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Apllication of the Treffinger Model Assisted by Open-Ended Problems in Improving Students' Mathematical Problem Solving Ability

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Abstract

This research aims to describe the increase in students' mathematical problem solving abilities and students' responses through the application of the Treffinger model assisted by open-ended problems. This type of research is classroom action research carried out in three cycles. The subjects of this research were 25 students in class VII of SMP Islam Persada Didaktika in the odd semester of the 2023/2024 academic year. Based on data analysis, classically it shows that students' learning mastery has increased in each successive cycle, namely 24%, 64%, 84% with an average value of problem solving ability from cycle to cycle respectively, namely 59.2, 73.2, 81.6. Apart from that, students responded very positively to the treffinger model assisted by open-ended problems.

Keywords: Numbers, Mathematics, Open-ended, Problem solving, Treffinger.

1 INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals and skills needed by themselves, society, nation and state (Wibawa, 2017).

Problem solving ability is one of the most important abilities in mathematics. Problem solving skills must be applied from an early age because it will really help people in solving problems in everyday life (Ariawan & Nufus, 2017). Based on the explanation of the 2013 curriculum, NCTM and the opinions of several experts that have been described, it can be concluded that problem solving skills are very important for every student to have (La'ia & Harefa, 2021). However, mathematics learning is still considered less relevant to the goals and characteristics of mathematics learning, teachers rarely train students in solving problems individually or in groups and students are also less able to apply concepts in solving mathematical problems. As a result, students' mathematical problem solving abilities do not develop optimally.

The low problem solving abilities of students are also proven by the results of assessments conducted by the Trends in International Mathematics and Science Study (TIMSS) (Rambe & Afri, 2020) the average score is 397 while the international average score is 618. Conditions that are not much different can also be seen from the results of the PISA study which is more worrying, the study which began in 2000 placed Indonesia in 39th place out of 41 countries, in 2003 it was in 38th position from 40 countries, in 2012 it was in 61st position out of 65 countries and most recently in 2015 it placed Indonesia in 69th position out of 76 countries. Thus, the TIMSS and PISA studies revealed that Indonesian students were weak in solving non-routine questions related to

justification or proof, solving problems that require evidentiary reasoning, finding generalizations or conjectures and finding relationships between the data or facts provided. This shows that the abilities of junior high school students in Indonesia are very poor compared to other countries.

However, in reality, even though problem solving skills have a very important role in mathematics learning (Sumartini, 2016), what happens in school is often not in accordance with what is expected (Juliantari et al., 2018). This also happened at Persada Didaktika Islamic Middle School, especially in class VII. Based on the results of classroom observations and interviews with class VII mathematics teachers, information was obtained that students had difficulty understanding problems, planning solutions and carrying out mathematical problem solving, and students were reluctant to re-examine the results obtained. Students tend to only be able to answer routine questions, namely questions whose solutions are similar to the questions given previously. Apart from that, there are still many students who are reluctant to ask questions and express their opinions regarding the material studied and the questions discussed.

Apart from interviews with class VII mathematics teachers, researchers also conducted interviews with several students. From the results of the interview, students preferred to work on questions whose solutions were similar to the examples given by the teacher or examples in the book. Students are also less interested in working on story problems, because students still have difficulty changing problem sentences into mathematical sentences. This indicates that students cannot understand the questions well, so students cannot plan to solve the questions well. Apart from interviews and classroom observations, researchers gave initial tests to class VII to measure students' initial abilities in solving mathematical problems. The initial test results show that students' mathematical problem solving abilities in number material are still low. Of the 25 students, only 4 students got a score of 70 and 21 students got a score < 70. From this data, it is known that the mathematical problem solving abilities of class VII students at SMP Islam Persada Didaktika are still low or still below the set KBM, namely 70.

Based on these problems, the researcher has the following objectives: (1) Describe the increase in mathematical problem solving abilities of class VII students at SMP Islam Persada Didaktika through the application of the Treffinger learning model assisted by open-ended problems, and (2) describe the responses of class VII students at SMP Islam Persada Didaktika towards mathematics learning through the application of the Treffinger learning model assisted by open-ended problems.

2 RESEARCH METHODS

The method used in this research is Classroom Action Research which follows the Kemmis and Mc.Taggart model. The implementation of research activities was carried out over 3 cycles, where each cycle consisted of planning, implementation, observation and reflection. The research subjects were 25 class VII students. The research was conducted at Persada Didaktika Islamic Middle School in the odd semester of the 2023/2024 academic year, namely July to August. The data sources in this research are students and teachers. Students are to obtain data about problem solving abilities and student activities in the learning process in the classroom, while teachers are to see the effect of actions and the level of success in implementing the Treffinger model approach assisted by Open-Ended problems. The data collection techniques in research use test, observation, interview, documentation and questionnaire methods.

3 RESULTS AND DISCUSSION

This research was conducted from July to August 2023. Each cycle consists of several stages, namely: planning, implementation, observation and reflection. Before conducting research, researchers and collaborators discussed preparing a Learning Tool Plan using the Treffinger model approach with the help of Open-Ended problems, observation sheets and final tests carried out at the end of each cycle. The researcher, assisted by collaborators, observed each course of the learning process to see students' activities in solving mathematical problems and determine the development of the learning process and the influence of the actions of the Treffinger model assisted by Open-Ended problems on students' mathematical problem solving abilities. Based on the implementation of actions carried out over 3 cycles, data was obtained that students' mathematical problem solving abilities by applying the Treffinger model approach assisted by Open-Ended problems had increased. The results of observations made by researchers and collaborators can be seen in Table 1.

Table 1. Comparison of Student Learning Completeness

Completeness	Pre cycle	Cycle I	Cycle II	Cycle III
Complete	4 Student	6 Student	18 Student	21 Student
Not Finished Yet	21 Student	19 Student	7 Student	4 Student

From Table 1, it can be depicted in graphical, that is a figure about how many students completed in their learning, in Figure 1.

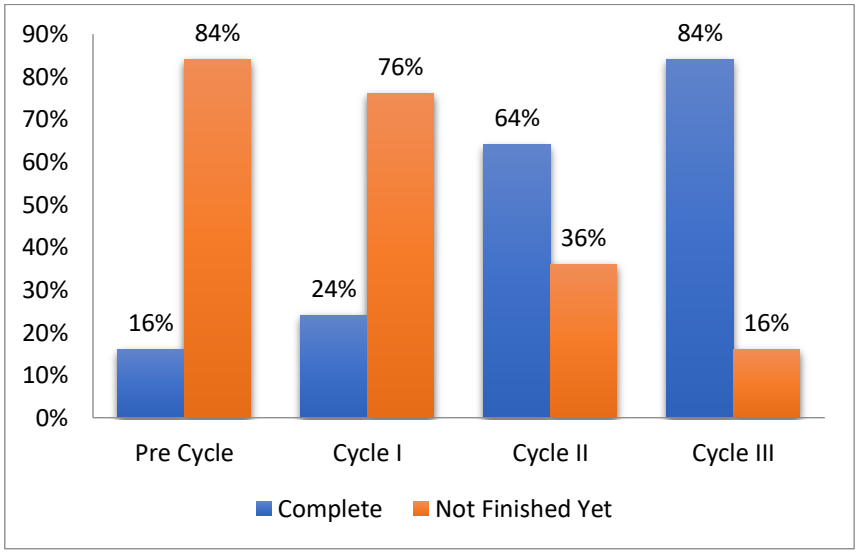


Figure 1. Student Learning Completeness

Based on the comparison graph of research completeness carried out by collaborators from cycle I to cycle III, there was an increase. In cycle I, students' ability to answer questions using the Treffinger model approach with the help of Open-Ended problems obtained a percentage of 24%, increased in cycle II to obtain a percentage of 64%, until in cycle III they obtained a percentage of 84%.

The application of the Treffinger model approach assisted by Open-Ended problems in the learning process has a good influence on mathematics learning so that it can improve students' mathematics learning outcomes. With learning carried out using the Treffinger model approach with the help of Open-Ended problems, students actively participate in learning, make students accustomed to discussing, so that students do not find it difficult to solve problems because they feel helped by discussion activities. The Treffinger model approach assisted by Open-Ended problems can also increase students' creativity in

answering questions. Even though there was no significant increase, it is enough to prove that the Treffinger model approach assisted by Open-Ended problems can generate students' ideas to be creative in answering questions. This is supported by Nohda's opinion stating that the aim of the Treffinger model of learning using Open-Ended problems is to help develop students' creative activities and mathematical thinking patterns through simultaneous problem solving (Erman Suherman, Revised Edition). So the Treffinger model approach assisted by Open-Ended problems is more appropriate to use in mathematics learning because this approach can facilitate students understanding hierarchically arranged ideas or concepts contained in mathematics (Delyana, 2015). With the increase in student interest in mathematics lessons, students have a positive attitude towards learning mathematics. Students feel happy and can be helped by learning carried out by discussion so that students can be motivated to understand every problem and take steps to solve the problem.

The increase in final test results for each cycle proves that students' mathematical problem solving abilities influence the learning outcomes obtained by students. By using the Treffinger model approach with the help of Open-Ended problems, it can improve students' mathematical problem solving abilities in number material so that students' mathematics learning outcomes can improve.

4 CONCLUSION

The Treffinger model approach assisted by Open-Ended problems in number material is applied well so that it can improve students' mathematical problem solving abilities in class VII SMP Islam Persada Didaktika. This can be seen in the final test results which continue to increase every cycle. In cycle I obtained a percentage of 24% with an average value of 59.2. Cycle II obtained a percentage of 64% with an average value of 73.2. Meanwhile, cycle III obtained a percentage of 84% with an average value of 81.6. So that students' ability to solve number problems becomes better.

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