Analysis of Computational Thinking Ability Student Mathematics with Application Problem Based Learning Model

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Abstract. This study aims to: (1) Describing students' mathematical computational thinking ability after applying the problem based learning's (PBL) model; (2) Describing students' difficulties in completing the students' mathematical computational thinking ability test after applying the problem based learning (PBL) model. The subjects of this study were students are 8th grade student of SMP Negeri 4 Tebing Tinggi in the 2022/2023 academic year while the object in this study was the students' mathematical computational thinking ability by applying a problem based learning model. The results showed that: (1) Students' mathematical computational thinking ability is getting better after the implementation of the problem based learning (PBL) model compared to previous learning that still uses conventional learning. From 42 students, there are 10 students who have high category of mathematical computational thinking ability, 23 students who have medium category, and 9 students who have low category. For each indicator, it is described as follows: The decomposition indicator of the average value of students in the medium category, the pattern recognition indicator in the medium category, the algorithm in the medium category, abstraction and generalization in the low category (2) Students with high category have no difficulty in any indicator, students with moderate category have difficulty in procedure and concept's criteria. Meanwhile, students with low category have three of difficulty namely, principle, procedures and concepts.

Keywords : Analysis, Computational Thinking Ability, Problem Based Learning

1 Introduction

An interesting topic in discussions of mathematics education is the evolution of the school mathematics curriculum, particularly in terms of its application and the components of the underlying learning theory. This makes sense considering that changes in learning mathematics cannot be separated from changes in the way mathematics is taught in schools. Indonesia needs to be more careful in creating a strategic educational framework so that it can adapt to the global

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competition in the 21st century full of advances in technology and information. The problem of an increasingly dynamic educational curriculum. The twenty-first century has seen rapid advances in science and technology. So, for students to compete globally, they must be able to master a wide range of skills. The National Science Teachers Association (NSTA) says that critical thinking and problem solving can be improved through learning. This is in line with what is said by the National Council of Teachers of Mathematics (NCTM) (NCTM, 2000:3), which says that learning mathematics can help students become better at: 1) solving problems; 2) reasons and evidence; 3) communicate; 4) establish a connection; and 5) showing what they know (representation). As the definition above says, solving problems is an important part of mathematics education.

One of the cognitive abilities needed in the twenty-first century is the ability to think computationally (Computational Thinking). Computational thinking mental processes teach students how to solve problems in various contexts. The cognitive skill known as computational thinking allows teachers to recognize patterns, deconstruct complex problems into manageable steps, plan and design a series of procedures to find solutions, and create data representations through simulations (Fathur, 2015).

Problem-based learning is one approach to encourage computational thinking in the realm of mathematics among students. The development of students' mathematical computational thinking skills in class is greatly assisted by the use of learning models that are tailored to the material they convey for each student's specific level of conceptual understanding. Consequently, students are encouraged to be proactive in their mathematics education through a set of learning standards. Problem-based learning is a teaching method that prioritizes encouraging more student-based education (PBL).

The importance of students' mathematical computational thinking skills in solving mathematical problems cannot be overstated, as shown by the previous description (free work). If students can use these skills, they can recognize patterns and create algorithms to solve real-world problems. As a result, academics want to research "Analysis of Students' Mathematical Computational Thinking Ability in the Application of Problem Based Learning Models".

2 Theoretical Study

1. Students' Mathematical Computational Thinking Ability

Among the tools for computational thinking covered by Ioannidou (2011, p. 4) are:

a. Decomposition is the process of dissecting a complex problem into smaller, more manageable components. This is done to enable understanding, independent development, and evaluation of each part of the problem. Taking on difficult problems, understanding concepts, and developing large-scale systems can become simpler as a result.
b. Pattern recognition is essential for finding the best solution to a problem and understanding how to deal with a particular type of problem. Understanding common patterns or traits can help us identify problems and create solutions. Identification of patterns, similarities, and relationships is discussed in section c. Generalization and abstraction of patterns. A quick strategy for solving a new problem based on an earlier

similar problem is generalization. Important considerations include the process of identifying data similarities and the processes/strategies used,

c. Designing an algorithm is a method for finding a solution by specifying the action to be taken. Algorithmic thinking is necessary when the same problem has to be solved repeatedly. An example of an instructional algorithm used in schools is learning to multiply or divide. Below are some sample problems and their solutions to help you understand the computational thinking strategies discussed above.

2. Problem Based Learning

The problem-based learning approach is the most significant development in education, according to Bound and Felifi (Rusman, 2011:230). Margetson (Rusman, 2011: 2030) argues that problem-based learning methods are more suitable for developing open, reflective, and critical thinking and other abilities needed for lifelong learning. It is a boon to a person's capacity for logical thinking, conversation, teamwork, and interpersonal interaction. active.

Learning that begins with difficulty is a problem-based approach. Students can improve their math skills by applying this knowledge. The goal of problem-based education is to encourage students' abilities to absorb and retain information, to think analytically, to pursue their own learning, and to collaborate effectively with peers. To start with, it puts the created problem into a framework appropriate to the topic at hand. Work ethic and problem solving skills. 2007:122 (Permana and Sumarmo) (Permana and Sumarmo) Both (Permana and Sumarmo) are permanent.

3 Research Methods

Descriptive qualitative research is the method used in this research. "Qualitative research is used to investigate complex problems," according to Sugiyono (2016: 9).

Qualitative data analysis method used in this study. Analysis in a qualitative approach to this study adheres to the Miles and Huberman model. Sugiyono (2016: 246) states that "consisting of three activity flows that start interactively and continue to completion. Data analysis activities include data reduction (Data Reduction), data display (Data Display), and generate conclusions (Conclusion). Figure 1 shows more information about the process:

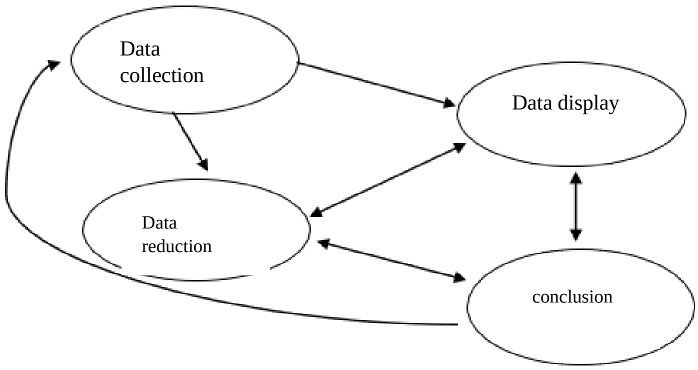

Figure 1. Research methods

Data from the test results of students' mathematical computational thinking skills were analyzed descriptively with the aim of describing students' mathematical computational thinking skills after implementing the problem-based learning (PBL) model. According to the Ministry of Education and Culture (in Purba, 2017:98) that "for determining the minimum standard, it is guided by the Minimum Completeness Criteria (KKM) 70". Based on this view, the results of students' mathematical computational thinking ability tests can be presented in the following criteria intervals:

Table 1. Level of Students' Mathematical Computational Thinking Ability

Level	Criteria
85 ≤ KBKMS ≤ 100	High
70 ≤ KBKMS < 85	Medium
0 ≤ KBKMS < 70	Low

The results of students' mathematical thinking skills and problem solving are collected to be examined and assessed. Each student's answer is given a score based on the rules set out in the research methodology on how to assess students' mathematical and computational thinking skills. According to the scoring rules, the most you can get for each indicator is 4, and the least you can get is 0. Since there are 4 indicators, the most you can get for each question is 16, and the total score for all 4 questions is 64.

To find out what each student scored, you add up all the scores on their answer sheets and then convert them into a score between 0 and 100. Since the highest score for each question is 25, the four questions can add up to 100. Table 3.12 lists the scores found. into one of three categories based on how well a student can think mathematically and solve problems: high, medium, or low.

4 Research Result

The results of this study are to describe students' mathematical computational thinking skills after implementing problem based learning (PBL) learning models and describe students' difficulties in completing students' mathematical computational thinking skills tests after implementing problem based learning (PBL) learning models in class VIII-5 SMP Negeri 4 Tebing Tinggi.

Based on the results of testing the learning media developed by researchers, it has been validated with considerable validity. The Learning Implementation Plan (RPP) is 4.46, and the Student Worksheet (LKPD) is 4.45 and the Student Book is 4.56. From these data, all validation values ranged from $4 \leq Va < 5$ with valid categories.

Based on the results of the mathematical computational thinking ability test of 42 students, it is obtained that the level of students' mathematical computational thinking ability is spread across three criteria, namely low, medium and high. The accumulated average value obtained on each indicator on students' mathematical computational thinking skills is 75.93. This value falls into the medium category. In the mathematical computational thinking ability of students, there are 10 with the lowest score of 48.44. In addition, it was obtained that the highest score was 95.31 and the lowest score was 48.44, so the range value of 42 students was 46.88. However, judging from the standard deviation (13.50).

The description of the students' difficulties in completing the students' mathematical computational thinking ability test was obtained from the results of the students' computational thinking ability tests and interviews with the students' difficulty criteria, namely (1) facts, (2) concepts, (3), and (4) concepts. The answer sheet for the computational thinking ability test of each student was corrected based on the computational thinking ability score and categorized into high, medium and low.

Students with high thinking skills have no difficulty in doing the tests given. Meanwhile, students' mathematical computational thinking abilities were in the middle. Students struggle with procedures and concepts that fall under the C4 and C5 cognitive domains. And low, students struggle with the criteria of principles, procedures, and concepts. Students who struggle in principle are unable to use formulas which are the nature of existing methods, in solving a given problem. When students cannot apply (C3 cognitive domain) the correct formula, the problem solving step is wrong. Then there are the difficulties in the algorithmic indicators, in particular mentioning correctly the steps used to construct a solution to a given problem. Procedural difficulties, where students cannot determine the steps to do the correct problem (C4 cognitive domain), and finally, conceptual difficulties, where students cannot draw conclusions or analyze correct problem solving (C5 cognitive domain).

5 Conclusion

1. Students' computational thinking ability on number pattern material after applying the problem based learning (PBL) model is obtained, from 42 students there are 10 students who have a high level of computational thinking ability, 23 students who have a medium category, and 9 students who have a low category .
2. Students' difficulties in completing the students' mathematical computational thinking ability test, as follows:

a. In the high category, of the 4 questions that the researcher gave, students tended to only be able to solve correctly and precisely on indicators of decomposition, pattern recognition and algorithms. However, the generalization and abstraction indicators of students are less precise in drawing conclusions from number pattern questions.

b. In the medium category, students tend to focus on procedural criteria, where they cannot distinguish the formula for determining the nth term between arithmetic sequences and geometric sequences. There is an error that is used to compile a solution to the problem of determining the nth term of a sequence (cognitive domain C4) which is given correctly, which causes students to experience conceptual difficulties, especially in generalization and abstraction indicators, where students are unable to draw conclusions from the given problem . correct and precise on the subject of number sequences (cognitive realm C5)

c. In the low category, they face three difficulty criteria: main student criteria, procedures, and concepts. Students who have difficulty in principle cannot distinguish the formulas for arithmetic sequences and geometric sequences from a given problem. As a result, when students are unable to apply (cognitive domain C3) the correct formula in carrying out the problem solving steps, the results are wrong. Students incorrectly arrange the steps for solving sequence problems based on the difficulty level of the algorithm indicator. The geometric sequence material is a question that must be asked, and students use arithmetic formulas to solve it. This difficulty is included in the procedural difficulty category, because students cannot determine the steps to do the correct problem (cognitive domain C4), and there are also conceptual difficulties, because students cannot draw conclusions or analyze solutions correctly. between problems of arithmetic sequences and geometric sequences (domain). C5) cognitive.

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