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PROBLEM-SOLVING ABILITY IN THE THINK TALK WRITE LEARNING MODEL ASSISTED BY GEOGEBRA SOFTWARE

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Article Info	Abstract

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This study was driven by the low mathematical problem-solving abilities of students. To address this issue, Think Talk Write (TTW) learning model, supported by GeoGebra software, was implemented as an intervention. The research aimed to determine whether students taught using the TTW learning model assisted by GeoGebra demonstrate greater improvement in mathematical problem-solving skills compared to those taught through conventional methods. This quasi-experimental study employed a quantitative approach with a non-equivalent control group design. The sampel in this research was class VII-G, with 28 students and Class VII-H, with 26 students. Data were collected using a mathematical problem-solving ability test and analyzed quantitatively. The gain index results indicated that the experimental class experienced a higher improvement in problem-solving skills than the control class. Furthermore, the t' test at a 5% significance level confirmed significant differences in mathematical problem-solving abilities between the two groups. Thus, it can be concluded that the TTW learning model assisted by GeoGebra software significantly enhanced students' mathematical problem-solving abilities compared to conventional learning methods.

INTRODUCTION

The objective of mathematics education in the 21st century emphasizes equipping students with the 4Cs skills: communication, collaboration, critical thinking, problem-solving, creativity, and innovation (Septikasari Resti & Frasandy, 2018). This aligns with the National Council of Teachers of Mathematics (Maulyda, 2020). which outlines five key standards to achieve mathematics learning goals: problem-solving, reasoning and proof, communication, connections, and representation. However, data from the 2022 Programme for International Student Assessment (PISA) survey reveal that Indonesia ranks 68th out of 81 countries in mathematics, with a score of 379 (OECD, 2023). According to Siswanto and Meliasari (2024), this underperformance is largely attributed to students' weak problem-solving skills, particularly in addressing non-routine or higher-order problems. Consequently, it can be inferred that the mathematical problem-solving abilities of Indonesian students remain relatively low (Harahap & Surya, 2017).

Low problem-solving skills among students need to be considered because it is an important component in preparing a superior generation in accordance with the demands of 21st century competence. Meanwhile, the learning commonly used in mathematics learning is conventional learning. The conventional or traditional learning model is learning where the learning process is carried out in the old way through lecture method, where the teacher plays the main role in determining the content and the sequence of steps in delivering material to students. so that in the learning process students become passive and only receive the information provided. This of course means that students' problem-solving abilities do not develop properly. Therefore, an effective learning model is needed so that students are more active during the learning process. One of the learning models that can overcome students' difficulties in solving mathematical problems is cooperative learning. With this model, students are expected to be more active and cooperate in determining solutions to problems given by teachers. One type of cooperative learning that can be applied is Think Talk Write (TTW).

The TTW learning model is a carefully planned strategy that involves thinking (thinking), speaking or discussing (talk), and writing the results of the discussion (write) to achieve the expected competencies (Suyanto, 2016). In this model, students learn in groups (collaboratively) to demonstrate and solve problems in the Student Worksheet, then present it in front of the class. This encourages student activity and makes learning more effective. The use of the TTW learning model provides students with a quality learning experience, where they learn directly and in real life so that it is easier to understand the learning material and improve their learning outcomes. Thus, the application of the TTW learning model has the potential to improve students' mathematical problem-solving skills.

In addition to using learning models that can improve mathematical problem-solving skills, the use of learning media such as mathematics software can make it easier for students with different characteristics to visualize and learn the material. One of the media that can be used to improve mathematical problem-solving skills is Geogebra software. Geogebra software is a dynamic software that makes mathematics learning more effective, efficient, and fun for teachers and students, with 2D and 3D capabilities (Klemer & Rapoport, 2020). (Geogebra facilitates the presentation of material as a dynamic visualization that captures students' attention as they learn. Teachers no longer have to draw shapes that take a long time on the board. As a result, there are usually few examples and students only take notes without getting the opportunity to ask questions or understand concepts, so learning becomes one-sided. Meanwhile, by using Geogebra, apart from encouraging teachers to draw shapes, students can also try drawing shapes using Geogebra on their smartphones.

In a study conducted by (Sinamo & Siregar, 2019), it was found that the application of a scientific learning approach assisted by Geogebra Software can be used to improve students' mathematical problem-solving skills on quadrilateral materials. Therefore, other models can also be applied to improve mathematical problem-solving skills with the help of Geogebra Software, one of which is TTW model.

Based on the discussion above, it is necessary to change the learning system as a step to overcome this long-standing problem. Improving the quality of the learning system can be achieved through the selection of appropriate learning models, media, and materials. This study applies TTW cooperative learning model using Geogebra software.

METHOD

This study employed an experimental method using a quasi-experimental design with a non-equivalent control group structure. Two classes were selected as research samples: one serving as the experimental class and the other as the control class. The experimental class was taught using TTW learning model supported by Geogebra software, while the control class received instruction through conventional teaching methods. The sample consisted of two specific classes: Class VII-

G, with 28 students, designated as the experimental class receiving the TTW model treatment with Geogebra software; and Class VII-H, with 26 students, assigned as the control class and taught using the conventional approach. Both groups studied the same topic, which focused on statistical concepts

The data collection technique used in this study is a mathematical problem-solving ability test. This mathematical case-solving ability test consists of a pretest (initial test) & posttest (final test). The types of pretest and posttest questions given are the same, so that it can be seen what happens between before the learning process and after learning based on 2 classes that are sampled.

Pretest is carried out to find out the basic abilities of students. The posttest was administered to examine the differences in the improvement of students' mathematical problem-solving skills within the experimental class following the application of the treatment.

The data processing techniques carried out in this study were carried out by providing tests, interviews and filling out questionnaires. The data are grouped into test and non-test data. The test result data will be processed using statistical statistical tests while non-test data will be analyzed qualitatively. The statistical test used can be seen in Figure 1.

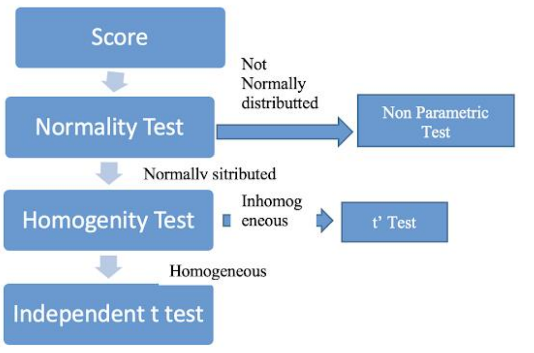

Figure 1. Test Data Analysis

RESULTS AND DISCUSSION

The results of the mathematical problem solving ability test in the experimental class and control class can be seen in Table 2**.**

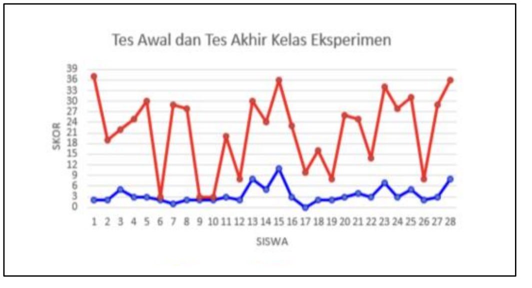

Figure 2. Initial Test Scores and Final Test of the Experimental class

Figure 2 indicate a general improvement in students' scores in the experimental class. To further analyze the data, a quantitative comparison of the test results from the experimental and control classes was conducted. To determine whether the observed differences are statistically significant, additional statistical tests are required.

Initially, a normality test was performed to determine whether the normalized gain data originated from a population with a normal distribution. The Lilliefors test was employed to assess the normality of the normalized gain data for both the experimental and control classes. The outcomes of the normality test calculations using the Lilliefors test are presented in Table 1.

Table 1. Results of Normalized Lilliefors Data Gain Test Calculation

Class	$\bar{x}$	s	Count	Critical
Control	0,4527	0,2335	0,1168	0,1641
Experiment	0,1846	0,1428	0,1697	0,1699

In Table 1, it appears that in the experimental class and the control class, $L_{counts} < L$, so Ho is accepted. Based on the results, it was determined that the data from both the experimental class and the control class originated from a normally distributed population. Following this, a homogeneity analysis was conducted to assess whether the variances of the two datasets were homogeneous. The outcomes of the homogeneity analysis are displayed in Table 2.

Table 2. Normalized Gain Data Homogeneity Test Calculation Results

Class	n	s	Fcal	Critical
Control	28	0,2335	2,6743	1,9395
Experiment	26	0,1428		

Table 2 shows that $F_{counts} > F_{critically}$, so Ho is rejected. Therefore, the data is not homogeneous.

Table 3. Normalized Gain Data Homogeneity Test Calculation Results

Class	n	$\bar{x}$	v	$t'_{calculate}$
Control	28	0,4527	0,0545	5,1291
Experiment	26	0,1846	0,0204	

To determine whether there is a significant difference in the improvement of mathematical problem-solving skills between students taught using the TTW learning model assisted by Geogebra software and those taught using the conventional learning model, a t' test was performed. The results of the t' test calculations are presented in Table 3.

Using the test criterion of 2.0540 Ho was rejected. This indicates a significant difference in the improvement of mathematical problem-solving skills between students taught using the TTW learning model assisted by Geogebra software and those taught using the conventional learning model. To determine which is better, we can refer to the average Gains index listed in Table 3, where students in the experimental class get a higher average gains index than students in the control class. Thus, we can conclude that the improvement of students' ability to solve mathematical problems learned with the TTW model using geogebra software is more effective compared to students who follow the traditional learning model.

The findings of this study align with those of previous research by (Atikasari & Kurniasih, 2015; Hayati, 2018; Putri et al., 2023), namely the mathematical ability of students whose learning using TTW cooperative model acquires higher mathematical skills than students who obtain conventional learning. In addition, with the TTW learning model, the learning process in the classroom becomes more active (D. A. Azizah et al., 2022). Furthermore, (F. N. Azizah et al., 2023) mentioned that the Think Talk Write learning method can trigger ideas that exist in students. In the experimental class, students are given guidance to improve problem-solving skills through three stages, namely Think, Talk, and Write. This is as stated by (Hayati, 2018) who stated that students' problem-solving skills can be developed by using TTW strategy at each learning step.

In the think phase, students need to reflect on the problem presented by noting down the important things in their respective notebooks. So that these activities accommodate students to think about possible ways to find answers (Ganiati et al., 2018). The process that occurs in these activities is in line with the first and second problem-solving indicators, namely understanding the problem and planning the problem-solving. Where understanding a problem involves students knowing what they are looking for in a problem or problem, while planning a problem solving means that students can create sketches, drawings, models, formulas, or algorithms that are used to solve the problem. This has to do with the fact that problem-solving abilities are first related to the ability of learners to think when reading math texts or math story problems (Hadrimus et al., 2022). For the second problem-solving ability, this is related to what can be found in the reading process after students read the mathematics text, then make important notes from the text (Suryawati et al., 2019).

Next is the talk stage, at this stage students are required to be able to exchange ideas by discussing. Thus, the discussion is expected to produce solutions based on the understanding possessed by the students (Ganiati et al., 2018). The process that occurs in these activities is in line with the third problem-solving indicator, namely implementing strategies to solve problems. Where implementing strategies to solve this problem includes communication and discussion between friends in a language they understand (Sastrawan et al., 2017). This relates to the fact that the third problem-solving ability is related to the process of students in gathering and developing ideas through structured conversations (Istarani & Ridwan, 2014).

The last stage in this learning is the write stage to write the conclusion of the given problem solving. The activity carried out after the think and talk activity is to devote the results of both into a written (Ganiati et al., 2018). The process that occurs in these activities is in line with the fourth problem-solving indicator, which is interpreting the results obtained. Where interpreting the results obtained includes students constructing their own knowledge as a result of collaboration (Suryawati et al., 2019).This relates to the fourth problem solving ability related to recording the solution to the problem and calculating it according to the given problem (Sastrawan et al., 2017).

Meanwhile, in the control group, students applied conventional learning methods. The conventional learning model is learning by doing face-to-face classes in class, solving problems, and independent assignments. This means that conventional learning focuses more on face-to-face meetings between students and teachers that occur in the classroom and with this model, the material is delivered directly by the teacher (Suwarno, 2018). This causes low achievement in mathematics in students which greatly affects their ability to solve problems because the teaching and learning process is only focused on the teacher.

From this explanation, it can be observed that the experimental class utilizing TTW model demonstrates superior mathematical problem-solving skills compared to the control class, which employs a conventional learning model. However, (Suyanto, 2016) notes that the TTW learning model may be less time-efficient, as it requires students to independently construct concepts initially. If these concepts are not well understood, students may become overly reliant on their peers during the "talk" stage. Therefore, the use of Geogebra Software to optimize time in the teaching and learning process and to increase student learning motivation requires learning innovation by utilizing one of the digital tools, namely Geogebra (F. N. Azizah et al., 2023).

By using Geogebra Software, the material presented can be delivered effectively, because the dynamic image visualization can attract students' attention when learning statistics material in grade VII. Teachers no longer need to draw data that must be presented in the form of tables and graphs on the board which can be time-consuming, so students only take notes and get a few examples, which results in them not getting the opportunity to ask questions and solve problems properly.

CLOSING

Conclusion

The improvement in mathematical problem-solving skills among students using TTW model assisted by Geogebra Software is better than that of students using conventional learning models. This is evident from the comparison of test scores, where the experimental class using the TTW model achieved higher scores than the control class using the conventional model. Each step of the TTW learning model contributes to the development of mathematical problem-solving skills. Additionally, the integration of Geogebra software enhances the effectiveness of teaching time.

Saran

TTW model, assisted by Geogebra Software, aligns with the independent curriculum currently implemented in Indonesia's education system and can be considered a viable alternative for the learning process. Therefore, further research is needed to explore the effectiveness of the TTW model with Geogebra Software in enhancing other mathematical abilities and in shaping the profile of Pancasila students.

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