Critical thinking ability through student worksheet development based on Missouri Mathematics project learning model using think talk write

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Abstract. This study aims to describe the mathematical critical thinking skills of class VIII students through the development of Student Worksheets based on the Missouri Mathematics Project learning model using Think Talk Write strategies. This research was conducted at junior high school number 11 Lubuklinggau in the Even semester of the 2018/2019 school year with research population were all students of class VIII at junior high school number 11 Lubuklinggau. Data collection technique used was a test technique to measure students' critical thinking skills on the material of Cubes and Cuboid. While the data analysis uses descriptive qualitative analysis. Based on the results of data analysis, it was found that the average percentage of students' thinking abilities in class VIII was 76.97 and was in the Good category.

1. Introduction

Mathematics is a subject that is always taught at every level of Education, so mathematics is one of the important subjects to be mastered by every student [1]. To understand the lesson well, a good concentration of thought is needed so that students are able to apply the material that has been learned into the material being studied and students must master the ability to think critically well. If the ability to think critically can be developed properly, then students can think openly, able to analyze problems well systematically and in succession [2]. The ability to think critically mathematically is needed so that students can solve problems in mathematics. Not developing critical thinking skills will hinder students' ability to solve various mathematical problems [3]. The ability to think critically is important to master because by automatically thinking critically someone will be able to solve simple and complex problems in everyday life [4]. Efforts to establish optimal student critical thinking skills require interactive classes, students are seen as thinkers not taught, and teachers act as mediators, facilitators, and motivators who help students in learning not teaching [5]. Another reason students find it difficult to understand mathematics is that mathematics they feel is less meaningful. There are still teachers, when learning mathematics does not relate to everyday life [6].

The ability to think critically is the ability of students to analyze and evaluate information to decide whether the information can be trusted so that it can be used to draw valid conclusions [7]. Another definition of critical thinking skills is logical which is focused on making decisions what to believe and what to do [8]. Another definition of critical thinking is the activity of reasoning based on valid facts and arguments as a reference for doing something or making decisions [9]. Indicators of critical thinking skills used in this study are Interpretation (Understanding the problem indicated), Analysis (Identifying relationships and concepts given), Evaluation (Using the right strategy), Inference (Conclusion) [10].
The use of Student Worksheets based on the Missouri Mathematics Project Learning Model using Think Talk Write Strategy in the learning process is able to improve the quality of learning and provide new innovations in the learning process in the classroom, besides this through learning it is expected that students’ critical thinking skills can be better than usual through LKS arranged according to the applicable curriculum, needs and characteristics of students. Worksheet based learning Missouri Mathematics Project uses Think Talk Write Strategy containing non-routine problems that measure critical thinking skills. The questions are made based on existing indicators on the ability to think critically. In the worksheet also contains problems that must be resolved both in groups and individually, so that students are required to be able to solve problems alone or together in groups. At the end of the worksheet a project sheet is also provided to see the extent of students’ critical thinking skills after the learning process. Therefore through learning using this worksheet is able to develop critical thinking skills.

The formulation of the problem in this study is how the critical thinking skills of VIII grade students of SMP Negeri 11 Lubuklinggau through the development of Student Worksheets based on the Missouri Mathematics Project Learning Model using Think Talk Write Strategy.

2. Methods
This research was conducted at Junior High School number 11 Lubuklinggau with the subject of the research was students of VIII class junior high school number 11 Lubuklinggau. The research method used is Research and Development with a descriptive qualitative approach. The test used consisted of 4 questions containing indicators of critical thinking ability of class VIII students after participating in mathematics learning using LKS based on Missouri Mathematics Project Learning Model using Think Talk Write Strategy. Data collection in this study uses the technique of scoring critical thinking skills consisting of 4 indicators referring [10], namely: Interpretation (Understanding the problem indicated), Analysis (Identifying relationships and concepts given), Evaluation (Using right strategy), Inference (Conclusion).

Table 1. Scoring rubric of critical thinking ability.

| No | Indicator | Description | Score |
|----|-----------|-------------|-------|
| 1  | Interpretation | Do not write the known and the asked | 0 |
|    |           | Write the known and the asked but not exact | 1 |
|    |           | Write only what is known exactly or just what is asked exactly | 2 |
|    |           | Write the known and the asked questions correctly but are incomplete | 3 |
|    |           | Write the known and asked of the questions precisely and completely | 4 |
| 2  | Analysis  | Does not make a mathematical model of the given problem | 0 |
|    |           | Make a mathematical model of a given problem but not exactly | 1 |
|    |           | Make a mathematical model of the problem given precisely without giving an explanation | 2 |
|    |           | Make a mathematical model of the problem given precisely but there is an error in explanation | 3 |
|    |           | Make a mathematical model of the problem given correctly and provide an explanation correctly and completely | 4 |
| 3  | Evaluation | Do not use strategy in solving problem | 0 |
|    |           | Use incorrect and incomplete strategies in solving questions | 1 |
|    |           | Use the right strategy in solving problems but not complete or use strategies that are not right but complete in solving problems | 2 |
|    |           | Use the right and complete strategy in solving problems but making mistakes in calculations | 3 |
|    |           | Use the right and complete strategy in solving problems and correct in doing calculations | 4 |
Table 1. Cont.

| Inference | Score |
|-----------|-------|
| Do not make conclusions | 0 |
| Make inaccurate conclusions and do not fit the context of problem | 1 |
| Make inaccurate conclusions even though they are adjusted to the context of problem | 2 |
| Make conclusions precisely, according to context but not complete | 3 |
| Make conclusions precisely and completely in accordance with the context of question | 4 |

After the test is given to students of VIII class, the next step is to calculate the score of students' critical thinking skills, using the following calculation:

\[ N = \frac{\text{Score obtained}}{\text{Maximum Score}} \times 100 \]

Furthermore, the scores obtained are converted into a table of critical thinking abilities.

| Score Category | Score | Critical Thinking Ability |
|----------------|-------|---------------------------|
| Excellent      | 81 – 100 | Frequency: 14, Percentage: 51.86 % |
| Good           | 61 – 80  | Frequency: 9, Percentage: 33.33 % |
| Enough         | 41 – 60  | Frequency: 4, Percentage: 14.81 % |
| Less           | 0 – 40   | Frequency: 0, Percentage: 0 % |

Total: 27, 100 %

Based on table 3 above, it can be seen that in general students can follow the learning well. In the learning process to achieve optimal results requires active thinking. This means that the optimal learning process requires critical thinking from the learner. Therefore, critical thinking is very important in the
process of learning activities [11]. This is in line with the opinion [12] which states that one of the learning models that can actively involve students in the learning process is the Missouri Mathematics Project model using Think Talk Write Strategy. This can be seen in the final student test results obtained as many as 14 students get the value of critical thinking skills in the range of grades 81-100 and are in the very good category, with a percentage of 51.86%. This shows that more than half of students can master critical thinking skills very well. While there are 9 students who get grades in the range of grades 61-80, with the Good category and get a percentage of 33.33%. In the Fair category there are 4 students who are in the range of grades 41 - 60 with a percentage of 14.81%. Whereas for the less category there were no students who got grades in the range 0 - 40.

Furthermore, the distribution of each aspect of indicators in the critical thinking skills of VIII grade students of Junior High School number 11 Lubuklinggau is as follows:

| Indicator | No Item | Question | Total | Maximum Score | Percentage | Category |
|-----------|---------|----------|-------|---------------|------------|----------|
| Interpretation | X_1 | X_2 | X_3 | X_4 | 76 | 395 | 432 | 91.44 | Excellent |
| Analysis | X_1 | X_2 | X_3 | X_4 | 49 | 344 | 432 | 79.63 | Good |
| Evaluation | X_1 | X_2 | X_3 | X_4 | 57 | 302 | 432 | 69.91 | Good |
| Inference | X_1 | X_2 | X_3 | X_4 | 59 | 322 | 432 | 74.54 | Good |

Based on table 4 above, for indicator 1, namely interpretation obtained a percentage of 91.44% and is in the very good category. This shows that students have been able to understand the questions well, so that in this indicator the percentage obtained is also extraordinary. In the second indicator that is the analysis obtained a percentage of 79.63% and is in the good category. Indicator of analysis looks students have been able to identify and connect the concepts given, students have also been able to make mathematical models of the problems given. So that the process is in accordance with the expected procedures on the ability to think critically. The third indicator is evaluation, getting a percentage of 74.54 and is in the good category. In this indicator students have been able to use the right strategy and be able to do calculations correctly in solving the given problems.

The last indicator, namely inference, gets a percentage of 69.91% and is in the good category. This indicator students are able to make and draw conclusions from solving the problems given. Overall, the four indicators of critical thinking ability of students have been able to complete all stages properly and correctly. Overall indicators of critical thinking ability of students of VIII class of Junior High School number 11 Lubuklinggau on the material of Cubes and Cuboid get a percentage of 76.97 and are in the Good category. Based on the results of the above data, the learning process using the Missouri Mathematics Project (MMP) model demands students to learn to participate in teams, learn independently, be skilled in solving problems and making decisions [13].

4. Conclusion

Based on the results of research and analysis conducted, it can be concluded that indicator 1, namely interpretation, obtained a percentage of 91.44% and is in the very good category. In the second indicator that is the analysis obtained a percentage of 79.63% and is in the good category. The third indicator is evaluation, getting a percentage of 74.54 and is in the good category. The last indicator, namely inference, gets a percentage of 69.91% and is in the good category. While overall indicators of critical thinking ability of students of VIII class of Junior High School number 11 Lubuklinggau on the material of Cubes and Cuboid get a percentage of 76.97 and are in the Good category.
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