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ANALYSIS OF STUDENTS' METACOGNITION IN SOLVING MATHEMATICAL PROBLEMS ON THE TOPIC OF SYSTEMS OF LINEAR EQUATIONS WITH TWO VARIABLES BASED ON THE INITIAL ABILITY OF GRADE VIII STUDENTS OF SMPN 18 MAKASSAR

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Abstract

The main purpose of this study is to analyze students' metacognition in solving mathematical problems on the subject of a two-variable linear equation system based on students' initial abilities. This type of research is a descriptive study with a qualitative approach which was carried out at SMP Negeri 18 Makassar. The subjects of this study consisted of 3 people who were taken each by 1 student with low ability, medium ability, and high ability. Data collection techniques used test and interview methods, and instrument validation was carried out with 2 expert validation stages. Technical analysis of data using descriptive analysis and qualitative data analysis starting from data reduction, data presentation and drawing conclusions. Test the validity of the data using triangulation techniques. From the results of the study it was concluded that (1) the subject of high initial ability category could fulfill all metacognitive indicators, namely prediction, planning, monitoring, and evaluation (2) the subject of medium initial ability category was only able to fulfill two metacognitive indicators of the four metacognitive indicators, namely prediction and planning, (3) the subject of low initial ability could only fulfill one metacognitive indicator of the four metacognitive indicators, namely predictions of students being able to understand what is known and asked in the questions, students are also able to change story questions into mathematical models.

Keywords: Metacognition, Solving Mathematical Problems, Students' Initial Ability

Introduction

Mathematics is a field of study that can be studied from elementary school to college. In fact, the reason for mathematics in education is to train students to think logically, critically and systematically, this is stated in the objectives of the mathematics subject as outlined in the Minister of National Education Regulation Number 22 of 2006 concerning standards for elementary and secondary education units, including 1.) Understanding mathematical concepts, explaining the relationships between concepts and applying concepts flexibly, accurately, efficiently and precisely in problem solving. 2.) Using reasoning on patterns and properties, performing mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements. 3.) Solving problems which includes the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained. 4.) Communicating ideas with symbols, tables, diagrams or other media to clarify situations or problems. 5.) Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention and interest in studying mathematics, as well as a tenacious and confident attitude in problem solving (Ministry of National Education, 2006: 346)

The results of the PISA (2009) study showed that Indonesian students performed poorly on internationally standardized questions, particularly in mathematical problem-solving. This low ability stems from students' lack of familiarity with challenging problems that require deeper thinking. A strong thinking process will lead to cognitive development (Piaget, as cited in Cremers, 1988).Based on the description of the objectives of mathematics

learning, it can be concluded that problem solving is a part of the mathematics curriculum that is quite important in the mathematics learning process. This ability is very useful when studying mathematics and in everyday life. Survey results*The Trends in International Mathematics And Science Study(*TIMSS, 2011) shows that Indonesian students' mathematics ranking is 36th out of 49 countries.

According to Imel (2002), metacognition is essential for successful learning, because metacognition enables students to manage their cognitive skills and identify their weaknesses, which can be improved through subsequent cognitive skills. People who are able to perform a particular skill can be said to be able to perform metacognition, that is, think about how to perform the skill. Students can be encouraged to perform metacognition by increasing their awareness that metacognition is necessary to improve their academic achievement. The results of his research indicate that students who perform metacognition (*metacognitively aware learners*) perform better than students in general who do not engage in metacognition, because metacognition enables students to plan, follow developments, and monitor their learning process.

One of the main materials for learning mathematics in grade VIII in junior high school is linear equations in two variables. One of the basic competencies is basic competency 4.5, which is solving problems related to systems of linear equations in two variables. This material is closely related to everyday life and is one of the challenging topics to learn. This is because students find it difficult to understand the questions. According to research results in the journal (Fadli: 2015) that the difficulties experienced by students are characterized by the presence of student errors in answering questions related to systems of linear equations in two variables (SPLDV). The errors in question include (a) Errors in placing the symbols that form SPLDV, (b) Errors in formulating mathematical models, (c) Errors in using the properties of addition and multiplication in equations, and (d) Errors in performing operations on numbers. The difficulties felt by students are when given math problems in the form of stories. They have difficulty in understanding the meaning, what is asked in the story problem so that students have difficulty in converting math story problems into mathematical models.

This problem also occurs in the eighth grade of SMP Negeri 18 Makassar. Many students still struggle with word problems, especially in SPLDV material. Students' problem-solving skills are still relatively weak. They struggle to translate word problems into mathematical sentences. Furthermore, some students are confused about the initial steps they should take.

In line with this information, the researcher conducted a study related to students' metacognitive abilities on SPLDV material in class VIII of SMP Negeri 18 Makassar. Research related to this theme is very important to do because it can provide information about students' abilities in using their metacognition as a tool in solving mathematical story problems. The results of this study can be used by teachers as a basis in selecting strategies and methods in solving the problem of students' low metacognitive abilities. Therefore, the main objective of this study is to analyze and describe students' metacognitive representation abilities on the material of two-variable linear equation systems in class VIII of SMP Negeri 5 Sinjai.

Research methods

This research is a descriptive study with a qualitative approach conducted at SMP Negeri 18 Makassar, Makassar City, South Sulawesi in the odd semester of the 2021-2022 academic year. The research subjects were 3 students, each representing high, medium, and low-ability students, selected based on initial ability tests and teacher recommendations. The research method consists of three stages, beginning with problem formulation and literature review, followed by instrument development and validation, data collection and analysis, and the final stage of report preparation and conclusion drawing. The data collection technique used 4 initial ability tests and 3 metacognitive ability tests with SPLDV material validated by 2 experts, as well as interviews with the three selected subjects to verify the data in the written test results. The data analysis technique used qualitative data analysis with condensation, data presentation, and conclusion drawing. The data validity test used was triangulation of techniques/methods.

Research result

Based on the results of the research conducted in the first stage, namely administering initial ability tests to 13 students, the results obtained were as stated in Table 1 below:

Table 1. Initial Ability Test Results

No	Category	Frequency
1	Tall	3
2	Currently	5
3	Low	5
Amount		13

Next, one subject was selected for each ability. Subject selection was based on the students' scores on the initial ability test and the mathematics teacher's consideration of students who were able to communicate well, both written and verbal, and willing to participate in the research data collection process.The criteria for assessing test results are as follows.

Table 2. Criteria for assessing test results

Category	Interval
Tall	87-100
Currently	73-86
Low	0-72

(Directorate, 2017 Junior High School Development Team).

The selected research subjects are presented in Table 3.

Table 3 Coding of Research Subjects

No	Category	Code
1	Tall	ST
2	Currently	SS
3	Low	SR

After selecting the subjects, the metacognitive ability test was administered to the three subjects to determine their cognitive abilities. The metacognitive ability test results were analyzed, followed by interviews to validate the test data.

Table 4 Summary of Metacognitive Abilities of All Subjects in Questions 1 and 2

Subject	Question No.	Prediction	planning	monitoring	evaluation
ST	1	√	√	√	√
	2	√	√	√	√
SS	1	√	√	×	×
	2	√	√	×	×
SR	1	√	×	×	×
	2	√	×	×	×

1. High initial ability

Based on the results of the written test and student interviews for questions 1 and 2, it can be stated that ST has been able to fulfill all metacognition indicators, namely being able to understand the problems in the questions, explaining what is known and asked in the questions, being able to transform the story problem model into mathematical form and being able to determine strategies and reasons for using these steps, ST has used formulas and steps that are coherent and appropriate. ST has been correct in the calculation process and has rechecked the answers before being collected.

2. Medium initial ability

Based on the results of written tests and student interviews for questions 1 and 2, it can be stated that SS is only able to fulfill two metacognition indicators, namely being able to understand the problems in the questions, explaining what is known and asked in the questions, being able to transform the story problem model into mathematical form, not being able to determine the strategy and reasons for using these steps, SS has not been able to use formulas and steps that are coherent and correct. SS is not yet accurate in the calculation process and does not recheck the answers before being submitted.

3. Low initial ability

Based on the results of the written test and student interviews above for questions number 1 and 2, it can be stated that SR is only able to fulfill one indicator of metacognition, namely being able to understand the problem in the question, explaining what is known and asked in the question, being able to transform the story problem model into a mathematical form, not being able to determine the strategy and reasons for using these steps, SR has not been able to use formulas and steps that are coherent and correct. SR is not yet correct in the calculation process and has rechecked the answer before being submitted.

The results of this study are in line with the results of Hasanah's research (2017) in his research which stated that the metacognition of students who have high mathematical abilities can be fulfilled in all aspects and are able to solve problems in questions, while students who have medium and low metacognitive abilities are only fulfilled in certain aspects.

Conclusion

Based on the results of the research and discussion, the researcher can draw the conclusion that the metacognitive abilities of students on the SPLDV subject are, the subject of high category initial ability, based on the results of the study it was obtained that ST can fulfill all metacognitive indicators, namely prediction, planning, monitoring, and evaluation. The subject of medium category initial ability, SS can only fulfill two metacognitive indicators from the four metacognitive indicators, namely, prediction, students are able to understand the problems in the questions, understand what is known and what is asked in the questions and planning, students are able to change story problems into mathematical models and determine the steps and appropriate strategies to solve mathematical problems. The subject of low category initial ability, SR can only fulfill one metacognitive indicator from the four metacognitive indicators, namely prediction, students are able to understand what is known and what is asked in the questions and can change story problems into mathematical models.

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