



Metacognitive Processes of Seventh-Grade Students in Algebra Problem Solving

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ABSTRACT :

The metacognition process is very important in solving mathematical problems. With the metacognition process, students can more effectively understand problems, choose the right strategy, and implement strategies to find solutions. This study uses a qualitative approach, with a case study type of research on class VII H students of Madrasah Tsanawiyah Negeri 3 Tulungagung . Data collection techniques are carried out by conducting problem-solving tests and interviews. Data analysis techniques use data reduction, data presentation, and drawing conclusions. The metacognitive processes used are planning, monitoring, and evaluating. In the planning process, students determine the strategy that will be used to solve the problem. In the monitoring process, students monitor the progress of the problem-solving process that they are doing. In the evaluating process, students reflect on the results and the resolution process that has been carried out. The results of this study are 1) Students with high problem-solving abilities carry out the entire metacognitive process starting from planning, monitoring, and evaluating. 2) Students with moderate problem-solving abilities carry out the metacognitive process starting from planning and monitoring. 3) Students with low problem-solving abilities only carry out the planning metacognitive process. This study suggests more intensive training and guidance for teachers to improve students' metacognitive abilities, as well as the development of learning strategies that can facilitate students' metacognitive processes in solving mathematical problems.

Key words: *Metacognition Process , Problem Solving , Algebra*

INTRODUCTION

Objective learning mathematics in schools so that participants educate have the ability as follows . (1) Understand draft mathematics , explaining relatedness between concept and application draft or algorithm in a way flexible , accurate , efficient and precise in solution problem (2) Using reasoning on patterns and properties , doing manipulation mathematics in make generalization , compiling proof or explain ideas and statements mathematics (3) Solving problems that include ability understand problems , designing mathematical models , solving models and interpreting them. solutions obtained (4) Communicating idea with symbols , tables , diagrams, or other media for clarify condition or problem (5) Have characteristic value utility mathematics in life , namely have a sense of desire knowledge , attention , and interest in learn mathematics as well

as attitude tenacious and confident self in solution problem .¹

One of necessary aspects get attention special For reach objective learning mathematics is the need develop ability solution problem participant educate Good real world context and in context mathematics . Ability solution problem is ability must mastered participant education as supplies living in the real world . So that when participant educate find problems in life daily , participants educate can look for solution from the problem with Good . . Solution problem According to Polya there are 4 steps main that is :²

1. Understand the problem .
2. Make a plan to finish the problem .
3. Implement settlement problems .
4. Check and repeat the answers obtained .

Solution problems are closely related with metacognition , namely skills possessed by somebody in control of his thought process in a way aware . Researchers argue that metacognition is a central feature in life-long learning in general and science education in particular, and that metacognitive engagement is key for developing deeper conceptual understanding of science ideas. Researchers have an opinion that metacognition is a feature mainly in learning lifetime life whose involvement is key for developing understanding concepts . With the ability to regulate and control one's thinking, or “thinking about thinking” becomes an essential part of such learning. With ability metacognition that regulates and controls thinking someone in himself Alone or “ thinking about think ”, to be part important in learning For face 21st Century Challenges .

Metacognition was introduced by John Flavell who defined it as thinking about thinking (thinking about thinking) or knowledge of somebody about the thinking process . Metacognition as ability For understanding and monitoring activity thinking , so that the metacognitive process everyone is different . Here picture components process metacognition according to Schraw and Herscovitz 2012.³

¹ Suciati and Hardiansyah, *Ability Mathematical Problem Solving Participant Junior High School Students Reviewed from Metacognition in Creative Problem Solving Learning* . Journal of Mathematics Education . Vol. 9, No. 2, December 2019, p. 133.

² Khairun Nisa Rambe, et al., *Metacognitive Analysis in Mathematical Problem Solving in Problem-Based Learning Reviewed from Learning Styles* . Paradigm Journal of Mathematics Education. Vol. 13, No. 2, December 2020, p. 4.

³ Niva Wengrowicz, Yehudit Judy Dori, and Dov Dori. *Metacognition and Meta- assessment in Engineering Education* . Springer International Publishing AG 2018, p.193.

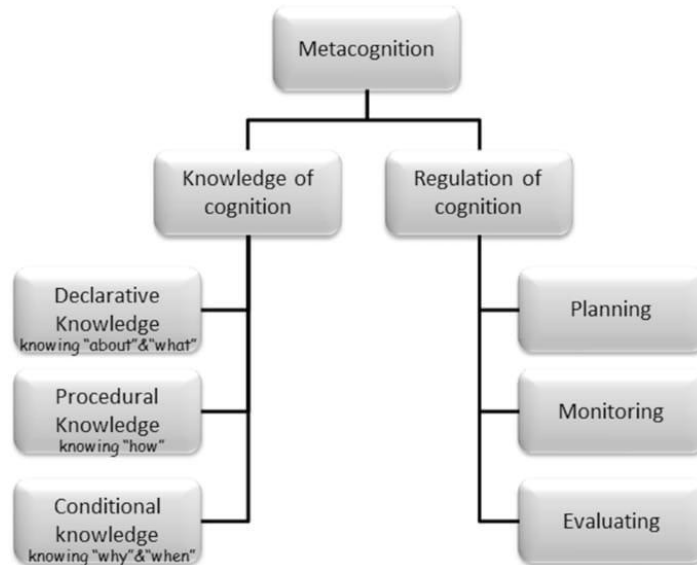


Figure 1. Metacognition Process

The metacognitive process consists of three stages namely planning skills, monitoring skills, and evaluating skills . planning is activity think about return information important , knowledge will used , strategy, and allocation right time For finish problem . Skills monitoring that is effort think about return in control of the strategy and time required . Skills evaluation that evaluates results and strategies that have been used including review return road repair .

Based on the explanation above , it appears that metacognition has a role important in solving problem mathematics . Participants educate need good metacognition in order to be able to with aware translation problem the to in form mathematics , so that besides Can finish problem with correct answer but also can wake up pattern structured and systematic thinking , so if confronted with different problems but Still in the same concept participant educate still can finish it .

Mathematics education in Singapore makes a pentagon frame to describe the method they teach mathematics to the participants his students . According to the Singapore Ministry of Education (MOE) this set direction in implementation teaching , learning , and assessment mathematics in all level education schools , which emphasizes understanding conceptual skills , processes, metacognition , and attitudes .⁴ Following mathematical pentagon framework in Singapore.

⁴ Zemira R. Mevarech , and Lianghou Fans. *Cognition, Metacognition , and Mathematics Literacy* . Springer International Publishing AG 2018, p.267

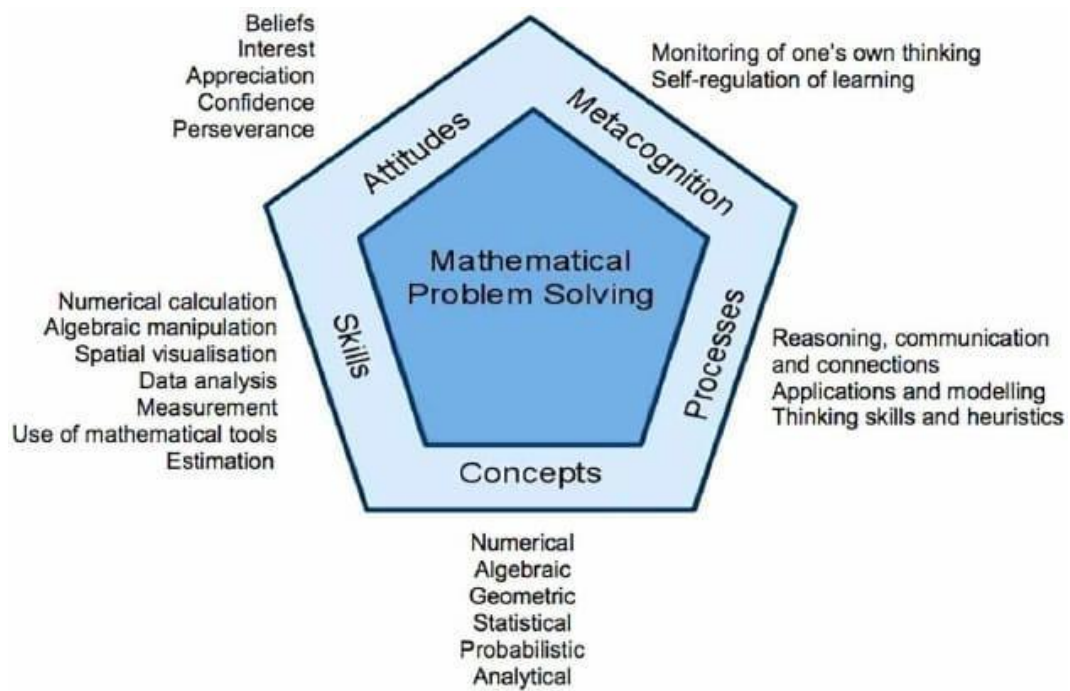


Figure 2. Mathematical Pentagon Framework in Singapore

Metacognition is one of the determining factors for a person's success in solving problems. ⁵In problem solving, it seems undeniable that the involvement of cognitive activity is essential. Metacognition has a significant impact on overcoming students' difficulties in solving problems, especially mathematical problems. ⁶Metacognitive awareness plays a crucial role in solving problems.

Algebra is a material important point in mathematics . Studying Algebra means learning object mathematics in the form of facts , concepts , skills , and principles . Concepts mathematics arranged in a way tiered from the simple to the complex and customized with level education . Concept is the most important thing that must be understood by someone . Concept will become base knowledge that will be used later in solution problems . If the concept is accepted No in accordance with should be , then will result in difference .

One of the strategies for increasing awareness participants educate in solving problem mathematics is to develop skills in metacognition . Skills metacognition own important role in various activity cognitive including understanding , communication , attention , memory , and problem solving problem . Participants students who have skills good metacognition will can finish problem with okay , that's it on the contrary . Therefore, researchers are interested in researching “ Metacognition Processes Students Based on Ability Solving Mathematical Problems in Algebra Grade VII”.

⁵Erlina Prihatnani and Daniel Supriyadi. *Metacognitive Process Mahasiswa educate ...* , p.210.

⁶Luthfiyanti Aprilia, et al ... p. 13.

Methods

The approach used in this research is a qualitative one. A qualitative research approach is one used to examine natural conditions, with the researcher as the key instrument. The data obtained will be presented in descriptive form and analyzed in detail to present the existing findings, allowing for more specific research .

Judging from the problems that have been found in the initial study, namely " Students' Metacognitive Process Based on Solving Mathematical Problems in Algebra Material of Class VII H MTsN 3 Tulungagung", the researcher used a case study research type, namely research that intensively studies an individual or group that is seen as experiencing a particular case. In this study, the case studied is the metacognitive process of students in solving mathematical problems in Algebra material which tends to be less noticed by educators and students in the learning process. In the data collection process, the researcher used supporting instruments, namely problem-solving test questions, and interview guidelines for students who are the objects of research.

Result

Study held on Friday , March 1, 2024, attended by 29 participants and 32 participants educate Class VII. Two participants educate No follow study This due to illness . Subject research that follows tests written there are 29 participants' education . Research done will give question test writing and continue to do interviews . Test write followed by all participants educated in One class , continued with an interview to six participant students representing each level ability solution problem participant educate in class.

The first research is to do a test solution problem , there are two questions given to participants . Test This done For knowing the metacognitive process at a time level ability to solve problems with participants educated in problem Algebra . Metacognitive processes in research This load three stages namely planning, monitoring, and evaluating. Indicator solution problem researchers use indicator solution problem according to Polya. Based on results test solution problems that have been done , 8 participants obtained educate own ability solution problem high , 13 participants educate ability solution problem medium , and 8 participants educate ability solution problem low of 29 participants students who follow test . Interview done to six participant students consisting of two participants educated with ability solution problem high , two participants educated with ability solution problem medium , and two participants educated with ability solution problem low , so the total subject study There are 6 participants educated .

Subject	Code	Ability Level	Solution to problem
AJM	S1T		Tall
FAA	S2T		Tall
MRA	S3S		Currently
ASH	S4S		Currently
SAF	S5R		Low
AFS	S6R		Low

High Ability Subjects

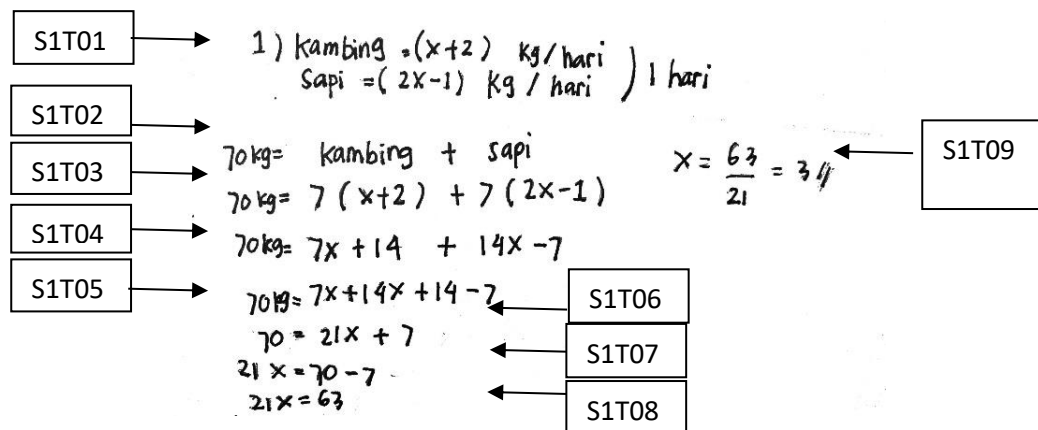


Figure 3. Answer Test Subject S1T

Subjects capable of solving problem mathematics carry out metacognitive processes in a way complete, starting from the planning, monitoring, and evaluating processes at the stage solution Polya's problems include stage understanding problem, planning completion, implementation plan completion, and inspection back. The first process that is carried out with ability is planning. Planning is defined as a process of thinking about important things that exist in given problems and selecting the right strategy. In the planning process at the stage understand problem subjects capable of being tall with Good things known and asked from questions presented. Subject mention known things from regarding, "Rations food goats and cows every day", the subject can also mention the thing asked "Looking for the value is x Bu", the subject can also connect things known and asked For plan solution "Because what is known in One Sunday, the food goats and cows I multiply seven ma'am" they are also deaf matter mentioned on the sheet the answer. At this stage plan settlement subjects connect relatedness with known things with matter that was asked, and the subject can also connect it with draft mathematics that has been studied previously that can help him in finishing problems obtained.

Furthermore, subjects capable of carrying out the monitoring process at stage carry out plan completion. The monitoring process is an interpreted process to do steps, solutions and find answers. Subject monitor every step of the workmanship with consistent and careful For avoid error. Subject with systematic steps until obtained exact results. At this stage end subjects do

evaluating process at the stage inspection back , subject make time For do checking answer as well as step workmanship previously For ensure everything Correct .

Medium Ability Subjects

The image shows a handwritten solution for the equation $1.7(x+2) + 2(2x-1) = 70$. The steps are as follows:

$$1.7(x+2) + 2(2x-1) = 70$$

$$= 7x + 14 + 4x - 2 = 70$$

$$= 7x + 4x + 14 - 2 = 70$$

$$= 11x + 12 = 70$$

$$11x = 70 - 12$$

$$11x = 58$$

$$x = \frac{58}{11} = 5.27$$

There are five arrows pointing from boxes containing the number '5' to each of the five lines of the solution.

Figure 4. Answer Test S1S Subject

Subject capable currently in solve problem mathematics carry out metacognitive processes with not enough complete , start from the planning, monitoring, and implementation processes conducting evaluation at the stages solution Polya's problems include stage understand problem , planning completion , implementation plan completion , and inspection back . Subjects with ability currently carry out the planning process in stages to understand and plan given problems . Planning is done subject with method know things that are known and asked are also written on the sheet answer . The subject can also plan settlement to connect relatedness with known things with what was asked as well as connection with material mathematics previously .

In the subject monitoring process capable currently can carry out plan settlement with good . The monitoring process is carried out with a finished question with sequential steps (Nurul Ma'rifah ,) . The subject can explain steps of the work that he did do with the danger itself . The subject also monitors steps to the solution with good .

However , at this stage end subject No carry out evaluation at stage inspection back . Evaluating is the process of reviewing and returning the results that have been obtained and ensuring truth steps the solution he does (Aisyah and Muhammad ,) . At the time the interview subject confessed " No do inspection return" For sure the answer he gave was , "No ma'am, straight away carry on number 2". Subject after finding the answer subject directly continue on number furthermore or directly collect it from researchers .

Low Ability Subjects

① ⁷⁰ (~~x~~+2) (2x-1) :

Kambing = (x+2) kg / hari
Sapi = (2x-1) kg / hari

Figure 5. Answer Test Subject S1R

Subjects capable of solving problem mathematics carry out metacognitive processes in a way that is not complete, subjects only carry out the planning process at the stages solution Polya's problems include stage understanding problems and planning completion. In the planning process, with understanding Meaning questions, write things that are known and asked (Nurul Ma'rifah.) . However subject No can connect related things asked and known, so that subject No can do stage planning completion. Subject capable low stop at the planning process only, he No can continue to the next process, because subject no find the way that will done for finish question said "I forgot how Ma'am method multiplying the existing x like this, ma'am" subject stop work and choose resigned direct gather sheet The answer is " I surrender, ma'am, I don't know" Confused".

Conclusion

Based on presentation of the results data research and discussion about the process of metacognition participant educate based on ability solution problem mathematics material algebra can it is said that ability solution problem mathematics participant educate influential towards his metacognitive process do, good for participant educate with ability solution problem mathematics high, medium, and low. The metacognitive process carried out by the participants educated with ability to solve problem mathematics high on material Algebra covering three processes, namely planning, monitoring, and evaluating. The metacognitive process carried out by participants educated with ability to solve problem mathematics currently on the material Algebra includes two processes, namely planning and monitoring. The metacognitive process carried out by participants educated with ability to solve problem mathematics high on material Algebra has only one process, namely planning.

ACKNOWLEDGMENTS

We would like to express our gratitude to UIN Sayyid Ali Rahmatullah Tulungagung, who has given guidance, input, and very meaningful facilities during the research process. cooperation from school, math teacher, daan student class VII H MT'sN 3 Tulungagung as subject research and support from various parties very much help in the research process. We hope that results

study This can give contribution positive in the world of education , in particular in learning mathematics for more pay attention to the metacognitive process participant his students .

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