ANALYSIS OF DIFFICULTIES IN UNDERSTANDING MATHEMATICAL CONCEPTS AS SEEN IN THE FACE OF STUDENTS' METACOGNITIONAL ABILITIES

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ABSTRACT

Understanding mathematical concepts is an important foundation for thinking in solving mathematical problems and everyday problems. Metacognition is a person's knowledge, awareness and control of their thinking processes and results. This article aims to describe students' difficulties in understanding mathematical concepts in terms of student metacognition. This research is a qualitative descriptive study. The subjects in this study were 6 students of class VIII MTs PK Tafiqul Jannah. Students' metacognitive abilities consist of three categories, namely high, medium, and low. Each category of metacognitive ability is represented by 2 students. The results of the study show: (1) students with a high metacognitive ability category can fulfill all indicators completely. (2) students with a medium metacognitive ability category can only fulfill three indicators completely, namely restating a concept that has been learned, classifying objects based on whether or not the requirements that form the concept are met, and applying the concept algorithmically. (3) students with a low metacognitive ability category can only fulfill two indicators, namely restating a concept that has been learned and classifying objects based on whether or not the requirements that form the concept are met.

Keywords : *Metacognition , MTs PK Tafiqul Jannah , Mathematical Concepts, Understanding*

INTRODUCTION

The problem is that people often fear or consider mathematics to be difficult compared to other subjects. Therefore, teachers must use engaging and enjoyable learning strategies to help students forget the difficulties of teaching and learning, especially in mathematics, and thus help them solve problems, especially in mathematics.

Students' low mathematical conceptual abilities mean that they only express their opinions after being directly pointed out by the teacher and do not ask questions even though they do not yet understand the material presented by the teacher. In the learning process, teachers still use conventional learning, namely teacher-centered learning, which causes boredom in students during the learning process. Conceptual understanding is an important thing in mathematics. One of the characteristics of mathematics is that it has abstract objects that can cause students to experience difficulties in understanding a concept. Students will find it easier to solve math problems if they can first understand the concept. Furthermore, a good and correct conceptual understanding will make it easier for students to remember a material taught by the teacher without having to memorize formulas.

Students' knowledge is procedural in nature, meaning they tend to memorize examples given by teachers without developing a clear understanding of their concepts. Students encounter obstacles when given problems that cannot be solved directly using a formula, but rather through the application of several different formulas or concepts. This situation makes it difficult for students to understand mathematical concepts, making it very easy for misconceptions to arise, which in turn can lead to difficulties in understanding further concepts.

By developing metacognitive awareness, students are expected to become accustomed to constantly monitoring, controlling, and evaluating their actions. In fact, a person needs to manage their thoughts effectively by utilizing existing knowledge, controlling and reflecting on their own thought processes and outcomes, and reflecting on what they think can help them solve a problem. This awareness of their thought processes is called metacognition.

Metacognition consists of the prefixes "meta" and "cognition." "Meta" is a prefix for cognition, meaning "after" cognition. Literally, metacognition is interpreted as cognition about cognition, knowledge about knowledge, or thinking about thinking (Desmita, 2012). Huitt defines metacognition as a person's knowledge of their cognitive system, their thinking about their thinking, and their essential skills in "learning to learn" (Sudia, 2015). Slavin defines metacognition as knowledge about one's own learning or knowledge of how to learn (Danial, 2010).

Metacognition is defined as thinking about thinking , or one's knowledge of the world of one's thought processes (Chairani, 2016). Metacognition is the ability to use the mind, where the object of thought is one's own thought processes. Therefore, it can be concluded that students who manage their cognitive activities well are likely to be able to handle tasks and solve problems effectively.

Metacognition plays a crucial role in the mathematics learning process, particularly in problem-solving. Students become aware of their own thinking processes and evaluate their own outcomes, thus reducing errors in problem-solving.

METHODS

The method used in this study is descriptive qualitative because this study describes or illustrates the analysis of difficulties in understanding mathematical concepts using the *core model* in terms of students' metacognitive abilities. The data sources for this research are in the form of field

notes or data obtained from questionnaires on metacognition and first and second stage test questions to determine students' understanding of mathematical concepts in solving mathematical problems.

The data analysis technique used in this study is the Miles and Huberman model data analysis. The data analysis process begins by reviewing all available data from various sources, namely from the results of the first and second stage test questions, personal documents, official documents, images, photos, and so on. In data collection techniques, triangulation is defined as a data collection technique that combines various data collection techniques and existing data sources.

This researcher uses a metacognitive questionnaire instrument to categorize students into three categories: high metacognition, medium metacognition, and low metacognition. Before use, the test instrument is validated first by means of logical validity, namely asking experts to make judgments on the instruments that have been made and empirical validity by conducting instrument tests on students who will be used on a limited scale to determine the suitability of the instrument to be used.

Table 1. Range of Metacognition Values

Metacognition	Range of values
Tall	$x \geq$ Mean + SD
Currently	Mean − SD < x < Mean + SD
Low	$x \leq$ Mean – SD

Information:

x = Value or score obtained by the student.

RESULTS AND DISCUSSION

This research was conducted at MTs PK Tafiqul Jannah in the even semester of the 2016/2017 academic year. The subjects were 38 eighth-grade students. To obtain the research data, a metacognitive ability questionnaire was administered to the students. After completing the metacognitive ability questionnaire, the students were divided into three categories: high, medium, and low metacognitive ability.

The results of the students' metacognitive ability questionnaire can be seen in Table 2.

Table 2. Results of the Student Metacognitive Ability Questionnaire

No	Metacognitive Ability Categories	Number of Students (people) VIII
1	High Metacognitive Ability	5
2	Moderate Metacognitive Ability	26
3	Low Metacognitive Ability	7
	Number of Students	38

The results of the metacognition questionnaire contained in Table 4.1, show that in class VIII students who are included in the category of high metacognitive ability are 5 students, medium metacognitive ability are 26 students, and low metacognitive ability are 7 students. The selection of research subjects is based on what has been written by previous researchers, namely in the form of *purposive student selection* . Each category of metacognitive ability was selected 2 students from class VIII by asking for consideration from the mathematics teacher and assisted by other considerations, such as daily test scores, student activity in learning, student skills in working on problems in class, and student ability to express opinions or their thoughts, both verbally and in writing.

Data for each category of metacognitive ability of class VIII students of MTs PK Tafiqul

Jannah were analyzed based on indicators of students' understanding of mathematical concepts in solving mathematical problems. These students are MT students as research subjects for the *high metacognition category* , MS students as research subjects for *the medium metacognition category* , and MR students as research subjects for the *low metacognition category* .

Based on the validity of the known data, MT students in understanding mathematical concepts from the 6 questions, students can fulfill the indicators of restating a concept that has been learned, classifying objects based on whether or not the requirements that form the concept are met, applying concepts algorithmically, providing examples and non-examples of concepts that have been learned, presenting concepts in various forms of mathematical representation, and developing the necessary and sufficient conditions for a concept. This is in accordance with the research, where students can solve the questions well, so that students can solve the questions smoothly and correctly without errors in calculations, are active in answering questions, easily understand the material, and can mention the information in the questions, namely writing what is known and what is asked in the questions.

Based on the validity of the known data, MS students in understanding the mathematical concepts of the 6 questions, students have not been able to fulfill the indicators of providing examples and non-examples of the concepts that have been studied, presenting concepts in various forms of mathematical representation, and developing the necessary and sufficient conditions for a concept. This is in accordance with the research, where students have not been able to solve the problem well, because when solving the problem there was an error in the calculation, but students can answer questions calmly, even though they were silent for a while, students can understand the material, and can state the information in the question correctly, namely by writing what is known and what is asked in the question. In the MS student category, they were only able to fulfill three indicators because when working on the test questions in stages I and II, they were only able to work on questions number 1,2,3, questions number 1,2,3,4 and questions number 1,2,3,6 so it can be concluded that on average for MS students, they can only work on questions number 1,2,3, which is only 3 indicators.

Based on the validity of the known data, MR students in understanding the mathematical concepts of the 6 questions, students have not been able to fulfill the indicators of applying concepts algorithmically, providing examples and non-examples of concepts that have been studied, presenting concepts in various forms of mathematical representation and developing necessary and sufficient conditions for a concept. This is in accordance with the research, where students have not been able to solve the problem well, because when solving the problem there are errors in problem planning and calculations, when answering questions students look confused with what is asked so they are less active in answering questions, students also have difficulty in understanding the material, but students can mention the information in the question, namely by writing what is known and what is asked in the question. In the MR student category, they are only able to fulfill two indicators because when working on the test questions in stages I and II, they are only able to work on questions number 1,2, questions number 1,2,4 and questions number 1,2,3, so it can be concluded that on average, MR students can only work on questions number 1,2, which is only 2 indicators.

CONCLUSION

The understanding of mathematical concepts at MTs PK Tafiqul Jannah with the category of high metacognitive ability students can fulfill all indicators completely. The understanding of mathematical concepts at MTs PK Tafiqul Jannah with the category of moderate metacognitive ability students can only fulfill three indicators completely, namely restating a concept that has been learned,

classifying objects based on whether or not the requirements that form the concept are met, and applying the concept algorithmically. The understanding of mathematical concepts at MTs PK Tafiqul Jannah with the category of low metacognitive ability students can only fulfill two indicators, namely restating a concept that has been learned and classifying objects based on whether or not the requirements that form the concept are met.

REFERENCES

Desmita. (2014). *Psychology of Student Development.* Bandung: Remaja Rosdakarya.

Sudia, M. (2015). Metacognitive Profile of Junior High School Students in Solving Open-Ended Problems Reviewed from the Level of Student Ability. *Jurnal Math Educator Nusantara* , Vol 1 No 1.

Danial, M. (2010). The Effect of PBL Strategy on Students' Metacognitive Skills and Responses. *Jurnal Chemica* , Vol. 1 No. 2.

Chairani, Z. (2016). *Students' Metacognition in Mathematical Problem Solving.* Yogyakarta: CV Budi Utama Publishing Group.