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THE INFLUENCE OF THE GEOGEBRA-ASSISTED RECIPROCAL TEACHING LEARNING MODEL ON MATHEMATICS LEARNING OUTCOMES

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ABSTRACT

The purpose of this research is to see whether there is an influence of the reciprocal teaching learning model assisted by GeoGebra on the mathematics learning outcomes. This study uses a quantitative method with a quasi-experimental research type. The population of this research was the 11th grade students of SMA IT Asy-Syadzili Malang and the sampling technique used is purposive sampling. Research results show that the average experimental class score was 78.72. While in the control class the average value was 64.47. The experimental class uses a geogebra-assisted reciprocal teaching learning model which makes it easier for students to understand geometry learning so that the posttest scores in this class are better compared to the control class which uses a conventional learning model. Therefore, it could be concluded that there is a significant influence of the reciprocal teaching learning model assisted by GeoGebra on the learning outcomes of geometric transformation mathematics for class XI SMA IT Asy-syadzili Malang.

Keywords: reciprocal teaching; GeoGebra; learning outcomes

1. Introduction

Education is a very long process. Success determined by many factors, including children as students, parents and teachers educators, education costs, support surrounding environment, and learning models as well appropriate media (Nurdiansyah et al., 2021). Education is very important in life because it is a process of changing attitudes and the behavior of a person or group of people to become mature is through education and training (Silalahi & Hutauruk, 2020).

Mathematics lessons aim to ensure students have the ability to understand mathematical concepts, reason on patterns and properties, solve problems, communicate ideas, and have an attitude of appreciating the usefulness of mathematics in life (Irfan, 2016). Mathematics is one of the sciences that trains students to think rationally, logically and critically (Cresswell & Speelman, 2020). The obstacle when learning mathematics is that most students think the subject is the most difficult and scary. Perceptions like this must be eliminated because they will be the cause of students' learning failure in mathematics.

The mathematics learning process is closely related to the mastery and application of concepts. Abstract mathematical concepts are arranged sequentially and tiered and require certain proof, therefore learning requires mastery of previous mathematical concepts because they are a prerequisite for moving on to the next concept (Lysenko et al., 2016).

The researcher conducted initial research study observations through interviews with the class the teacher said the low scores were known from the students' learning results in mathematics lessons in the odd semester of the 2022/2023 academic year. This is obtained from the score data provided by the teacher which shows that the class average score is 43 below the minimum score of 75. Based on the average test score which is still below the minimum standard, it can be seen that students' mathematics learning outcomes are still not good. So, it is necessary to provide a solution to the problem of student grades.

Currently, various types of learning models have been developed that teachers can use to improve student learning outcomes, especially mathematics learning. Each learning model has different efficiency in its application. One learning model that can be applied in mathematics learning is the Reciprocal Teaching Model. Reciprocal Teaching is a learning model to achieve the independent learning process and students are able to present in front of the class, so that the learning objectives are achieved (Mulyono et al., 2018). Reciprocal Teaching is an approach to teaching students that is designed in four independent understanding strategies, namely summarizing, creating questions related to the material, explaining and predicting (Sapta et al., 2019).

GeoGebra software is used to support the implementation of learning. Geogebra is quite dynamic mathematics software where this software combines geometry, algebra and calculus so that it is used as a mathematics learning medium (Septian et al., 2020). The reason for using GeoGebra learning media is to make it easier for students to understand mathematical concepts in transformation material and position teachers to become facilitators in the student learning system through GeoGebra in Reciprocal Teaching.

Based on research conducted by (Priatna et al., 2018) with the title "Developing GeoGebra-Assisted Reciprocal Teaching Strategy To Improve Junior High School Students' Abstraction Ability, Lateral Thinking and Mathematical Persistence". The results showed that the mathematics persistence of students who studied with the Reciprocal Teaching learning strategy assisted by GeoGebra was significantly higher than students who studied with conventional learning. This research uses a Quasi Experimental method with a pretest-posttest control group design with 2x3 factorial, while the research that will be carried out is a Quasi Experimental method with a Nonequivalent control group design and examines understanding of mathematical concepts and their equations using the Reciprocal Teaching learning model assisted by GeoGebra.

In line with other research by (Muqtada et al., 2018) entitled "Reciprocal Teaching Assisted by GeoGebra to Improve Students Mathematical Communication" concluded that the reciprocal teaching learning model assisted by GeoGebra can improve students' communication skills. The difference in research methods is using classroom action research to improve mathematical communication skills, while the research that will be carried out uses experimental quantitative research methods and examines understanding of mathematical concepts. The similarity to previous research is that it uses a reciprocal teaching learning model assisted by GeoGebra.

Referring to the description above, the researcher intends to conduct a research study entitled "The Influence of the Geogebra-Assisted Reciprocal Teaching Learning Model On Mathematics Learning Outcomes".

2. Research Methods

This research was carried out in Asy-Syadzili IT High School Malang on even semester of the academic year 2022/2023. The research was conducted with a quantitative approach, using quasi-experimental research methods, namely by providing two different treatments to two groups of students (Mulyono, 2021). The first group was given a model learning with the Reciprocal Teaching model assisted by Geogebra as an experimental class, while the second group was given conventional learning model as a control class.

Design research used in This research is a Nonequivalent Control Group Design, namely providing a pretest to determine the initial condition before being given treatment, as well as a posttest after being given treatment in each group. In this design the experimental group and control group are not selected randomly (Bulus, 2021).

The population in this study were class XI high school students in the even semester of the 2022/2023 academic year. This research used a purposive sampling technique, so that classes XI-6 and XI-7 were selected as the experimental class with a total of 47 students and classes XI-5 and This research was carried out in four meetings.

Research data collection methods include test and questionnaire methods. The test method is used to obtain learning outcome data mathematics students. In this research, the test was carried out twice for the experimental class and the control class, namely the initial test and the final test. The test given to students is an essay consisting of 5 questions. The questionnaire was used to obtain data on student responses to the geogebra-assisted reciprocal teaching learning model. To obtain accurate data, before learning outcome test instruments and response questionnaires are used, the instruments must fulfill two important requirements, namely valid and reliable (Mulyono et al., 2018).

Before carrying out tests to determine mathematics learning outcomes and student response questionnaires, content validity testing was carried out by two teachers in the field of mathematics (Souza et al., 2017). The results of content validation show that the mathematics learning outcomes test and student response questionnaire are suitable for use.

After the content validity test was carried out, it was continued with a validity test using the Pearson Product Moment correlation formula with a significance value of 5% (Esezi Isaac & Eric Chikweru, 2018). The researcher carried out a validity test of the test items by trialling 5 questions from the description of the geometric transformation chapter and 10 questionnaire items on student responses to the geogebra-assisted reciprocal teaching learning model on 22 students in class XI-8 of SMA IT Asy-Syadzili.

Validity test using Pearson Product Moment correlation showed that all 5 statements submitted were valid with the lowest r value of 0.546 and the highest r value of 0.693. With a significance level of 5%, the r table is 0.4227. The results of the validity test calculation using the help of IBM SPSS Statistics 26 software showed that all questions describing conceptual understanding were greater than r table, so it can be concluded that the questions were valid. So that the description questions can be used for research (Maulana, 2023).

Calculating the validity of the questionnaire using the product moment correlation formula is carried out with the help of IBM SPSS Statistics 26 software. 10 Questionnaire items that are declared valid are numbers 1, 2, 3, 4, 5, 6, 7, 9, and 10. Next, their reliability will be tested and Invalid questionnaire items in number 8 will not be used in the research.

Reliability Test is used to determine the consistency of the measuring instrument, whether the measuring instrument used is reliable and remains consistent if the measurement is repeated (Surucu & Maslakci, 2020). Reliability means being trustworthy. This means that the instrument can provide precise results. To determine reliability, the Alpha Cronbach formula is used. An instrument is said to be reliable if the Cronbach's Alpha reliability coefficient is higher or equal to 0.70 ($r11 \geq 0.7$) (Mashfufah et al., 2020). The reliability of the student mathematics learning outcomes test is 0.73 and the student response questionnaire is 0.75, so it can be concluded that the question instruments and questionnaire items are reliable.

Furthermore, from the 5 description questions and 9 questionnaire items the student responses which have been declared valid and reliable, will be used as pretest and posttest questions for the experimental and control classes. After getting a score, proceed with hypothesis testing.

Before hypothesis testing is carried out, the data obtained must meet the prerequisite tests, namely the normality test for mathematics learning outcome scores using the Kolmogorov-Smirnov Test. Test homogeneity for both groups using the levene' test.

After the prerequisite tests are met, the data will then be tested for the research hypothesis using the independent sample t-test. The test was carried out with the help of IBM SPSS Statistics 26. The test criteria for the calculated t value were compared with the t table at a significance level of 5%. If the calculated t value > t table, then Ho is rejected.

3. Results and Discussion

The data collected in this research were mathematics learning outcome scores obtained through a post-test at the end of the research. The data showed that the average score for the experimental group was 78.72 and the average score for the control group was 64.47. Descriptive analysis of the posttest experimental class and control class can be seen in the table below.

Table 1. Descriptive Statistics Results (Posttest)

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std. Deviation**
Eksperimental Group	47	55	95	78.72	9.638
Control Group	47	40	85	64.47	10.490
Valid N (listwise)	47				

Table 1 shows that the total sample of posttest scores in the experimental and control classes is 47 students. The average final ability score (posttest) for understanding mathematical concepts for students in the experimental class was 78.72 higher than students in the control class who had an average of 64.47. The maximum score in the experimental class is 95 and the control class is 85. The minimum score in the experimental class is 55, while in the control class it is 40. In addition, the standard deviation of the experimental class is 9.638 lower than that of the control class, namely 10.490. This means that the diversity of scores in the control class is higher than in the experimental class.

Next, to find out whether the mathematics learning outcomes of students who take part in learning using the geogebra-assisted reciprocal teaching learning model are better than the mathematics learning results of students who take part in learning with conventional learning, it is necessary to test the hypothesis, but before that prerequisite testing is carried out on the data distribution which includes normality tests and homogeneity test.

The normality test using the Kolmogorov-Smirnov formula in calculations using IBM SPSS Statistics 26 showed that for the experimental group the significant value was 0.061 which was greater than 0.05 at the 5% significance level. control group, namely a significant value of 0.099 which is greater than 0.05 at a significance level of 5%. So it can be concluded that each posttest sample group for the experimental class and control class comes from a normally distributed population.

the results of the homogeneity test using the Levene test obtained a significance value of 0.812 which is greater than 0.05 at the 5% significance level. So it is concluded that the posttest data groups for the experimental class and control class are homogeneous.

Based on the results of normality and homogeneity of variance tests, it was found that the distribution of student mathematics learning outcomes data in the experimental group and control group was normally distributed and had a homogeneous variance. Next, an independent sample t-test was carried out, it was found that the calculated t = 6.860 was more than the t table = 1.98609. So, H0 is rejected, which means that the mathematics learning outcomes of students who follow learning using the reciprocal teaching learning model are better than the learning outcomes of students who follow conventional learning.

The mean percentage value of the student response questionnaire to the reciprocal teaching learning model assisted by GeoGebra is 89.07. So it can be concluded that the student response is very positive and can be accepted by students.

Based on the results of the posttest with a total of 47 experimental class students using the reciprocal teaching learning model assisted by GeoGebra, there were 34 students who got a score ≥ 75 from the learning mastery score set by the school, namely 75, and 13 students who got a score below 75. It can be concluded that 72 % of experimental class students obtained a complete learning score, and 28% of experimental class students did not complete their learning.

Based on the test results using the independent sample t-test, there were differences in the average student mathematics learning outcomes between the experimental group and the control group. This shows that learning with the geogebra-assisted reciprocal teaching learning model is better than conventional learning. This is because the reciprocal teaching learning model consists of four independent understanding strategies, namely summarizing the lesson material, composing questions, clarifying the knowledge that has been learned, then predicting the next material.

GeoGebra software can be used as a mathematics learning medium to demonstrate or visualize mathematical concepts and as a tool to construct mathematical concepts. Student activity that is more positive and enthusiastic in learning activities is one of the factors that makes the average score obtained by students in the experimental class higher than the average score obtained by students in the control class.

learning that takes place in the control class is carried out using a conventional learning model. during discussions, only a few students read the book in its entirety and paid attention to the teacher when explaining the material being discussed and answering questions given by the teacher, so only a few students really understood the concept of the material. Apart from that, it is difficult for students to visualize geometric objects in problems and teacher-centered learning. So students feel bored and tired of learning mathematics. Not all students can easily understand information given abstractly, especially those related to geometry. This results in students feeling lazy about studying geometry material which can result in students' grades dropping.

Using GeoGebra software is very suitable in geometric transformation subject matter because the existing features can transform objects on the screen, drawing geometric shapes easily and precisely in terms of distance, angle and area.

Apart from that, there is also a click-drag feature to describe or arrange geometric shapes that require visualization such as rotation.

Student response questionnaires were obtained from questionnaire sheets that had been filled in by 47 students in the experimental class. Student responses to the reciprocal teaching learning model assisted by GeoGebra showed very positive responses. This is shown by the percentage of student response questionnaire results obtained for each indicator. The indicator for student response to the reciprocal teaching learning model assisted by GeoGebra was a percentage of 89.07 with very positive criteria. So it can be concluded that the reciprocal teaching learning model assisted by Geogebra can be accepted by students with a very positive response.

This is reinforced by the results of research by (Priatna et al., 2018) on the persistence in learning mathematics of students who were given Reciprocal Teaching treatment assisted by GeoGebra
this strategy is significantly higher compared to students who receive conventional learning

According (Arbain & Shukor, 2015) to shows that GeoGebra software has a positive impact on student achievement. Students also have positive perceptions of GeoGebra software in terms of enthusiasm, self-confidence and motivation. This software must be introduced to Mathematics educators so that students can explore the world of Mathematics more widely and enable students to think critically and creatively.

based on research results (Tamam & Dasari, 2021) Using Geogebra in mathematics lessons has several benefits, namely: (1) Geogebra is software to help learning activities, such as exploring, visualizing and building mathematical concepts, (2) Improving students' mathematical abilities such as proof and mathematical reasoning abilities, as well as making it easier for students to mathematical problem solving, and (3) Geogebra is easy to access from anywhere and at any time.

4. Conclusions

Based on the description of the research results and discussion, it is known that there are differences in the mathematics learning outcomes of students who follow the geogebra-assisted reciprocal teaching learning model and students who follow conventional learning. The mathematics learning outcomes of students who take part in learning using the geogebra-assisted reciprocal teaching model are better than the mathematics learning results of students who take conventional learning. Based on this, it can be concluded that mathematics learning using the geogebra-assisted reciprocal teaching learning model has a positive influence on students' mathematics learning outcomes.

For future researchers, it is hoped that the instruments used will not only use questionnaires but also interviews with the respondents studied, so that the data obtained is more complete. Researchers must pay attention to good time management in the preparation and implementation of the learning process and the availability of infrastructure used for Learning Activities.

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