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Application of MNR Learning in Improving Students' Mathematical Reasoning Ability

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Abstract

Mathematics learning in schools has the aim of teaching students about logical, analytical, systematic, critical and creative thinking as well as having the ability to cooperate. From this, learning mathematics should be able to improve students' mathematical reasoning abilities. This study aims to determine how *Matematika Nalaria Realistik* (MNR) learning can improve students' mathematical reasoning abilities and student responses to the application of MNR learning. This research is a classroom action research conducted in three cycles and involves 35 students of Madrasah Tsanawiyah. Data were obtained through written tests, class observations, interviews and questionnaires. The findings of this study are that MNR learning can help students improve students' mathematical reasoning abilities, evidenced by an increase in the total score obtained by students on aspects of mathematical reasoning ability from the 1st cycle to the 3rd cycle. In addition, students have a positive response to MNR learning. Teachers can apply MNR learning as an alternative method of learning mathematics to improve students' mathematical reasoning abilities.

Keywords: mathematical reasoning, MNR learning, students' ability.

1 INTRODUCTION

Education has an important role in ensuring the development and survival of a nation because education can form intelligent, smart and skilled human beings. Education is also able to realize quality and creative human resources or human resources and be able to compete in every challenge of technological progress that continues to develop. The way to achieve educational goals is through interaction in the learning process at school, systematically and also directed towards changing the behavior of each student as expected. Mathematics is one of the compulsory subjects taught at school. Mathematics is a lesson that is arranged in an orderly, logical. Especially for learning mathematics, students can use reasoning on patterns, traits, perform mathematical manipulations in making generalizations, compiling evidence, or explaining ideas from mathematical statements. Mathematical material and mathematical reasoning are two things that cannot be separated, namely mathematical material is understood through reasoning, and reasoning is understood and trained through learning mathematics (Handayani, 2013). In the School Mathematics Curriculum, mathematical reasoning and connection are two basic mathematical skills that must be mastered by high school students.

Unfortunately, in carrying out learning activities, mathematics teachers still use learning methods that use conventional methods, namely lectures, explaining material, and giving assignments or homework. This learning method makes students less able to explore the potential for mathematical reasoning so that students are less able to solve mathematical problems. Another fact shows that students' ability to solve story problems is still relatively low. Many students still cannot understand the meaning of story problems and change story problems into their mathematical form. Students are also still not

proficient in drawing conclusions from a problem (story questions), Even in analyzing and solving problems that use many formulas, most of the students still cannot solve them well. The problem was presented by Suprihatin, Maya, and Senjayawati (2018) as an obstacle faced by some Indonesian students because teachers are not involved in learning mathematics, so students become passive in receiving information conveyed by the teacher.

Teachers must be able to work out how to change the views of students who were previously reluctant to learn mathematics to become interested in learning mathematics and make students' mathematical reasoning power increase and be able to apply students' mathematical reasoning in everyday life in various ways. There are many ways to develop students' reasoning abilities, and according to Widiartana (2018), among others, teachers encourage students to be able to think logically by giving application questions in accordance with everyday life which are then converted into mathematical form. Students themselves can also develop reasoning abilities by learning to analyze something based on steps that are in accordance with mathematical theorems and concepts.

The use of the MNR learning approach in learning mathematics can be a means to develop students' reasoning abilities. This approach can be used because learning with this approach uses problems related to everyday life so students must be able to find ways to solve them with appropriate steps. The MNR learning approach is structured with reference to meeting the needs of children to learn. MNR is a mathematics learning concept that emphasizes the use of reasoning in understanding mathematics and using mathematics to improve reasoning power and problem solving skills, especially in everyday life (Pebriani et al., 2020). This means that to be able to understand mathematics, students are expected to use their mathematical reasoning and can be applied in everyday life.

Reasoning is a thought process that is carried out in a way to draw conclusions (Chen, Jia, & Xiang, 2020). Mathematical reasoning is thinking logically in solving mathematical problems (Abidin et al., 2020). Logical thinking is interpreted as a thinking activity by following a certain pattern or according to certain logic in solving problems. Mathematical reasoning is a thought process that connects known facts or evidence to a conclusion (Mandasari, 2021). So that mathematical reasoning can be said as drawing a conclusion by connecting the evidence and facts that have been known previously. Brodie stated that, "Mathematical reasoning is reasoning about and with the object of mathematics. Mathematical reasoning is reasoning about mathematical objects. Based on the opinions of the experts described above, it can be concluded that mathematical reasoning is a thinking activity to be able to draw a conclusion based on facts, evidence and relevant sources by paying attention to mathematical objects in the form of facts, concepts, principles and skills that have been proven to be true value.

Mathematical reasoning ability is the ability to understand mathematical ideas more deeply, observe data and explore implied ideas, compose conjectures, analogies and generalizations (Marufi, et al., 2022). In other words, a person's mathematical ability will be obtained not only by understanding mathematical concepts but also by analyzing and exploring implied mathematical concepts and being able to conclude them by following the rules of truth. Gardner states that mathematical reasoning ability is the ability to analyze, generalize, synthesize/integrate appropriate reasons and solve non-routine problems. Students' mathematical reasoning in learning mathematics needs to be developed. The indicators of students who have mathematical reasoning abilities are: (1) submitting conjectures, (2) performing mathematical manipulations, (3) compiling evidence, providing reasons/evidence for the correctness of the solution, (4) interesting conclusion of a statement, (5) checking the validity of an argument, (6) finding patterns or characteristics of mathematical phenomena to make generalizations (Novianda & Prabawanto, 2021). In other reference, Oktaviani, Herman, and Darhim (2022), indicators that show reasoning include: (1) presenting mathematical statements orally, in writing, drawings and diagrams, (2) submitting conjectures, (3) performing mathematical manipulations, (4) drawing conclusions, compiling evidence, providing reasons or evidence for several solutions, (5) drawing conclusions from statements, (6) checking the validity of

an argument, (7) determining the pattern or nature of mathematical phenomena to make generalizations.

Based on some of the opinions of the experts mentioned above, it can be concluded that mathematical reasoning ability is the ability possessed by a person to be able to think or formulate a truth, analyze and conclude a statement and be able to communicate it systematically, coherently and logically. then the indicators (aspects) of mathematical reasoning abilities studied are as follows: (a) the ability to present mathematical statements orally, in writing; (b) the ability to make allegations; (c) the ability to determine the pattern; (d) ability to predict answers and process solutions; (e) the ability to draw conclusions, or make generalizations.

Mathematical reasoning ability is needed in various aspects of life, because with mathematical reasoning, a person will have the ability to be able to solve a problem he faces appropriately, systematically, objectively, and able to express/communicate his opinion in a coherent and logical manner. Thus, students are expected to be able to use mathematical reasoning skills in everyday life and can also be used in other fields of science.

The MNR learning approach emphasizes the use of reasoning in understanding mathematics (Rusdin & Rusli, 2020). Realistic Understanding of MNR is concretizing a mathematical concept with structured steps according to the MNR steps (Rinata & Mariana, 2019). By MNR, students are taught to analyze problems, draw conclusions and solve problems with various logical problem solving methods. The MNR approach has several stages or learning syntax. This learning syntax is a way for students to understand mathematical concepts as a whole and meaningfully. There are six stages of the learning approach, namely as follows: (1) giving real problems, (2) understanding concepts, (3) reasoning and communication, (4) problem solving, (5) exploration and math games, (6) practice questions (Rusdin & Rusli, 2020).

2 RESEARCH METHODS

This study aims to determine how the application of MNR learning can improve students' mathematical reasoning abilities, as well as see students' responses to the use of MNR learning in the classroom. This study uses a qualitative approach with classroom action research methods. This research was conducted in three cycles, each cycle carried out in four stages, namely: planning, implementation, observation, and reflection.

The subjects involved in this study were 35 grade VII private MTs Students in the Bekasi area, West Java, Indonesia. The research instrument used by the researcher was in the form of observation sheets, test descriptions, and interviews. Observations were carried out in three cycles. Observation prior to conducting Classroom actions were carried out to check the level of students' initial mathematical reasoning. The test is given in the form of a posttest at the end of each cycle, while interviews are conducted after the learning cycle is complete.

The data obtained was then analyzed using the data analysis technique proposed by Arikunto (2013) which consisted of data reduction, data presentation, and data verification. At the data reduction stage, the researcher selects the data by classifying, simplifying and removing unnecessary data, then in presenting the data, the researcher organizes the data in a systematic and easy-to-understand way, thus enabling the researcher to draw conclusions. In data verification, the researcher interprets the data or draws conclusions from the results of the description of the data obtained, by looking for relationships, similarities, or differences as answers to existing problems. The data was validated by using data triangulation technique.

3 RESULTS AND DISCUSSION

The research findings regarding the overall mathematical reasoning ability of students are presented in Table 1. The results of tests on students' mathematical reasoning abilities conducted in the 1st cycles, 2nd, and 3rd, showed a significant increase in scores, the class average score was 65.71 and students who achieved/exceeded the class average score or more and had increased their mathematical reasoning ability in the 1st cycle as many as 45.71% of students, this was included in the medium category, in the 2nd cycle that the average score of the class increased to 73, and the number of students who achieved/exceeded class average value or more and there has been an increase in mathematical reasoning abilities as much as 65.71% of students, this is included in the high category, and in the third cycle the score again experienced an increase in the class average to 79,57 and students who achieved/exceeded the class average score or more and had experienced an increase in their mathematical reasoning ability as many as 88.57% of students, in the high category.

The results of the increase in scores indicate that the application of MNR learning is proven to help improve students' mathematical reasoning abilities. The results of this study are in line with a number of previous studies. Pambudi et al. (2021) found that MNR learning was able to improve students' mathematical communication skills, other researchers Pebriani et al. (2020) found that MNR learning could foster Creative and Innovative Problem Solving (CIPS), Rusdin and Rusli (2020) found that the MNR learning model contributes significantly to students' mathematical thinking skills, research conducted by Rohana and Ningsih (2019) found that there was an effect of using MNR on students' mathematics learning achievement, and Rusdin (2019) found that the application of the MNR learning model can improve students' reasoning power and problem solving abilities.

3.1 Student's Mathematical Reasoning Ability Test Results

The results of tests on students' mathematical reasoning abilities given to students at the end of each cycle can be seen as shown in Table 1.

Table 1. Percentage of Increase in Students' Mathematical Reasoning Ability

Rated aspect	Learning outcomes		
	1st Cycle	2nd Cycle	3rd Cycle
Grade Average	65.71	73	79.57
Students who achieved/exceeded the class average	45.71%	65.71%	88.57%
Students who have not achieved the class average	54.29%	34.29%	11.43%

Table 1 shows that the average class value in each cycle has increased from the class average value of 65.71 in the second cycle, there is a significant increase with a class average of 73, and in the third cycle the class average obtained is also increased to 79.57. Table 1 also shows that the number of students who have achieved/exceeded the class average score has increased in each cycle, in the first cycle the number of students who have reached/exceeded the class average score was 45, 71% students, in the second cycle as many as 45. 65.71% of students, and in the third cycle as many as 88.57% of students in the high category.

Based on the results of data acquisition as shown in Table 1, there has been an increase in the average score, indicating that the application of MNR learning is proven to help improve students' mathematical reasoning abilities.

3.2 Results of Student Responses to MNR Learning

Students' attitude scores were obtained by calculating the average score using weights. The scoring guidelines used by the researcher are for answers (1) disagree (2) disagree,

(3) agree, (4) strongly agree. The response of students' attitudes towards MNR learning given for three cycles can be seen in Table 2.

Table 2. Student Responses to MNR Learning

Information	1st Cycle	2nd Cycle	3rd Cycle
Maximum/ideal score	40	40	40
Earning score	23	29	38
Percentage	57.50%	72.50%	95.00%
Category	Low	Currently	Tall

Table 2 shows that student responses to the application of MNR learning in the 1st cycle were 57.50% of students answered strongly agree with the low category, in the 2nd cycle the student response to the application of MNR learning was 72.50% of students answered Strongly agree with the medium category, and at the 3rd cycle that students' responses to the application of MNR learning have increased as much as 95% of students who answered strongly agree with the High category. This shows that the response of students' attitudes towards the application of MNR learning is positive.

Description of Teacher's Feedback/Opinion. The first, the teacher stated that he had never been familiar with MNR learning, let alone applied it to the daily learning process. Second, at the beginning of learning students will need a long time to understand each question or command given. MNR learning will be really effective, if several things are considered, namely the time available, teacher preparation and readiness, and no less important is the readiness of the students themselves. Third, teaching materials and modules in MNR learning really help students understand the concept of the material being taught, because in this learning, before students understand the concept, they must first (re)discover the concept through teaching materials and the MNR Learning Module. Forth, for the form of reasoning questions, the new teacher knows him. Questions like that are rarely given to students at school. Fifth, in general, the teacher gave a positive response/view to problem-based learning, stating that MNR learning can be used as an alternative learning that can be implemented in the field.

4 CONCLUSION

Based on the research data obtained, it shows that the mathematical reasoning ability of the 7th grade students of MTs Attaqwa Putra experienced an increase from the 1st cycle to the 2nd cycle, and to the 3rd cycle after the MNR learning approach was implemented. This is shown by as many as 33 students experienced an increase in mathematical reasoning abilities based on the total score of aspects of mathematical reasoning abilities. The average percentage of test scores on mathematical reasoning abilities increased from 45.7% in the 1st cycle to 65.7% in the second cycle and to 88.57% in the 3rd cycle and in the high category. Based on the results of interviews and questionnaires, students' responses to mathematics learning related to students' mathematical reasoning increased from the 1st cycle, to the 2nd cycle, and to the 3rd cycle. Students have a positive response to learning MNR as an effort to improve mathematical reasoning abilities. These findings indicate that the MNR learning model can be an option for teachers to maximize students' learning activities in class and improve students' mathematical reasoning abilities. Further research is needed to prove the statistical effectiveness of using the MNR learning model to improve students' mathematical reasoning skills and abilities.

From the results of this research report, the researchers provide the following suggestions: (a) there is a need for follow-up in the next classroom action research, because the researcher realizes that the results of this research report still have weaknesses and shortcomings; (b) for the sake of perfection of the results of the learning improvement

report, researchers on another occasion will carry out classroom action research as an effort to improve the quality of lessons in their schools.

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