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Students' Mathematical Reasoning Ability Viewed from Self-Regulated Learning in the Missouri Mathematics Project Learning with Open-Ended Approach

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Abstract

The mathematical reasoning ability of class VIII students of SMP Negeri 1 Kedungwuni is still relatively low. The purpose of this study is to analyze and describe students' mathematical reasoning abilities in the MMP learning model with an open-ended approach in terms of students' self-regulated learning. The method used is a mixed method with an explanatory sequential design strategy. The results showed that: (1) students' mathematical reasoning abilities in the MMP learning model with an open-ended approach achieved classical mastery; (2) there is a positive influence of students' self-regulated learning on students' mathematical reasoning abilities in the Missouri Mathematics Project (MMP) learning model with an open-ended approach, namely 17.1%; (3) the average mathematical reasoning ability of students in the MMP learning model with an open-ended approach is better than the average mathematical reasoning ability of students in learning with a scientific approach; (4) there are differences in students' mathematical reasoning abilities in terms of students' self-regulated learning in the MMP learning model with an open-ended approach; (5) a description of students' mathematical reasoning abilities in terms of self-regulated learning in the MMP learning model with an open-ended approach, namely (a) students with high levels of self-regulated learning are able to fulfill all indicators of mathematical reasoning abilities well; (b) students with intermediate level self-regulated learning tend to be quite capable in all indicators of mathematical reasoning ability; (c) students with a low level of self-regulated learning tend to be able to present mathematical statements, but tend not to be able to fulfill the other three stages.

1. Introduction

Education is one way of forming human ability to use rationally as an answer in dealing with problems that arise in an effort to create a good future. Based on Law no. 20 of 2003 concerning the National Education System chapter 3, explains that national education functions to develop student abilities and shape dignified national character and civilization in the context of educating the nation's life. Education in Indonesia is needed to be able to train the next generation who are smart and have character so that they can develop Indonesia's progress.

Mathematics is one of the subjects that is the focus of education in equipping students to have the ability to think logically, critically, systematically, analytically, and creatively. Therefore, it is expected that students can master mathematics to make it easier to understand other fields of science. In accordance with what was explained by Regulation of the Minister of National Education Number 22 of 2006 concerning Mathematics Subject Content Standards, mentioning the objectives of learning mathematics, which among other things is for students to be able to: (1) Understand mathematical concepts, explain the interrelationships between concepts, and apply concepts or algorithms, in a flexible manner, accurate, efficient, and precise, in solving problems, (2) Using reasoning on patterns and properties, being able to

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perform mathematical manipulations in making generalizations, compiling evidence, or being able to explain mathematical ideas and statements, (3) Solving problems which include the ability to understand problems, designing mathematical models, completing models and interpreting the solutions obtained, (4) Communicating ideas with symbols, tables, diagrams, or other media to clarify situations or problems, and (5) Having an attitude of appreciating the use of mathematics in everyday life, namely having curiosity, attention, and interest in learning mathematics matic, as well as a tenacious and confident attitude in solving problems.

In accordance with one of the objectives of learning mathematics, namely using reasoning on patterns and properties, being able to manipulate mathematics in making generalizations, or being able to explain ideas from mathematical statements. In the process of learning mathematics, students need mathematical reasoning skills to solve problems by connecting concepts with the given problems. Based on the objectives of the learning, mathematical reasoning ability is one of the important abilities possessed by students. Students can add to their mathematical abilities with mathematical reasoning abilities, so that their mathematical abilities do not only memorize and remember (Khaerunnisa, 2022). In addition, mathematical reasoning abilities are included in indicators that are important for students to master in order to study advanced mathematics, including in developing higher-order thinking skills.

Learning to reason is not only needed by students, but in every aspect of life. Learning to reason enables us to determine and analyze every problem that exists, then to be able to solve problems appropriately, and to be able to express opinions and ideas in a coherent, clear, and logical manner (Herdiman, 2017). Mathematical reasoning ability is the ability to determine the right conclusions in an existing problem. The conclusions that will be obtained are characteristic reasoning, generalizations and ideas (Nawastiti et al., 2018).

Many factors affect the low ability of students' mathematical reasoning. One of them is mathematics itself which has a role as a product and process, meaning that students must understand the concepts, principles, laws, rules, and conclusions obtained and how to obtain all of that, the factors of teachers, parents, students, schools, and curriculum. The low ability of students' mathematical reasoning is also caused by the learning process which does not involve students in optimal situations for learning, so that learning tends to be teacher-centered, and classical (Nawastiti et al., 2018). In addition, students are less trained in working in groups to analyze mathematical problems, so that students rarely convey ideas to answer questions about the process analogous to the teacher.

Kedungwuni 1 Public Middle School is one of the high schools that implements the 2013 Curriculum in Pekalongan Regency. Based on an interview with a class VIII mathematics teacher at SMP Negeri 1 Kedungwuni, he said that the reasoning level of class VIII students at school was still at a low to moderate stage. Mathematical reasoning abilities have not been maximized by many students, because they still use only a scientific approach in learning, so they still focus only on teacher explanations. This makes students less interact in learning activities. In addition to the lack of mathematical reasoning abilities, it also has an impact on self-regulated learning (learning independence). This is in accordance with the data obtained from the results of daily assignments on the Cartesian Coordinate material which were attended by 32 students. From the results of the daily assignments, it was found that some students did not complete the questions properly. One of the daily assignment questions is as follows.

> 2. If line k is parallel to line m, and both are perpendicular to the Y axis, are the two lines the same distance from the X axis? Describe your solution.

The following are the answers to the daily assignment questions in Figure 1 from one of the students.

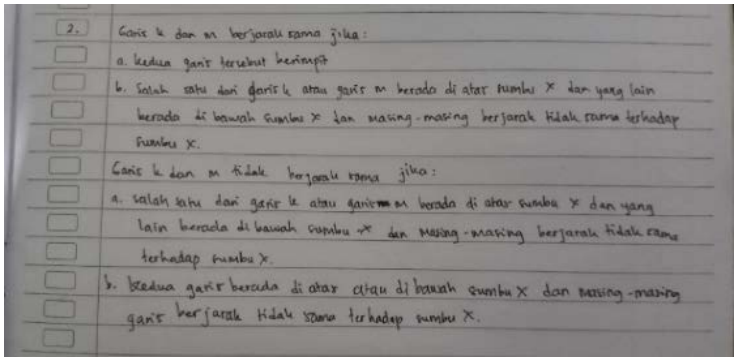

Figure 1. Answers to the Daily Task Questions

Can be seen in Figure 1 it is said that these students have not been able to understand a problem properly. Students have not been able to write down what problems are asked in the questions. Writing down the problems contained in the questions is an indicator of mathematical reasoning ability, namely determining patterns or mathematical properties to be able to make generalizations. In addition, in the field there are still many students who cannot choose learning strategies to be able to solve problems. Even though this is an indicator of self-regulated learning.

One effort to improve students' mathematical reasoning abilities is to use appropriate learning models. One learning model that can be used to improve students' mathematical reasoning abilities is using the Missouri Mathematics Project (MMP) model. The MMP Learning Model is one of the structured mathematics learning models with the development of ideas and the expansion of mathematical concepts accompanied by practice questions in the form of groups or individually, through this MMP model students are given the opportunity to think in groups in solving problems given by the teacher related to the material learning (Muhsin et al., 2020). The MMP model can develop students' mathematical reasoning abilities, this is proven from learning using the MMP model can achieve classical mastery, so it can be said that learning using the MMP model is better than the scientific approach (Wahyudi & Walid, 2020).

The steps for implementing the MMP learning model are: (1) review, (2) development, (3) cooperative work, (4) independent work, (5) assignments (Rivai & Surya, 2017). The advantage of the MMP learning model based on these five steps is that there is a lot of material that can be conveyed to students because it does not take much time. In addition, there are many exercises that will make students skilled with various questions, this can improve students' mathematical reasoning abilities.

Problems in mathematics are divided into two, namely closed and open. Closed problems have only one answer, while open problems have more than one correct answer or have many forms of problem solving. The open-ended approach is a learning approach that provides many opportunities for students to solve problems in various ways to get more than one correct answer, then discuss them to compare with the results of work (Winardi et al., 2018). Through an open-ended approach it will help students to train in using their creativity in solving problems in many ways so as to improve students' reasoning abilities and student learning outcomes (Winardi et al., 2018).

Students' mathematical reasoning abilities will get better so that an attitude is needed where students no longer rely on learning material from the teacher alone, but students themselves are able to find books or other sources of information, one of the attitudes in solving these problems is self-regulated learning to find information from various basic knowledge, so that students can make the right decisions (Fajriyah et al., 2019).

Self-regulated learning or independent learning is an active and constructive process, namely diagnosing learning needs by regulating and controlling performance, cognition, motivation and behavior to see difficulties as a challenge, so that students can evaluate the process and learning outcomes of a learning process (Nawastiti et al., 2018). The indicators of self-regulated learning in this study are: (1) having the initiative and motivation to learn, (2) diagnosing learning needs, (3) viewing a difficulty as a challenge, (4) setting learning goals or targets, (5) choosing and implementing learning strategies, (6) monitoring, organizing, and controlling learning, (7) utilizing and finding relevant sources, (8) evaluating learning processes and outcomes, (9) self-concept or self-ability (Fajriyah et al., 2019).

Based on this background, this study aims to find out (1) to test the mathematical reasoning abilities of class VIII students in the MMP learning model with an open-ended approach can achieve classical mastery, (2) to test students' mathematical reasoning abilities in the MMP learning model with the open-ended there is an increase, (3) to test the mathematical reasoning abilities of students taught by the MMP model with an open-ended approach is better than the mathematical reasoning abilities of students taught by a scientific approach, (4) to test students' mathematical reasoning abilities in terms of self-regulated learning in the MMP learning model with an open-ended approach there is an increase, (5) to describe students' mathematical reasoning abilities in terms of self-regulated learning in the MMP learning model with an open-ended approach.

2. Method

This research was mixed model research, which combines quantitative research and qualitative research. The research design was used a sequential explanatory design. The population in this study were class VIII students of SMP Negeri 1 Kedungwuni for the 2022/2023 academic year. Sampling by simple random sampling was obtained from class VIII C (control group) and VIII E (experimental group). Subjects in the

qualitative research were taken from the experimental group with purposive sampling, 6 students were selected consisting of 2 students in each self-regulated learning group.

Quantitative data analysis techniques in this study were carried out to test hypothesis 1, namely whether the mathematical reasoning abilities of class VIII students of SMP Negeri 1 Kedungwuni could achieve classical mastery? Hypothesis 2 test was used to test whether there was an effect of self-regulated learning on the mathematical reasoning abilities of class VIII students of SMP Negeri 1 Kedungwuni in the MMP learning model with an open-ended approach? Testing hypothesis 3 was used to test the average mathematical reasoning ability of class VIII students of SMP Negeri 1 Kedungwuni in the MMP model with an open-ended approach better than the average mathematical reasoning ability of students using a scientific approach. Hypothesis 4 was used to test whether there were differences in mathematical reasoning abilities in terms of self-regulated learning for class VIII students of SMP Negeri 1 Kedungwuni in MMP learning with an open-ended approach. Qualitative data analysis was carried out in stages: data reduction, data presentation, and drawing conclusions. After that, technical triangulation was carried out, namely examining data from the same source using different techniques.

3. Results and Discussion

3.1 Quantitative Data Analysis

Based on the results of the normality and homogeneity tests of the final data from the results of the final test scores for the mathematical reasoning abilities of the experimental group and the control group, it shows that the data is normally distributed and homogeneous. The research data is data on the final test scores of mathematical reasoning abilities and analyzed by normality test, homogeneity test, proportion test, simple linear regression test, two mean difference test, and one way analysis of variance test (One Way Anova). Based on the results of the analysis of the normality and homogeneity tests of the data and test scores using SPSS, it shows that the data is normally distributed and homogeneous. Then a classical learning mastery test was carried out with a proportion test.

Calculation of hypothesis 1, it was found that as many as 28 students out of 32 students had achieved individual mastery or had exceeded the maximum completeness criteria. The proportion test is used to determine whether the percentage of classical learning completeness of the experimental group students reaches the predetermined percentage of 75%. Test criteria: reject H_0 if $z_{count} \geq z_{(0.5-\alpha)}$, where$z_{(0.5-\alpha)}$ is obtained from the standard normal distribution list with probability $(0.5 - \alpha)$. Based on the calculations obtained, $z_{count} = 2.04$, with $\alpha = 5\%$ obtained $z_{table} = 1.64$. Obviously, $z_{count} = 2.04 \geq z_{table} = 1.64$, then H_0 is rejected. Thus, the percentage of students who complete individual mathematical reasoning abilities using the MMP learning model with an open-ended approach is more than or equal to 75% of the total number of students in the class, which is 87.5%. This is in line with the results of research (Wahyudi & Walid, 2020) that students' mathematical reasoning abilities in applying the Missouri Mathematics Project learning model achieve classical mastery.

Test hypothesis 2, based on the results of a simple linear regression analysis test, the equation is obtained$\hat{Y} = 33.595 + 0.678$X is linear, and the regression direction coefficient is significant. Based on calculations using SPSS obtained $Sig = 0.019$. Because $Sig < 0.05$, then H_0 is rejected. That is, a linear equation or there is a relationship between self-regulated learning and students' mathematical reasoning abilities in the MMP learning model. Because it has a positive value, it means that the relationship between self-regulated learning and students' mathematical reasoning abilities is positive, or it can be said that an increase in students' self-regulated learning will increase students' mathematical reasoning abilities. The contribution of self-regulated learning to students' mathematical reasoning abilities is indicated by the coefficient of determination (R^2) of 0.171, which is 17.1%. This is also in line with the results of research (Fajriyah et al., 2019) which states that student learning independence has a positive effect on students' mathematical reasoning abilities so that the higher the student's learning independence, the higher the students' mathematical reasoning abilities.

There are several other factors of 82.9% which can affect students' mathematical reasoning abilities such as affective and cognitive factors. This is supported by research (Cahya et al., 2021) which states that affective factors that can affect mathematical reasoning abilities besides learning independence are learning anxiety. This is evidenced by the results of interviews, where subjects E-05 and E-24 were asked to explain again how to solve question number 2, subjects E-05 and E-24 answered in quite a long time while these students were quite capable of answering the questions in the right way. . Then, when asked why it took so long to answer, the student replied that he was afraid if the answer was wrong and incorrect. This is in line

with research (Munasiah, 2016), learning anxiety has a direct negative effect on mathematical reasoning abilities, and if mathematical reasoning abilities are to be optimally improved, it is necessary to reduce or minimize feelings of anxiety, worry, or fear of mathematics when studying. One of the cognitive factors that can influence mathematical reasoning ability is mastery of mathematical concepts. This can be proven by the results of interviews, where subjects E-05 and E-24 were asked to re-explain the steps in answering question number 6, subjects E-05 and E-24 were unable to answer them correctly. Then, when asked why he could not answer question number 6, the student realized and admitted that he had not mastered the material or had not mastered the concept of the material. This is in line with research (Akuba et al., 2020) that there is a positive direct effect between mathematical reasoning abilities on the level of mastery of mathematical concepts, meaning that the more skilled students are in their mathematical reasoning abilities, the higher the level of mastery of these students' concepts in mathematics lessons, and conversely, if students' mathematical reasoning abilities are low, their level of mastery of concepts will also be low.

Test hypothesis 3, test the difference between the two means. The test criteria are to accept H_0 if $t_{count} < t_{table}$, with $t_{table} = t_{(1-\alpha)(n_1+n_2-2)}$, 5% significance level, and $dk = n_1 + n_2 - 2$. Based on the calculation, $t_{count} = 2.10$, while with α = 5% and dk = 32 + 32-2 = 62, $t_{table} = 1.67$. Obviously $t_{count} = 2.10 \geq t_{table} = 1.67$, then H_0 is rejected. This means that the average achievement of students' mathematical reasoning abilities in the MMP model with an open-ended approach is more than the average mathematical reasoning ability in the scientific approach. This is in line with the research results of Muhsin et al., (2020) that there was an increase in the learning independence of students who received the Missouri Mathematics Project (MMP) learning model better than students who received conventional learning models.

Test hypothesis 4, based on the results of the One Way Anova test obtained $F_{count} = 54.045 > F_{table} = 3.32$. This means that there are differences in students' mathematical reasoning abilities in terms of self-regulated learning. Followed by the Scheffe test, it is known that (1) the average mathematical reasoning ability of students in the upper self-regulated learning group is better than the average mathematical reasoning ability of students in the middle self-regulated learning group, (2) the average mathematical reasoning ability of students in the upper self-regulated learning group is better than the average mathematical reasoning ability of students in the lower self-regulated learning group, (3) the average mathematical reasoning ability of students in the middle self-regulated learning group is better than the average mathematical reasoning ability of students in the self-regulated group lower learning. It is clear that the average mathematical reasoning ability of students with the upper self-regulated learning group is better than the average mathematical reasoning ability of students with the middle and lower self-regulated learning groups. This is reinforced by research (Zannati et al., 2018) that student learning independence can help develop students' mathematical reasoning abilities, this can be seen in students with high learning independence have higher learning achievement than students with moderate learning independence and learning independence low.

3.2 Qualitative Data Analysis

Based on the results of the analysis on the students' self-regulated learning questionnaire, the student grouping data is obtained which is listed in Table 1 as follows.

Table 1. Results of Self-Regulated Learning Questionnaire Analysis

Group	Interval	The Number of Students
Upper	$84 \leq score < 120$	6
Central	$71.6 \leq score < 84$	21
Below	$0 \leq score < 71.6$	5

Based on Table 3.2.1, for each characteristic six students were selected as research subjects to analyze mathematical reasoning abilities in depth. Research subjects were selected based on the upper, middle, and lower levels of self-regulation. The research subjects for self-regulated learning are E-28 and E-32. The research subjects for middle self-regulated learning are E-08 and E-20. The research subjects for lower self-regulated learning are E-05 and E-24. The grouping of research subjects is listed in Table 2 as follows.

Table 2. Research Subject

Self-Regulated Learning Category	Student Code	Mathematical Reasoning Ability Test Scores	Self-Regulated Learning Questionnaire Value
Upper	E-28	100	85
	E-32	100	90
Central	E-08	92	72
	E-20	95	76
Below	E-05	65	70
	E-24	60	70

Analysis of students' mathematical reasoning abilities in terms of self-regulated learning in the MMP learning model with an open-ended approach was carried out by analyzing the results of tests of mathematical reasoning abilities and interview results. This section shows a discussion of students' mathematical reasoning abilities by comparing the results of tests of students' mathematical reasoning abilities and the results of interviews to obtain a description of students' mathematical reasoning abilities based on the level of students' self-regulated learning. There are steps of mathematical reasoning ability that are used as indicators in compiling interview guidelines are as follows: presenting mathematical statements, perform mathematical manipulation, determine the pattern or nature of mathematical phenomena, and draw conclusions and check validity

Presentation of the data in this study included a description of mathematical reasoning abilities and then divided into groups of mathematical reasoning abilities based on the results of tests of mathematical reasoning abilities and interviews. Drawing conclusions pays attention to the results of the mathematical reasoning ability tests and the results of the interviews. Then the researcher triangulates the results of the mathematical reasoning ability tests and the results of the interviews to check the validity of the data and concludes a description of mathematical reasoning abilities in terms of self-regulated learning. The following is a description of students' mathematical reasoning abilities in terms of self-regulated learning:

a. Students' Mathematical Reasoning Ability Viewed from Upper Self-Regulated Learning

There are two research subjects in the upper group self-regulated learning category, namely subjects E-28 and E-32. Top-level self-regulated learning subjects tend to have high mathematical reasoning abilities. The test scores for mathematical reasoning abilities obtained by subjects in the upper-level self-regulated learning group tended to be higher than those in the lower-level self-regulated learning group. Based on the results of the analysis of the students' mathematical reasoning abilities in the upper-level self-regulated learning group, it was found that subjects E-28 and E-32 were able to meet the indicators of mathematical reasoning abilities. For indicators of presenting mathematical statements, subjects E-28 and E-32 are able to write down the elements and identify questions correctly. For indicators of doing mathematical manipulation, subjects E-28 and E-32 were able to answer questions by linking the problem concepts well. For indicators to determine patterns or the nature of mathematical phenomena, subject E-28 and E-32 can also determine problem patterns to make generalizations. For indicators of drawing conclusions and checking the validity, subject E-28 and E-32 are able to conclude answers and check the validity of the answers by providing information proving the right or wrong of the answers to the questions that have been given.

From the results of interviews conducted with subjects E-28 and E-32, information was obtained that the self-regulated learning of subjects E-28 and E-32 was at a high level. For all the problems in the item questions can also be solved properly. This is in line with research (Isnaeni et al., 2018) which states that students with good reasoning are more likely to have better learning independence than students with less reasoning abilities.

b. Students' Mathematical Reasoning Ability Viewed from Central Self-Regulated Learning

Based on the results of the analysis of the students' mathematical reasoning abilities in the mid-level self-regulated learning group. Information was obtained for indicators of presenting mathematical statements, subject E-08 was able to write down the elements and identify questions, but in item number 6, 7, 8 they had not written down the elements of problem identification completely. Subject E-20 for indicators presenting consistent mathematical statements for writing elements and identifying questions. For

indicators of doing mathematical manipulation, subject E-08 was consistent in answering questions by linking the question concepts correctly. Likewise with subject E-20, but in question number 10 they were not able to answer the question by correctly linking the concept to the question because there were still errors in the answers. For indicators to determine the pattern or nature of mathematical symptoms, subject E-08 has been consistent in finding problem patterns to make generalizations. Likewise subject E-20, but in question number 10 subject E-20 has not been able to find the pattern or nature of mathematical symptoms. For indicators of drawing conclusions and checking the validity, in item number 3 subject E-08 has not been able to conclude answers and check the validity of the answers by providing information proving the right or wrong of the answers to the questions that have been given. Likewise, the E-20 subject was able to draw conclusions and check the validity of the answers properly.

From the results of interviews conducted with subjects E-08 and E-20, information was obtained that self-regulated learning for subjects E-08 and E-20 was at the middle level. For all the problems in the item questions, there are still a number of questions that cannot be resolved properly. Subjects E-08 and E-20 may try again in another way, so they can get answers that they think are correct. . This is in line with research (Astuty et al., 2019) which also states that different categories of learning independence will have an impact on students' understanding of mathematical reasoning abilities.

c. Students' Mathematical Reasoning Ability in terms of Self-Regulated Learning Below

Based on the results of a qualitative analysis of the lower group students' mathematical reasoning abilities. Information was obtained for indicators presenting mathematical statements, subjects E-05 and E-24 were able to write down the elements and identify questions consistently. For indicators of performing mathematical manipulation, subject E-05 was only able to answer questions by linking the concept of the question to item numbers 1, 2, and 3, while subject E-24 was unable to answer questions by linking the problem concept to item numbers 4, 5, 6, and 7. For indicators determining the pattern or nature of mathematical symptoms, subject E-05 was only able to find problem patterns to make generalizations on items 1, 2, 3, and 4, while subject E-24 was only able to find problem patterns to make generalization on items 1, 2, 8, 9, and 10. For indicators draw conclusions and check validity. Subject E-05 was only able to conclude answers and check the validity of the answers by providing information proving the right or wrong answers to the questions given in item numbers 2, 3, 4, 5, and 9. Subject E-24 was only able to conclude answers and check the validity of the answers by providing information proving the right or wrong of the answers to the questions that have been given in item numbers 1, 2, and 8.

From the results of interviews conducted with subjects E-05 and E-24, information was obtained that the self-regulated learning of subjects E-05 and E-24 was at the lower level. For all the problems in the item questions, there are still a number of questions that cannot be resolved properly. Subjects E-05 and E-24 may try again in another way, so they can get answers that they think are correct. This is in line with research (Nurwijayanti et al., 2017) that students who have low mathematical abilities still have difficulty solving problems.

Based on the analysis of mathematical reasoning abilities, it was found that students with the same self-regulated learning group did not always have the same mathematical reasoning abilities. A summary of students' mathematical reasoning abilities in terms of self-regulated learning can be seen in Table 3 below.

Table 3. Summary Description of Mathematical Reasoning Ability

Student Code	Mathematical Reasoning Ability Indicator			
	1	2	3	4
E-28	√	√	√	√
E-32	√	√	√	√
E-08	-	√	√	-
E-20	√	-	-	√
E-05	√	-	-	-
E-24	√	-	-	-

4. Conclusion

Based on the results and discussion that has been carried out in this study, the following conclusions are obtained: (1) the mathematical reasoning ability of class VIII students through the MMP learning model with an open-ended approach has achieved classical mastery, namely 87.5%; (2) there is a positive effect of self-regulated learning on the mathematical reasoning abilities of class VIII students of SMP Negeri 1 Kedungwuni through the MMP learning model with an open-ended approach, namely 17.1%; (3) the average mathematical reasoning ability of class VIII students of SMP Negeri 1 Kedungwuni through the MMP learning model with an open-ended approach is better than the average mathematical reasoning ability of students using a scientific approach; (4) there are differences in students' mathematical reasoning abilities in terms of self-regulated learning in the MMP learning model with an open-ended approach. The average mathematical reasoning ability of students in the upper self-regulated learning group is better than the average mathematical reasoning ability of students in the middle and lower self-regulated learning groups; (5) the description of mathematical reasoning abilities in terms of students' self-regulated learning through the MMP learning model with an open-ended approach is as follows: (a) students with upper-level self-regulated learning tend to be able to present mathematical statements, manipulate mathematics, determine patterns or characteristics mathematical symptoms and students can draw conclusions and check validity properly; (b) students with mid-level self-regulated learning tend to be quite capable of presenting mathematical statements, performing mathematical manipulations, determining the pattern or nature of mathematical phenomena and are quite capable of drawing conclusions and checking validity; (c) students with low-level self-regulated learning tend to be able to present mathematical statements, but are still lacking in doing mathematical manipulation, determining the pattern or nature of mathematical phenomena and drawing conclusions and checking validity.

Based on the conclusions above, the following suggestions can be given: (1) mathematics teachers at SMP Negeri 1 Kedungwuni can use the Missouri Mathematics Project learning model as an alternative learning model to improve mathematical reasoning abilities; (2) to find out students' self-regulated learning, the mathematics teacher at Kedungwuni 1 Middle School can distribute self-regulated learning instruments to students periodically, for example at the beginning of every odd semester; (3) the results of this study found that the level of mathematical reasoning ability of most students was still low, especially in the middle and lower self-regulated learning groups, it was hoped that the teacher could guide students in both groups more intensively; (4) the use of an open-ended approach in the learning process can be used as an alternative for teachers to develop students' mathematical reasoning abilities

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