Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.8, No.21, 2017

An Analysis of Students' Mathematical Reasoning Ability using Metacognitive Strategy Based-Learning in Malay Culture among Junior High School Students

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Abstract
This study aimed to determine mathematical reasoning ability (MRA) taughts using metacognitive strategy based-learning in Malay Culture to students at SMPN 4 Sei Suka. The study was carried out to five students of the eighth graders at SMPN 4 Sei Suka. Data were obtained from both mathematical reasoning ability test (MRAT) and interview. The data were analyzed descriptively. Based on the study, it was found that students' MRA was still below students' learning outcome, but students from Malay Etnic who have been taught using metacognitive strategy in Malay Culture were found to gave better reasoning ability than students from other ethnics. In addition, metacognitive strategy plays an important role to enhancing students' MRA.
Keywords: mathematical reasoning ability, metacognitive strategy, malay culture

1. Introduction

When learning mathematics, it is important for students to have some abilities (standard process) which has been standardized by National Council of Teacher Mathematics (NCTM). One of the abilities is reasoning abilities. In other words, reasoning ability is essential and has to be mastered by students.

Reasoning is a thinking process by using data or facts in drawing a conclusion. Having a good reasoning ability enables students to comprehend mathematics more easily. This is because of the structure and the strong connection within the concepts of mathematics itself. In addition, reasoning abilities is also very useful for students to solve problems in daily life. This is in line with what Lither (2008) stated that reasoning is a thought that was adopted to produce statement and reach a conclusion to solve problems, which is not always based on the formal of logical ways of thinking that is not limited by evidence .

When learning mathematics, reasoning ability plays important role to help students to solve mathematic problems. Thus, students should be guided so that they are able to have a good MRA. According to Brodie (2010), mathematical reasoning is reasoning related to mathematical objects. In fact, with MRA, students are easily to comprehend mathematic and the whole objects contained. It is also in line with what Napitulu, Suryadi and Kusumah (2016) stated that if a problem solving roles as the heart of mathematics, so a mathematical reasoning roles as a heart of mathematical problems solving. Based on this matters, it is clear that mathematical reasoning is an ability that must be owned by students when learning mathematics.

Researchers have obtained studies related to MRA using various learning models. One of the researcher is Kramarkski and Mevarech (2003) who used cooperative learning model and metacognitive training in their study. In this case, Kramarski and Mevarech investigated students' performance in three measurements; graphic of investigation, graphic of construction and questionnaire of metacognition. Other research was also obtained by Napitupulu, Suryadi and Kesumah (2016) by using problems based-learning. In the study, it was found that students' mathematical reasoning using problems based-learning increased compared to regular learning.

One of learning strategies that has positive influence to MRA is metacognitive strategy. It was clearly stated by Borich (1996) that metacognitive is a strategy to implement and monitor a model of thinking that involves learners' reasoning, and focus on the use of the reasoning. In this case, it is clear that the focus of metacognitive strategy is the reasoning of students. In addition, Nur (2000) stated that metacognitive was related to the students' knowledge about their own thinking and their own abilities to use learning strategies and certain capabalities appropriately. Therefore, students should be taught about startegies to assess their own understanding, calculate duration needed to learn something and choose an effective plan to study or solve problems. Based on this matters, it is clear that metacognitive strategy direct students to use reasoning (thoughts, comprehension and their prior knowledge) in solving mathematical problems. The following illustration is metacognitive strategy in order to acquire MRA.

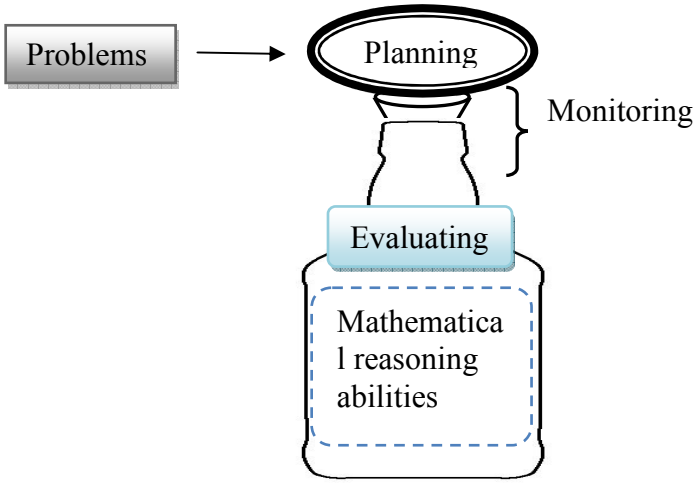


Figure 1. Metacognitive Strategy to Acquire MRA

In terms of educating students, we can not separate it with their culture. This is in line with Aristotle opinion (2008) that it is strange if the regulators of educational system believe that to make a well-behaved and moral country, they must educate its citizens through rules yet philosophy, law or customs rules. Thus, in educating students, cultural elements can not be separated.

Moreover, culture is very important in learning process since it was very clearly related to students. Culture is a common thing that is often seen and applied by students in everyday life. So, it has led to the fact that the existence of cultural elements as problem-based learning is able to attract students' attention. This is in accordance with Rutherford and Ahlgren (1990) that students should be given problems that appropriate with the level of their thinking maturity that requires them to think about the relevant evidence and state their own interpretation. Based on that condition, by providing contextual issues, it was resulting students to use their knowledge and observations to solve the problems given so that they do not feel bored and can express ideas of their knowledge so that they can give satisfactory results for themselves.

Based on the descriptions above, researchers think that it is important to obtain a study about "An Analysis of Students' Mathematical Reasoning Ability Using Metacognitive Strategy Based-Learning In Malay Culture Among Junior High School Students". Through this study, it was found the ability of students' mathematical reasoning and the role of Malay Culture in using metacognitive strategy towards MRA of students at SMPN 4 Sei Suka.

2. Research Method

Before the study was conducted, the researchers have conducted preliminary observations in order to find out the difficulties faced by students when learning mathematics. Observation was conducted by interviewing the teacher. From the result of observation, it was found that students found it difficult to do mathematics questions and did not find learning mathematics interesting. Meanwhile, in MRA, based on interview result, the teacher admitted that she/he had never applied such learning because of the thoughts of students might find difficulties to acquire the ability.

Next, the researchers designed a learning device (Lesson Plan), teacher's guide book, student book, students worksheet, and MRAT (MRAT) with metacognitive-based strategy using contextual problems that led to an increase of students' MRA. This contextual problem is problem around students which in Malay Culture.

Further study was conducted by giving a treatment to students in advance. The treatment is learning based on metacognitive strategy using the contextual problems. Learning took place in three sessions in which at each meeting students were given metacognitive strategy based-learning, and students were given a set of learning device.

The population in this study was students of class VIII-1 SMP Negeri 4 Sei Suka which consisted of 30 persons where Malay Culture as the dominant culture, Javanese and Batak. The sample of the study was 5 students of class VIII-1 SMP Negeri 4 Sei Suka who represented the overall students in terms of capabilities and culture. One person has high capability of Batak Culture, 2 persons has moderate capability of Malay Culture, one person has low capability of Malay Culture and one has low capability of Javanese culture. The classification of students ability referred to students' daily test scores, students who have grades above minimal mastery criteria (MMC) (70) included in the high category, the students whose grade are at MMC in medium category and the student who has the lowest value in the class are in the low category. In addition, the determination of the subjects also involves students' ethnicity. The determination of students' classification was based on interviews that researchers conducted to the subject teachers in class VIII. Here is a selection scheme of

the sample:

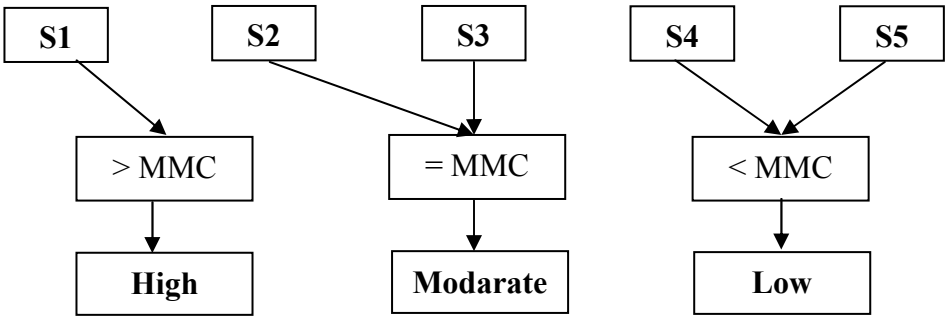


Figure 2. Selection scheme of the sample

Instruments in this research are MRAT and interviews. MRAT is used to determine the level of students' mathematical reasoning, while the interview that contains open questions aimed to clearly determine the difficulties that students encountered in doing mathematical reasoning test.

MRAT is arranged by providing a problem/situation and followed by five questions that contain mathematical reasoning abilities indicators defined by the researchers as follows: 1) suggesting assumption; 2) performing mathematical manipulations: 3) drawing conclusions from a statement and give an argumentation; 4) drawing conclusions, compiling evidence, giving reasons or evidence for validity of the solution; 5) finding a pattern or characteristic of mathematical indication and creating generalizations. MRAT consists of one question that includes five points of questions, point a has indicator 1, point b has indicator 2, point c has indicator 3, point d has indicator 4, and point e has indicator 5.

The technique of the data analysis in this study is descriptive. The entire finding of the study was described without specific statistical tests.

For more details, the following scheme is the procedure of this study:

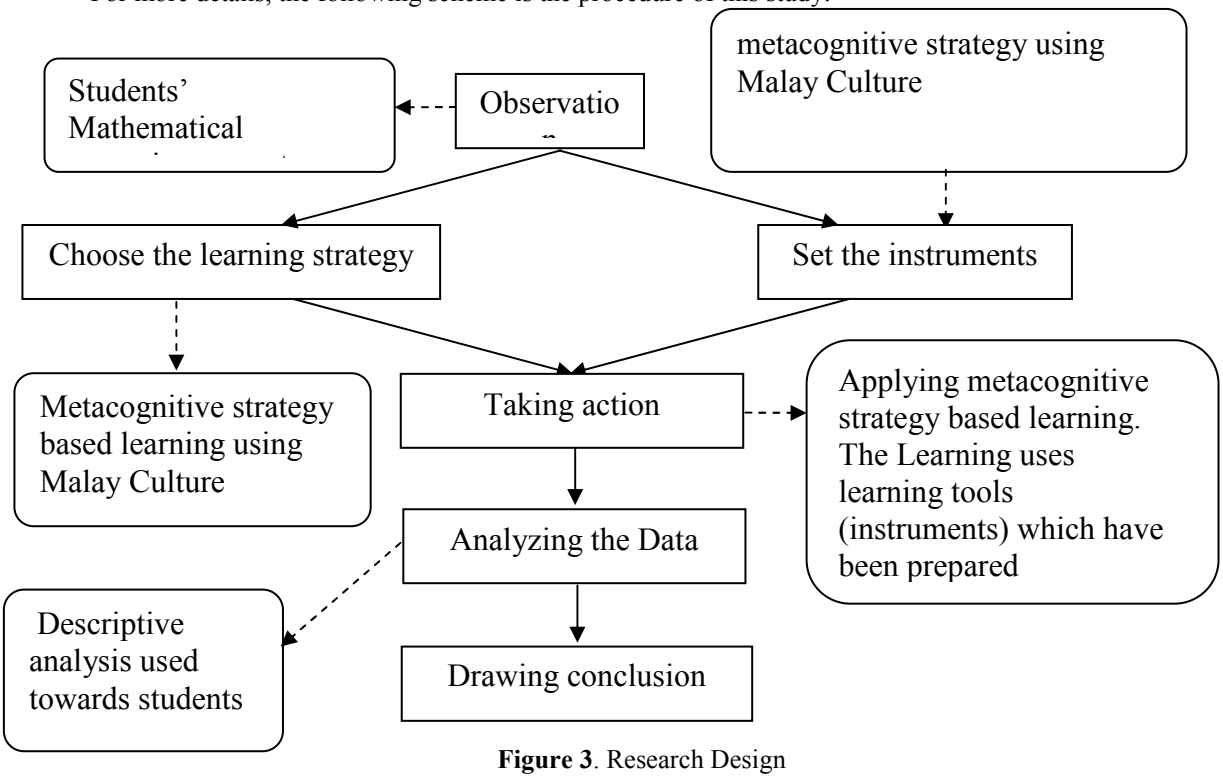


Figure 3. Research Design

3. Research Results

Based on the analysis, test score of MRA was found from five students which is shown in the following table:

Table 1. Students' MRA

Student	Score	Category
S2	80	High
S1	70	Moderate
S3	60	Low
S4	30	Low
S5	30	Low

Table 1 showed that there is a problem with these students' MRA. It could be seen from the test score acquired by the students. Students with moderate-score category (daily test score = 70) obtained MRA score 60. The same happened to students with low-score category who obtained MRA score 30. This showed that students' MRA have not met the standard score of MMC. Below is the comparison graphics of students' MRA and standard score MMC that students should be achieved.

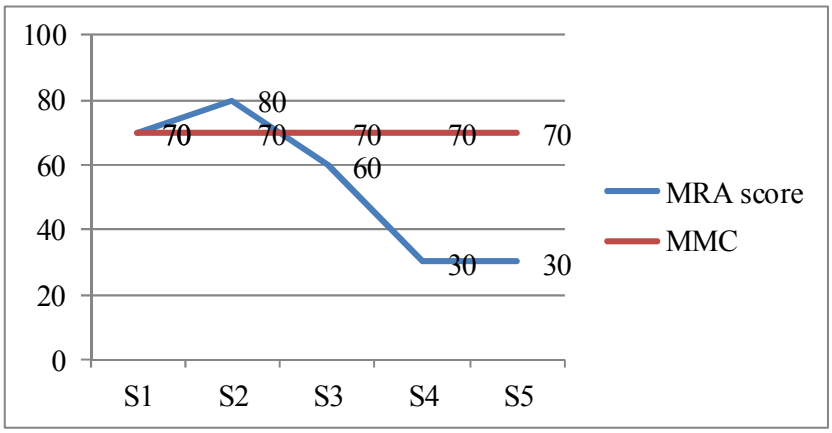


Figure 4. Comparison of students' MRA score and MMC

Graphics above showed students' MRA score and the standard score/MMC. From the graphs, it could be seen that mathematical reasoning was difficult to be understood by students. Out of 5 students, 3 were found to have MRA that is lower than the MMC. In addition, only 1 student was found higher than the MMC and 1 student was obtained the MMC. This result showed that students' learning outcome is better than their MRA.

Out of 5 indicators, only 1 that includes mathematical manipulation (calculation), that is the second indicator. From 5 students, S1, S2 and S3 could solve the question perfectly whereas S4 and S5 could only solve it by doing manipulation instead of answering what has been questioned (could not answer perfectly). This indicator could be considered as simple indicator to be solved by the students.

For the fifth indicator which is creating generalization, students tended to solve it without difficulty. The question is "What is the meaning of function?". From 5 students, all of them could answer it well. S1 and S2 could answer it correctly while S3, S4 and S5 could answer it with minimum mistake. This indicator could be considered as very simple indicator to be solved by the students.

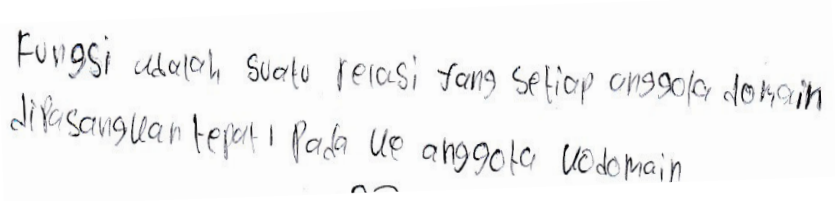


Figure 5. Student's Answer for Very Simple Indicator

The most difficult indicator is the first indicator in which students tend to unable to give a reason for their given assumption. In this case, students were only able to give assumption without giving an exact reason. Out of 5 students, S1, S2 and S3 have given assumptions with incorrect reasons. S3 had given assumption without reason whereas S4 and S5 had not answered the question. This indicator was the most difficult indicator to be solved by the students. Below is an example of students' task in solving Indicator no.1.

Figure 6. Student's Answer for The Most Difficult Indicator

Meanwhile, for Indicator 3 and 4, students' difficulty was in providing reasons for their given statements. For these indicators, S1 and S2 were able to answer correctly, S3 answered imperfectly while S4 and S5 were unable to give reason for their statements.

Classically, only 40% of students were able to have reasoning ability with good criteria (above MMC) while 60% of them were in poor category (below MMC). When it was linked to the classical mastery criteria (CMC), it has not met the classical criteria. This means that overall students (sampling students) had not met the classical mastery. Furthermore, students' total score and students' score for each indicator was shown in the table below.

Table 2. Students' Score for Each Indicator

Student	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Total Score
S2	5	20	15	20	20	80
S1	5	20	20	10	20	70
S3	5	20	10	10	15	60
S4	0	10	5	5	10	30
S5	0	10	5	5	10	30

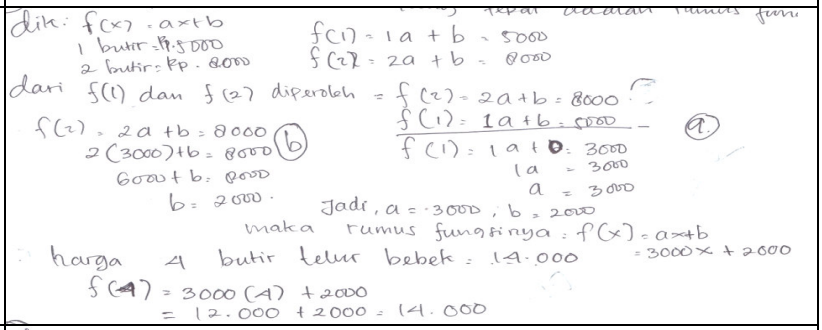
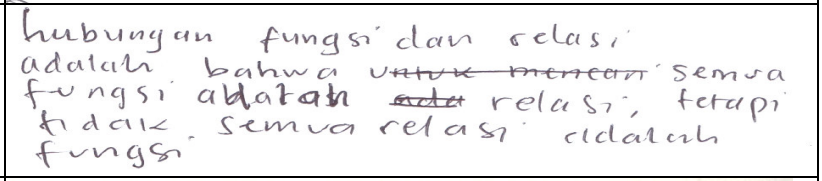
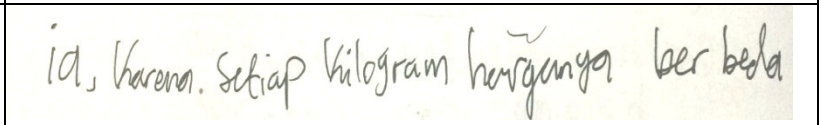
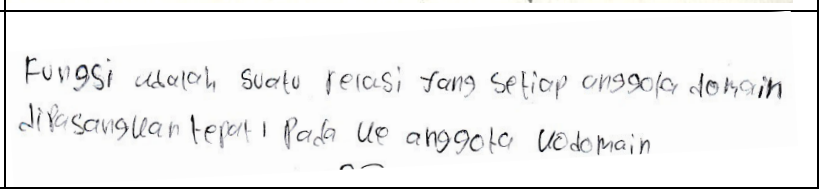
From the table above, it is clearly showed that in Indicator 1, overall students obtained very low score. The same thing was found in Indicator 3 and 4. Meanwhile in Indicator 2 and 5, students obtained relatively high score. Based on this finding, it is known that Indicator 1 is the most difficult indicator that was solved by the students, and it was followed by Indicator 3 and 4.

Table 3 below showed questions and the best answers from students. The table showed that from 5 students, none of them were able to answer Indicator 1 perfectly. Meanwhile, for Indicator 3 and 4, 1 student respectively was able to answer the question perfectly. For Indicator 2 and 5, students were able to answer them well.

Table 3. Students' Answers

Question:
1 duck egg was sold for Rp. 5000,- and Rp. 8000,- for two. Function of duck egg sale was stated in a linear function.

a) What is the correct function for the problem?
b) How much 4 eggs cost?
c) What is the relationship between function and relation?
d) Is the relation above a function? Explain!
e) What is the meaning of function?

No	Indicator	Students' Answers
1	Suggesting assumption	Rumus Fungsi ? karena mempermudah mendapatkan hasil
2	Performing mathematical manipulation	
3	Drawing conclusion from a statement and giving argumentation	
4	Drawing conclusion, compiling evidence, giving reasons or evidence for validity of the solution.	
5	Finding pattern or characteristic of a mathematical indication and creating generalization	

In this study, researchers conducted an interview to determine students' difficulties in solving test problems, especially for the first indicator. Based on the interview, students stated that they had not thinking about the

problems they should solve because they have not found this type of questions. The math problems that they usually faced are the ones that include calculation. Moreover, they could not give reasons because they have never done and found this type of questions.

In addition, from the interview it was found that students from Malay ethnic are easier to understand the lesson than students from other ethnics. This finding was in line with Malay Culture characteristics- open to new things- in which metacognitive strategy based-learning was a new learning strategy for students. This could be seen from the MRA score of Student 2 (S2), that is from Malays ethnic. Being taught by using metacognitive strategy, the prior category was "moderate" was changed to "high", and even became the highest score of the last test. This is in line with the role of metacognitive strategy to enhance students' learning outcome. Based on the interview, S2 stated that metacognitive strategy using contextual problem could train the student to use their thinking skills in solving problems during learning process. In addition, S2 also stated that he was more interested to follow the lesson. That was very different with the usual learning strategy teachers used in classroom. The result could be seen in the following table.

Tabel 4. Students' MRA and Students' Ethnicity

Student	Ethnicity	Prior Category	Score	Category
S2	Malay	Medium	80	High
S1	Bataknese	High	70	Moderate
S3	Malay	Moderate	60	Low
S4	Malay	Low	30	Low
S5	Javanese	Low	30	Low

The result from S2 was in line with findings in Simanjuntak (2014) that in Malay tradition, there is a tradition called "berbalas pantun" (reading traditional poetry). Not only about the similar rhyme, 'pantun' is also about strong logical reasoning to combine words. Therefore, it is clear that students from Malay ethnic are easier to understand reasoning process.

For contextual problems given, overall students admitted that they can create more comfortable learning situation and make them not only attach to numbers, like usual mathematics subject. Besides, such learning is different and more pleasant. This was not only stated by the students with high ability but also stated by students with low ability.

Overall, metacognitive strategy can increase students' MRA. It is students process their thoughts when learning was taking place. In addition, contextual problems can attract students' interest and attention. This could be said as reasons of increase students' MRA. Students also respond positively to the learning process.

4. Conclusion

Based on the results of this research, it can be concluded that:

- Students' MRA was still below students' learning outcome score. It can be said that students' learning outcome score were better than their MRA. However, students from Malay ethnic who have been taught using strategy metacognitive in Malay Culture were found to have better reasoning ability than students from other ethnics.
- Metacognitive strategy plays an important role in enhancing students' MRA. With this metacognitive strategy, students were motivated to continuously use their thinking ability in solving problems during the learning process. This can enhance students' MRA.

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