by students. The results of observations that were done in Class XI BDP 1 SMK Negeri 1 Bungo on January 5, 2022, received information that during the mathematics learning process, students paid less attention to the teacher when explaining. Students were less enthusiastic and only waited for what the teacher explained when given exercises, and students lacked the desire to do exercises. They only imitated the work of their friends without trying to do it themselves. When the teacher gives exercises with different sample problem models, students find it difficult to solve the problem. That matter stood out the most and caused a lack of results in learning mathematics from class XI BDP 1 students at SMK Negeri 1 Bungo. The learning model used was a classic method that was monotonous and limited to one-way learning methods, making it less proactive and difficult to understand. That became a significant problem in the learning process because students with difficulties learning mathematics can be disadvantaged in their career expectations and professional life (Sun et al., 2021).

Teachers play an essential role in developing effective methods to increase students' interest in mathematics, improve their understanding of conceptual knowledge, and enable them to establish arithmetic skills (Sun et al., 2021). The choice of method certainly relates to the version of the study taken. One of the learning models that has a practical application is the cooperative model, where students play a role in participating actively and cooperatively with their discussion groups in solving problems handed over to students by the teacher (Muhsin & Munandar, 2020). When solving problems, alternatives and learning

strategies are required to encourage critical thinking and problem solving, one of which is by applying the group investigation learning model.

Research conducted by Pradhana & Pramukantoro (2013) applied the concept of group investigation learning; this method's results can increase students' final grades. Learning with the group investigation method is another type of cooperative learning concept which involves randomly forming 4-6 people into small groups that are chosen without regard to gender, race, ethnicity, or achievements. After that, several small groups are combined into a single study class. According to Akly & Halimah (2015), The cooperative group investigation method is a learning method that requires students to have the skills to work in teams and involve students starting from the initial topic and how to solve it through investigation.

This group investigation learning method can improve students' skills both in communication and expressing opinions (Simanjuntak & Siregar, 2014). The benefits of this type of cooperative learning method are honing students' skills in obtaining views from others, being able to collaborate and work in teams with different backgrounds, quickly digesting subject matter, growing the capacity to think in solving problems and learning outcomes (Wiratana et al., 2013). The advantages of the group investigation type are that students can be more independent, have the opportunity to perform, increase creativity, and are more communicative in expressing things that are difficult to learn (Thalib et al., 2022) .

Based on the results of research by Metroyadi (2014) proved that at least there was an increase in student learning outcomes from 80.95% to 90.47% in the parameters of mastery learning Natural Resources and their Use in Science subjects using the group investigation method, but because it was carried out at elementary level education (Elementary School) there was still a shortage of learning media. Research of (Wahyuni, 2014) showed an increase in the minimum percentage of learning completeness increased from 30.56% to 83.33% where this method increased student interest and learning outcomes through social studies subjects. Another research by Aditya (2016) showed an increase in student interest and learning outcomes in science subjects, reaching 82.43% using the group investigation version. Research by Kurniawati et al. (2021) entitled "The Effect of The Group Investigation (GI) Type of Cooperative Learning Model on The Mathematics Learning Outcomes of Class VIII Students of SMP Negeri 2 Kediri". The study's results indicated an influence of the Group Investigation (GI) cooperative learning model on students' mathematics learning outcomes. The difference in the research conducted by Ika Kurniawati was that this research used a Quasi-Experimental type of research using a control class and an experimental class. In addition, the data analysis technique in this study was a polled variance t-test analysis.

Based on the background exposure and the limited research on the Group Investigation learning model regarding mathematics sub-matrix, the researchers conducted this quantitative research using the Group Investigation cooperative learning method through student mathematics learning outcomes; and it is expected that it can increase interest and student learning outcomes in Mathematics at SMK N 1 Bungo. According to (Bate'e, 2018) the advantage of the Group Investigation learning model is that students' learning motivation is more

significant because the sense of responsibility with the group is easier to see deficiencies to be corrected immediately. In groups, more people think about the obstacles they face, giving opportunities for students to develop their potential, provide opportunities for students to conduct more intensive investigations on a topic.

RESEARCH METHODS

According to Sugiyono (2017), a pre-experiment is a plan that covers one group or class through a post-test (post-test only). This study used pre-experiments to obtain information following estimates utilizing actual experiments in circumstances where it was impossible to control or change all the appropriate variables. This research applied the One Shot Case Study design. This research design is in the table below.

Table 1. Research Design

Class	Treatment	Final Test
Eksperiment	X	O

Source : Sugiyono (2017)

Information

O = *Pos-test*

X = The practice carried out in the experimental class is learning mathematics with the group investigation model

The location chosen by the researcher was class X1 BDP 1 SMK Negeri 1 Bungo, based on school observations where there were learning problems experienced by students in mathematics. The research was carried out in the odd semester of the 2022/2023 school year. The students in this study were all students of class X1 at SMK Negeri 1 Bungo, with a sample of 22 students consisting of 12 male students and 10 female students. The independent variable of the research is the student's perception of the Group Investigation model, and the dependent variable is the result of the student's mathematical scores. The tools used by researchers to obtain information were questionnaires and written tests. This research questionnaire has indicators: description, response or impression, understanding or understanding, assessment or evaluation. In comparison, the written test contains matrix material that was previously carried out with test validation, test trials and item analysis with the level of difficulty of the questions, the variety of questions and the reliability of the questions.

In general, the sequence of collecting research data begins with the preparation of the documents used, followed by the implementation of the learning model and ends with a final test. The method of data analysis used is a descriptive analysis of student learning outcomes data and inferential statistical analysis in the form of analysis prerequisite tests. The prerequisite test is divided

into two parts: the normality test and the simple linear regression test, followed by a determination test and hypothesis test to validate the hypothesis. Based on the data that has been processed, it is known that variable X obtains a t_{count} of 6.361 and a t_{table} value at a significant level $\alpha = 0.05$ is obtained at 1.725, so $t_{count} > t_{table}$, then H_0 is rejected. Based on the proposed hypothesis, it can be concluded that there is a positive influence between students' perceptions about the application of the Group Investigation type learning model to learning outcomes in mathematics.

RESULTS AND DISCUSSION

The group investigation type model is evaluated with an essay questions exam. This question is used to assess the steps and stages of the learning method in teaching and learning activities (KBM) will be used later. Meanwhile, the test function is to assess student understanding of the matrix material that has been explained. The results of the questionnaire validity test on a sample of 22 subjects with a significant level of 5% obtained an r_{table} of 0.432. Based on the $r_{count} > r_{table}$ validity test, it can be said that the item is valid. The results of the questionnaire reliability test obtained r_{table} of 0.432, which can be said that $r_{11} > r_{table}$ i.e. 0.915 > 0.432, so the questionnaire is reliable. The level of difficulty of the questions based on the calculations is easy in questions 1, 2, and 3. The level of difficulty of the questions is determined by calculating the differentiating power of the questions. Question number 1 has sufficient criteria, question number 2 has very good criteria, and question number 3 has sufficient criteria.

This data analysis aims to test the research hypothesis of whether the students' perceptions about applying the Group Investigation (GI) cooperative learning model can affect students' mathematics learning outcomes in class XI BDP 1 Bungo. Before testing the hypothesis, a normality test must be carried out first, simple linear regression, coefficient of determination.

The normality data testing was carried out with the liliefours test, obtained $L_{count} = 0.162$ and n = 22, then $L_{table} = 0.190$. Then obtained $L_{count} < L_{table}$, it can be concluded that the post-test data is normally distributed. Then a simple linear regression was carried out to determine the effect on the variable with the test results in Table 2.

Table 2. Simple Linear Regression Equation

		Coefficients[a]				
	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.792	13.054		0.214	0.833
	Gi	1.786	0.277	.821	6.440	0.000
a. Dependent Variable: learning outcomes						

Table 2 presents the results of the coefficient values through calculations based on equation (1):

$$Y = 2{,}792 + 1{,}786\ X \qquad\qquad \text{.................................... (1)}$$

Mathematically the constant value obtained from the linear regression equation is 2.792 by implementing the GI type cooperative learning model, students have a value of 2.792. Furthermore, a positive value of 1.786 is a consistent regression coefficient between variable X and variable Y, so an increase in units of variable X will affect an increase in student learning outcomes. Then, to determine and measure how much the influence of students' perceptions on the cooperative learning model of group investigation (X) through learning outcomes (Y) with indicators of the coefficient of determination values, i.e., 0 and 1. A small R value indicates the existence of the independent variable's limitations to explain the dependent variable accurately. An R value close to 1 indicates that the information provided by the independent variable can be used to estimate the dependent variable. The coefficient of determination test was carried out using SPSS v.26, with the results shown in Table 3.

Table 3. Coefficient of Determination

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.821a	0.675	0.658	8.740

a. Predictors: (Constant), Gi

Table 3 shows the dependent variable's correlation value (R) is the student's perception of the group investigation (X) cooperative learning model. Mathematics learning outcomes (Y) is 0.821, and R-Square is 0.675. Thus it can be understood that the type of cooperative group investigation model influences the results of learning mathematics with a percentage level of 67.5%, and variables outside the study influence the remaining 32.5%.

After that is doing a simple linear regression test, followed by a significance test. The t test or partial test is a test that states how the independent variable influences the dependent variable partially. Based on the results of data processing using the SPSS v.26 programs, it is known that variable X obtains t_{count} 6.440 > t_{table} 1.725 with a significant level of 5%. Then the hypothesis in this study can be accepted. It can be concluded that there is a substantial influence between students' perceptions about the application of the type of group investigation learning model to the achievement of mathematics learning outcomes on the matrix sub-topic.

The learning process in class XI BDP 1 related to the cooperative learning steps of the group investigation type; namely, learning began with the teacher randomly dividing several groups. Students were divided into 5 groups, each consisting of 4-5 students. After getting the topic, the teacher distributed activity sheets and asked students to observe them. Students identified the issues and planned the solutions, then examined the information, discussed with each other, and unified ideas and opinions. The teacher's role here was to oversee the discussion. The next stage was the group preparing a final report from the

discussion results, and group members determined the conclusions of the things they investigated. The teacher selected group members randomly to present the results of the discussion. The final stage was evaluation, in which the teacher provided training.

The first meeting of the implementation of the group investigation did not go well because the students were still adjusting to the learning model being implemented. Then, from the second meeting, the learning process began to run smoothly because students no longer hesitated in forming groups and dividing tasks. Furthermore, at the third meeting, the learning process ran smoothly. Students were used to learning and discussing in their groups and were more courageous in presenting the results of group discussions. The learning process at the third meeting was carried out well because it underwent an adaptation process with the model applied in the learning process. This result is related to Adora (2014) that forming groups in the investigation group can develop the courage to speak, social skills, and leadership attitudes and increase interaction between one student and another in a team. The research results from the three meetings showed that the learning process has increased.
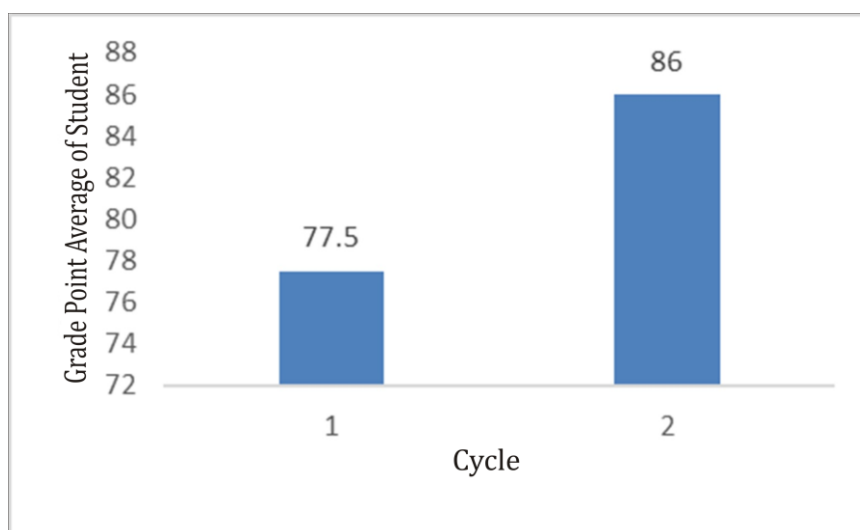

Figure 1. Student Test Average Score Diagram

The increase in the average value before and after the final test can be seen in Figure 1. The results in cycle 1 of the investigation group learning model obtained an average questionnaire response value of 77.5, while in the final test, it increased to 86. The average learning outcome based on the final test of students' mathematics for the sample class was 86.00, and the standard deviation was 14.95, with a score range of 100. From the results of these achievements, students have achieved scores above the minimum completeness criteria (KKM) of as many as 19 people. The comparison of student learning completeness can be seen in Figure 2.
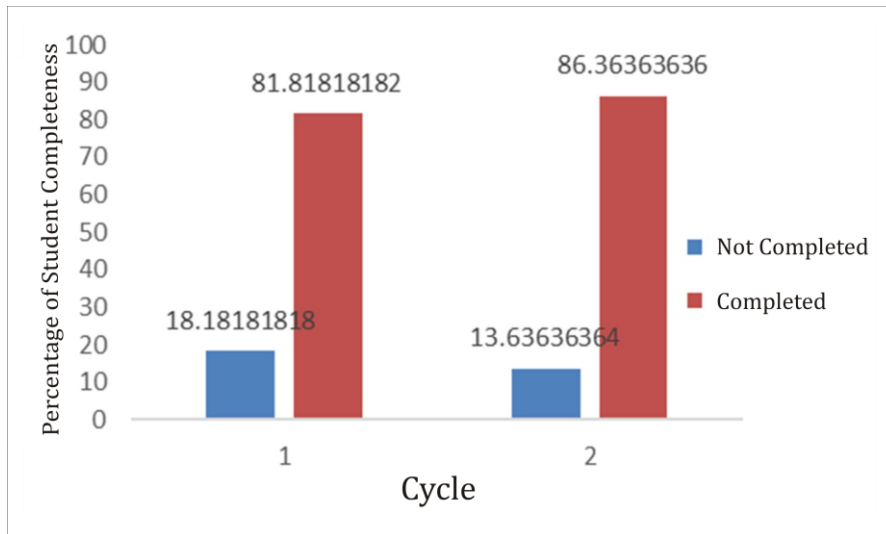
Figure 2. Student Completeness Diagram

Based on Figure 2, the percentage of completeness of students who exceed the minimum threshold value increases. The rate of student completeness in cycle 1 was 81.81% and increased to 86.36%. That result is supported by the research of Artini et al. (2015) that the GI model made an excellent contribution to student learning outcomes and improved better students' critical thinking skills. An overview of students' final test results in the sample class can be seen from the pattern of problem-solving by students on Figure 3.

Figure 3. Student Final Test Answer Sheet Number 1

Based on Figure 3 it can be seen that students could answer question number 1. Students have understood the substance during 3 meetings of the learning process about matrix operations. Students could complete multiplication with good and correct concepts and no longer had difficulties doing multiplication and addition, so they gave answers related to the concepts they had learned. That referred to students' happy feelings with the learning model applied, they did not feel bored with the method used, and they were motivated to be enthusiastic about learning, making it easier for students to understand the material. That was reflected in students having positive perceptions of the model applied.

Figure 4. Student Final Test Answer Sheet Number 3

Based on Figure 4, students could answer question number 3 regarding matrix operations when calculating matrix multiplication. It's just that there was an error when students completed the problem. Students were upside down in placing the multiplication position, which should be b + a, but they wrote a + b. That is related to students feeling that this learning model could eliminate boredom during the learning process so that they could be more serious in implementing learning and make them more interactive. In accordance with the positive perceptions of students, the type of Group Investigation cooperative learning model could increase motivation in learning.
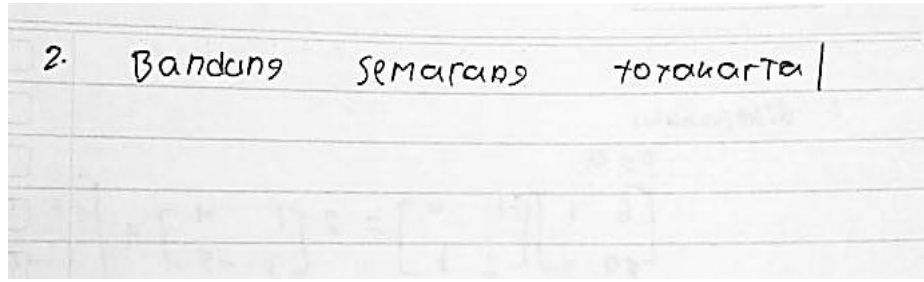
Figure 5. Student Final Test Answer Sheet Number 2

Based on Figure 5 students could not answer question number 2, students still lacked understanding the substance. They had difficulty understanding what was being asked in the questions, students only wrote down the cities they knew. So that they could not write down what was known in the questions and could not answer the questions correctly. That was because students had negative perceptions of learning mathematics, so they were not serious in the learning process, making it difficult to answer the questions given.

Thus Oktavia & Sofwan (2022) research developed that group investigation built students daring to express opinions and developed students' answering abilities. The existence of group investigation with guided discussion by the teacher for some students was considered more understandable. Of course, teacher skills are needed to guide the discussion to be more effective (Fikri et al., 2021). So, teacher competence is essential, and teachers must master the learning model applied to their students.

CONCLUSIONS AND RECOMMENDATIONS

The implementation of the learning model of the cooperative type with the GI learning type (group investigation) showed that the variable X obtained t_{count} = 6.361 so that it could be concluded that there was an influence of students' perceptions of the mathematics subject of class XI BDP 1 Bungo students on learning outcomes after implementing the learning model. The influence of the application of the GI learning model could be seen from the final test which had an average score that exceeded the KKM limit. Thus the authors suggest the following things based on research results for future improvement, i.e., the necessity to master effective learning models such as group investigation as a replacement method in carrying out the teaching and learning process and the necessity for variations in the use of this learning concept on different subjects. It is expected to provide more direction regarding steps to solve problems as an initial learning process so that students are accustomed to discovering concepts that begin with issues related to people's daily lives.

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