



## PROFILE OF STUDENTS' METACOGNITIVE SKILLS IN SOLVING MATHEMATICAL PROBLEMS OF SMPN 3 PALU IN VIEW OF MATHEMATICAL ABILITY

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### ABSTRACT

Understanding students' metacognitive skills in solving math problems concerning their mathematical abilities is crucial for identifying the cognitive processes involved in problem-solving. This study investigates the metacognitive skills of SMPN 3 Palu students with varying mathematical abilities in problem-solving. It focuses on students in class VIIJ during the 2022/2023 academic year, individually analyzing one high-ability and one low-ability student. The research, descriptive in nature, employs qualitative methods using written assignments and interviews for data collection. This study's analysis involved condensing data, presenting findings, and drawing conclusions. The findings reveal distinct approaches between high and low mathematical ability subjects. High-ability students consistently apply all three metacognitive skills (planning, monitoring, and assessment) across each problem-solving stage. Conversely, low-ability students demonstrate a limited use of metacognitive skills. While they employ planning at each stage, during implementation and result review, they primarily engage in planning and monitoring, neglecting assessment. Ultimately, it underscores the critical role of metacognitive skills in mathematical problem-solving, highlighting differences in their application between students of varying mathematical abilities.

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## 1. INTRODUCTION

In Indonesia, mathematics is a subject that must be studied (Afriansyah et al., 2019) at every level of education, from elementary, junior high, and high school to tertiary institutions and underlies various branches of knowledge. Activities carried out in everyday life, from small things to increasingly advanced technological developments, cannot be separated from mathematics. Mathematics has many uses, including calculating the weight of objects, determining selling prices, developing hardware and software, and overcoming various conflicts between people. Humans need mathematics to avoid many difficulties in their daily lives. Therefore, mathematics is essential to learn.

Mathematics is a field of study that can train problem solving skills. This is in accordance with the objectives of learning mathematics in the first point formulated in SK BSKAP No. 33 of 2022 concerning Amendment to the Decree of the Head of the Standards, Curriculum and Education Assessment and Education Assessment Agency, Ministry of Education, Culture, Research and Technology Number 008/H/KR/2022 concerning Learning Outcomes in Early Childhood Education, Basic Education Levels, and Secondary Education in the Independent Curriculum, that students understand mathematics learning material in the form of facts, concepts, principles, operations, and mathematical relations and apply them flexibly, accurately, efficiently, and precisely in solving mathematical problems (BSKAP, 2022). Based on the objectives of learning mathematics above, problem solving is one of the aspects that must be achieved by students.

Problem solving is one of the most important tools in learning mathematics. Problem solving is very important because it can be useful as a means of learning new mathematical ideas and skills so that students are able to get good results. A person with problem solving skills is able to develop critical thinking skills and strengthen math skills (Pathuddin et al., 2019).

Polya (Novita & Widada, 2018) suggests four steps that need to be considered in problem solving, namely: (1) understanding the problem; (2) make a solution plan; (3) implement the solution plan; and (4) re-examine the results obtained. When properly observed, problem solving is carried out based on the knowledge of cognition, as well as the regulation of cognition which is a component of metacognition. Mathematical problem solving can be improved through learning based on metacognition strategies (Telaumbanua et al., 2017).

Metacognition is widely used as an “umbrella term” to refer to a person's various cognitive processes (Craig et al., 2020). Metacognitive is very important in solving math problems. Metacognitive in problem solving helps students to recognize the problem to be solved, to distinguish what the problem really is, and to understand how the solution is. This is supported by the results of Wahyuddin's research (2016). which shows that metacognition has a positive effect on problem solving abilities. Metacognitive has two basic components which include metacognitive knowledge and metacognitive skills.

Metacognitive skills are mental abilities in cognitive structures that are consciously regulated, controlled, and examined for their thought processes (Azizah et al., 2019). Students with well-trained metacognitive skills can know how to learn the right way for themselves, so that students can organize and assess their learning process. This is able to help students understand the problems and strategies used in solving mathematical problems, so they are able to determine the right steps in solving problems and are able to determine the solution (Kurniawan et al., 2019).

Each student has a different way of solving the math problems encountered. This happens because of differences in students' mathematical abilities, there are students who

have high, medium, and low mathematical abilities. Differences in students' mathematical abilities have an effect on ways of thinking in receiving and managing information when solving problems (Isroil et al., 2017). This difference in mathematical ability can result in differences in the metacognition processes carried out by students when solving mathematical problems. But not all students are able to involve their metacognition processes in solving mathematical problems (Marliana & Aini, 2021).

In solving problems, students experience difficulties when given non-routine questions. In short, non-routine problems require mastery of mathematical concepts and principles first, while routine problems are just daily routines that allow students to master basic mathematics (Abdullah et al., 2017). In solving non-routine questions, students tend to solve questions without understanding the information needed and do not re-check the answers that have been written. This happens because students do not consider their metacognitive skills in solving a given problem. Teachers also need to know an overview of students' metacognitive skills in solving math problems to design appropriate learning strategies.

Further research Wulandari et al. (2019) shows that students' metacognition skills in solving problems in the planning and evaluation aspects can be said to be lacking, while in the monitoring aspect it can be said to be quite good. Bennu & Multazam (2021) show that: (1) Subjects with a high level of mathematical ability bring up all components of metacognitive skills, namely prediction, planning, monitoring, and evaluation in solving problems with sequential and repetitive patterns; (2) Subjects at moderate level of mathematical ability bring up all components of metacognitive skills namely prediction, planning, monitoring, and evaluation, but the patterns are not sequential and repetitive; (3) Subjects with a low level of mathematical ability raise the components of metacognitive skills, namely prediction, planning, and evaluation in solving problems with incomplete and non-repetitive patterns.

The purpose of this study was to profile the metacognitive skills of SMPN 3 Palu students in solving mathematical problems in terms of mathematical abilities.

## **2. METHOD**

In this study used a descriptive approach to the type of qualitative research. The subjects of this study were two class VIIIJ students of SMPN 3 Palu consisting of one high ability student and one low ability student. This research was conducted at SMPN 3 Palu, which is located at Jalan Kemiri No. 35, Kamonji, West Palu District, Palu City, Central Sulawesi in the odd semester of the 2022/2023 school year. The difference in metacognitive skills between subjects with moderate abilities and subjects with high and low abilities is less significant. The metacognitive skills of subjects with moderate mathematical abilities are not much different from subjects with high mathematical abilities who have been able to surpass them (Hidayah & Nabila, 2022). Therefore, the researcher chose 2 subjects, namely students with high mathematical abilities and students with low mathematical abilities. Data collection techniques using written assignments and interviews.

The credibility test was carried out using time triangulation. Time triangulation is carried out by giving the first written assignment in the form of a description of fractional operations and then conducting interviews to find out more about the students' metacognitive skills in the first written assignment, then one week or even two weeks will be carried out again giving a second written assignment by providing a description of fractional operations which is equivalent to the first written assignment, then a second interview is conducted to find out more about the students' metacognitive skills in the second written assignment.

This study used two instruments, namely the main instrument, namely the researcher himself, and supporting instruments, namely written assignment sheets and interview guidelines. Before a written assignment is used in research, the written assignment is first validated by a lecturer in the Mathematics Education Study Program, FKIP Tadulako University. Students with high and low mathematical abilities will be given written assignment sheets in the form of questions about fractional operations in the form of descriptions, then will be interviewed in depth when solving problems at each step of the Polya.

Data analysis in this study was carried out with reference to qualitative data analysis according to (Miles et al., 2014), namely data condensation, data display, drawing and verifying conclusions.

### 3. RESULTS AND DISCUSSION

#### 3.1. Results

The grouping of students based on mathematical abilities, namely students with high mathematical abilities as many as 7 people and students with low mathematical abilities as many as 5 people. The process of selecting subjects from each group is taken at least one student. Furthermore, one student was selected from each group, FA to represent a group of high-ability students and FD to represent a group of students with low abilities. The determination of the 2 subjects is based on daily test scores in the odd semester mathematics subject for the 2022/2023 school year, recommendations for mathematics teachers, student willingness, domicile of residence, and student communication skills.

Excerpts from the researcher's interview with the subject of FA at M1 for planning metacognitive skills in understanding the problem are presented as follows:

IRM102 : First of all, what did you do when you were first given a question?

FAM102 : Read the question first.

IRM103 : What for brother?

FAM103 : Let's understand the contents of the question.

Based on the results of the M1 written assignment and the interviews, it was found that in an effort to understand the problem, the FA subject first read the questions/problems first in a calm manner with the aim of getting the information contained in the questions so that the problem solving process is more focused and in accordance with the aims and objectives of the questions.

Excerpts from the researcher's interview with the subject of FA on M1 for monitoring metacognitive skills in understanding the problem are presented as follows:

IRM104 : How to?

FAM104 : Read it carefully and thoroughly

IRM105 : How come?

FAM105 : To get important information in the problem.

Based on the results of the M1 written assignment and interviews, it was found that in an effort to find out the intent and purpose of the questions and to obtain information from the questions, FA subjects checked what was understood from the questions by reading the questions carefully and thoroughly. FA subjects believed that after looking at it again by reading carefully and carefully they would understand the problem well so that they would get important information from the problem.

Excerpts from the researcher's interview with the FA subject at M1 for metacognitive skills in assessing the problem understanding are presented as follows:

IRM106 : Then after reading, what information is obtained from the problem?

FAM106 : Known and asked questions.

- IRM109 : Can you write down what is known and asked in the questions.  
FAM109 : (Rereading the question) Hmm.. you can  
IRM110 : What is known from the problem?  
FAM110 : Known girls get 14 part. Boys get 24 share and the husband gets the inheritance 28.750.000.  
IRM111 : Which 24 where are you from  
FAM111 : From  $124 + 124$ , right twice as much as girls.  
IRM112 : Is there any other information to know?  
FAM112 : There isn't any.  
IRM113 : Then what is asked.  
FAM113 : Asked how much inheritance was given to daughters and sons.  
IRM114 : What makes you sure that that is what is known from the problem?  
FAM114 : Because there is a part of the problem that is important to work on the problem.  
IRM115 : For those asked?  
FAM115 : Because there is a question mark.

Based on the results of the M1 written assignment and interviews, it was found that to see the efforts that had been made in understanding the problem, FA subjects examined or reflected on the information obtained through the strategy used and paid attention to the problem again. This can be seen that FA subjects can explain information about what is known and asked about the questions properly and correctly orally and in writing. FA subjects believe that the information explanation regarding what is known and asked is appropriate.

Excerpts from the researcher's interview with the subject of FA at M1 for planning metacognitive skills in making a solving plan are presented as follows:

- IRM116 : After you know the information about what is known and asked, what will you do next?  
FAM116 : Doing search for the share of the husband and the total inheritance.  
IRM117 : Furthermore.  
FAM117 : Searching for the inheritance of daughters and sons.

Based on the results of the M1 written assignment and the interviews, it was found that the FA subject carried out the planning process in developing the strategy to be used in solving the problem, namely finding the husband's share, then the total inheritance and finally looking for the inheritance of daughters and sons.

Excerpts from the researcher's interview with the subject of FA on M1 for monitoring metacognitive skills in making a solution plan are presented as follows:

- IRM118 : Apart from this plan, do you have any other plans?  
FAM118 : (Reviewing the question) Nothing sis.  
IRM119 : The reason?  
FAM119 : That's all I know and I think that's the way.

Based on the results of the M1 written assignment and the interview, it was found that the FA subject checked the flow of problem solving by monitoring the strategies used were on the right track. In this case the FA subject stated that the strategy that had been prepared was sufficient to achieve the goal and could be used to solve the problem after reviewing the questions given.

Excerpts from the researcher's interview with the subject of FA at M1 for metacognitive skills assessment in making a solution plan are presented as follows:

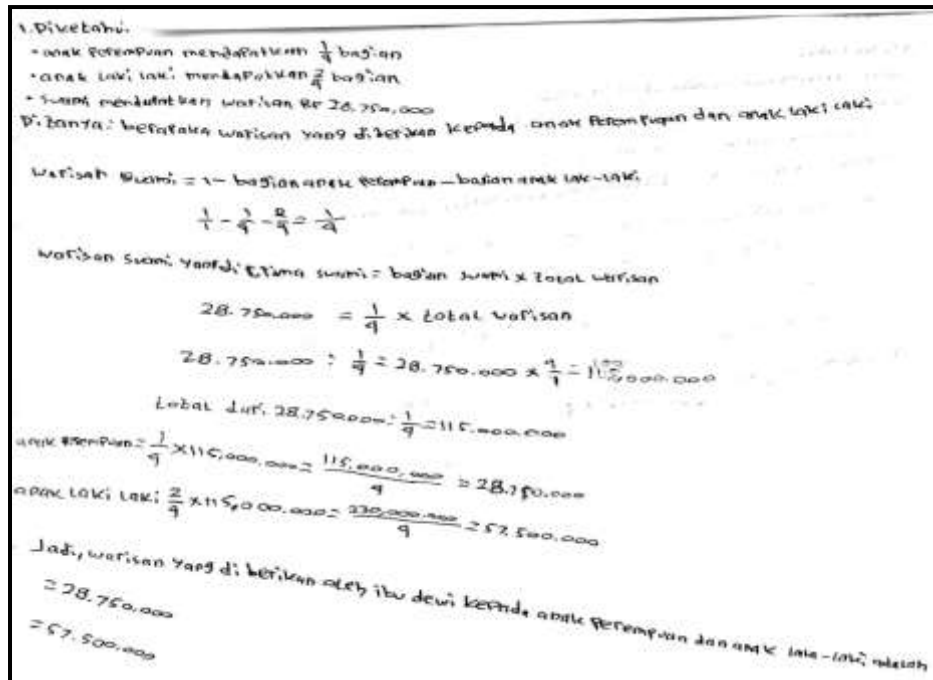
- IRM120 : In your opinion, this plan can be used to solve the problem?  
FAM120 : Can.

IRM121 : Why?

FAM121 : Because you can solve the problem correctly.

Based on the results of the M1 written assignment and interviews, it was found that the FA subject checked the suitability of the problem solving flow plan. Subject FA stated that the plan that had been prepared was sufficient and believed that it could be used to solve the problem so that no other strategy was deemed able to solve the problem.

FA subject's written answer in carrying out the M1 solving plan in the following figure.



Diketahui:

- anak perempuan mendapat  $\frac{1}{4}$  bagian
- anak laki laki mendapat  $\frac{2}{3}$  bagian
- sami mendapat warisan Rp 28.750.000

Ditanya: berapa warisan yang diberikan kepada anak perempuan dan anak laki laki?

Warisan suami = 1 - bagian anak perempuan - bagian anak laki-laki

$$1 - \frac{1}{4} - \frac{2}{3} = \frac{1}{12}$$

Warisan suami yang di terima suami = bagian suami x total warisan

$$28.750.000 = \frac{1}{12} \times \text{Total Warisan}$$

$$28.750.000 : \frac{1}{12} = 28.750.000 \times \frac{12}{1} = 345.000.000$$

Total Warisan = 345.000.000

anak perempuan =  $\frac{1}{4} \times 345.000.000 = 86.250.000$

anak laki laki =  $\frac{2}{3} \times 345.000.000 = 230.000.000$

Jadi, warisan yang di berikan oleh ibu dewi kepada anak perempuan dan anak laki-laki adalah

= 86.250.000

= 230.000.000

**Figure 1.**FA subject's written answer in carrying out the M1 solution plan

Figure 1 shows FA subjects carrying out the planning process by writing down the formula to be used so that they can implement the strategy that has been prepared in detail. Subject FA looked for the husband's share of inheritance first, then looked for the total inheritance left by Ibu Dewi and then looked for the amount of inheritance received by daughters and sons. The FA subject checks and corrects calculation errors and draws conclusions based on the steps taken.

Excerpts from the researcher's interview with the subject of FA at M1 for planning metacognitive skills in implementing the solving plan are presented as follows:

IRM122 : After you made the next plan, what did you do?

FAM122 : Count it.

IRM123 : Explain how did you calculate the problem?

FAM123 : Write down the formula for finding the husband's share. 1-girls section-share of boys =  $1-14-24=14$

IRM124 : Why use the adek subtraction operation?

FAM124 : Look sis, this is what the husband's part wants to look for. So to get the rest you have to subtract sis, the wife's share is reduced by the daughter's and son's shares.

IRM125 : How to get 14 ?

FAM125 : Look for the KPK first.

IRM126 : Furthermore.

FAM126 :  $44-14-24$  then the top is subtracted  $4-1-2$  so that 14

- IRM127 : What's next?  
 FAM127 : Dividing the husband's inheritance by the husband's share.  
 IRM128 : Where's that from bro?  
 FAM128 :  $28.750.000 = 14$  total inheritance to be  $28.750.000 \cdot 14 = 28.750.000 \times 41 = 115.000.000$ .  
 IRM129 : Why can it change like that?  
 FAM129 : What you are looking for is the total inheritance, sis, just moved the segment so it changes to  $. 28.750.000 \cdot 14$   
 IRM130 : Then why  $28.750.000 \cdot 14$  transformed into  $28.750.000 \times 41$ ?  
 FAM130 : The rules sis division of fractions can change to multiplication but which  $14$  turned into  $41$   
 IRM131 : Continue.  
 FAM131 : To find the total inheritance of the daughter  $14 \cdot 115.000.000 = 115.000.000 \cdot 4 = 28.750.000$ .  
 IRM132 : From where  $14 \cdot 115.000.000$ ?  
 FAM132 :  $14$  girls section and  $115.000.000$  of the total inheritance.  
 IRM133 : Means?  
 FAM133 : Girls section total inheritance.  
 IRM134 : Furthermore.  
 FAM134 : To find the total inheritance of sons  $24 \cdot 115.000.000$  .  $24$  is the son's share multiplied by the total inheritance equals  $2 \cdot 115.000.000 = 230.000.000$  and  $41 = 4$  means  $= 230.000.000 \cdot 4 = 57.500.000$

Based on the results of the M1 written assignment and the interview, it was found that the FA subject carried out the planning process by writing down the formula to be used and carrying out the strategy that was prepared in detail to get the desired results. FA subjects think about and express about the plans that are thought of when carrying out various possible problem solving strategies.

Excerpts from the researcher's interview with the FA subject at M1 for monitoring metacognitive skills in implementing the solution plan are presented as follows:

- IRM135 : There are several tipp-ex, why sis?  
 FAM135 : Because it's wrong.

Based on the results of M1's written assignments and interviews, it was found that FA subjects checked and corrected calculation errors when solving problems. This is visible because there are several x-types and numbers that are replaced.

Excerpts from the researcher's interview with the subject of FA at M1 for metacognitive skills assessment in implementing the solution plan are presented as follows:

- IRM136 : Means the answer is obtained?  
 FAM136 : So, the inheritance given by the mother goddess to daughters and sons is daughters  $28.750.000$  for boys  $57.500.000$ .  
 IRM137 : How come?  
 FAM137 : Because what is asked is how much inheritance is given to daughters and sons.

Based on the results of the M1 written assignment and interviews, it was found that the FA subject assessed the results obtained by making conclusions and checking the suitability of the results obtained with the purpose of the question so that the subject believed the answers were correct. The FA subject can also provide the right reasons for implementing the solving steps taken.

Excerpts from the researcher's interview with the FA subject at M1 for planning metacognitive skills in re-examining the results obtained are presented as follows:

- IRM138 : After you get the results, what do you do?  
FAM138 : read it.  
IRM139 : What for?  
FAM139 : To check correct or not.  
IRM140 : How long did you check it?  
FAM140 : 5 minutes  
IRM141 : Is such time enough?  
FAM141 : Enough.  
IRM142 : Why?  
FAM142 : Because time is enough to see how.

Based on the results of the M1 written assignment and interviews, it was found that the FA subject thought about and expressed how to check the steps that had been taken. In planning to re-check, the FA subject re-read the work that had been done and estimated that it would take around 5 minutes to re-check on the grounds that this time was sufficient.

Excerpts from the researcher's interview with the FA subject at M1 for monitoring metacognitive skills in re-examining the results obtained are presented as follows:

- IRM143 : How do you check whether it's true or not?  
FAM143 : From known to the end result.  
IRM144 : What do you mean the end result?  
FAM144 : Answer inheritance daughter and son.

Based on the results of M1's written assignments and interviews, it was found that to check whether the completion steps were on the right track or not, FA subjects looked back at the completion steps from start to finish to check for possible errors in writing and calculations.

Excerpts from the researcher's interview with the FA subject at M1 for metacognitive skills assessment in re-examining the results obtained are presented as follows:

- IRM145 : Is your sister's path correct?  
FAM145 : Already.  
IRM146 : Do you have another way?  
FAM146 : There is  
IRM147 : How to?  
FAM147 : By adding the daughter's inheritance plus the son's plus the wife's inheritance.  
IRM148 : How come?  
FAM148 : To find the total inheritance, if it is added to the three of them, it can produce the total inheritance, which means it is correct.

Based on the results of M1's written assignment and interviews, it was found that the subject FA considered the results of the investigation carried out to be correct. FA subjects reviewed whether the results obtained were correct or not by using another method, namely adding up the daughter inheritance, son inheritance and the inheritance received by the wife.

Excerpts from the researcher's interview with the subject of FD on M1 for planning metacognitive skills in understanding the problem are presented as follows:

- IRM102 : What did you do when you were first asked questions?  
FDM102 : Read it bro.  
IRM103 : What are you reading for?  
FDM103 : Let's find out.

Based on the results of the M1 written assignment and the interviews, it was found that in an effort to understand the problem the FD subject first read the questions calmly in order to get the information contained in the questions so that the problem solving process is more focused and in accordance with the intent and purpose of the questions.

Excerpts from the researcher's interview with the subject of FD on M1 for monitoring metacognitive skills in understanding the problem are presented as follows:

- IRM104 : How to?  
 FDM104 : Read carefully  
 IRM105 : Why is it like that sister?  
 FDM105 : Let's understand the problem.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject checked what was understood from the questions by reading the questions carefully in an effort to find out the intent and purpose of the questions and to obtain information from the questions. The FD subject believes that after looking at it again by reading it carefully they will understand the problem well so that they get important information from the problem.

Excerpts from the researcher's interview with the subject of FA on M1 for metacognitive skills assessment in understanding the problem are presented as follows:

- IRM108 : Can you write down what is known and asked in the problem?  
 FDM108 : It is known that a daughter gets 14 share, a son gets twice as much share as a daughter and the rest will be given to her husband.  
 IRM109 : Other information about what is known from the problem?  
 FDM109 : Hmm.. Nothing.  
 IRM110 : Why?  
 FDM110 : Because that's all that matters in the question.  
 IRM111 : As for the questions asked about the younger sibling?  
 FDM111 : How much inheritance did Mother Goddess give to a daughter and a son?  
 IRM112 : What makes you sure that that is what is known from the problem?  
 FDM112 : Because it's important.  
 IRM113 : According to the sister for what is known there is still something missing?  
 FDM113 : If I understand already bro.  
 IRM114 : What made you sure that that was what was being asked in the question?  
 FDM114 : There's a question mark.

Based on the results of M1's written assignments and interviews, it was found that in order to see the efforts made to be able to understand the problem, FD subjects did not realize the importance of checking the information obtained properly. This can be seen that the FD subject can explain information about what is asked correctly but for information about what is known to be inaccurate. Even though the information about what was asked was not written down, the FD subject was able to answer exactly what was asked in the question. The FD subject believes that the information about what is known and asked is appropriate, but the FD subject does not realize that the information about what is known is still not quite right.

Excerpts from interviews of researchers with FD subjects on M1 for skills metakognitif perencanaan dalam create a breakdown plan presented as follows:

- IRM115 : After you know about what is known and asked from the questions, what do you do next?  
 FDM115 : Many daughters inherit.  
 IRM116 : Furthermore.  
 FDM116 : Many inherited sons.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject carried out a planning process in developing a strategy to be used in solving the problem, namely looking for lots of inheritance from daughters, followed by lots of inheritance from boys.

Excerpts from the researcher's interview with the subject of FD on M1 for monitoring metacognitive skills in making a solution plan are presented as follows:

IRM117 : Apart from this plan, do you have any other plans?

FDM117 : I don't think there is.

IRM118 : Why?

FDM118 : That's all I know.

IRM119 : What about the husband's share and the total inheritance of Ibu Dewi? Aren't you looking for it?

FDM119 : Yes, it's not in the question.

IRM120 : So aren't you looking?

FDM120 : Because there wasn't one in the question, I didn't look for Sis.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject was not aware of checking the suitability of the problem solving strategy that had been thought of. This can be seen when the FD subject states that there is no other strategy without realizing again that the strategy is still insufficient to be able to solve the problem properly.

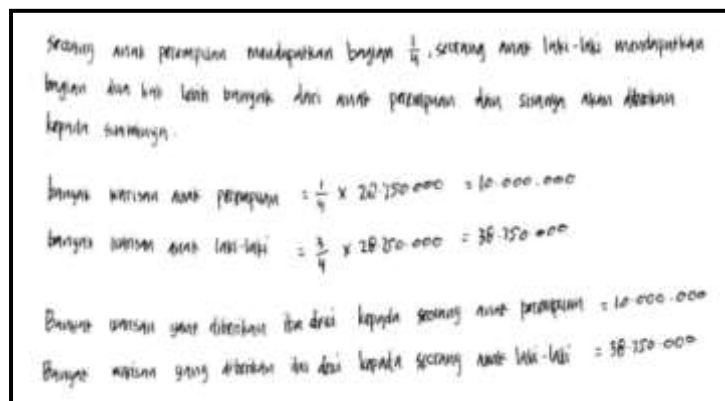
Excerpts from the researcher's interview with the subject of FA at M1 for metacognitive skills assessment in making a solution plan are presented as follows:

IRM121 : Then according to you, the plan can be used to solve the problem?

FDM121 : Not too sure sis but later the answer is appropriate.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject did not check the suitability of the problem solving flow plan. The FA subject stated that the strategy that had been prepared was sufficient but was not sure that the strategy that had been developed could be used to solve the problem properly.

The FD subject's written answers in carrying out the M1 solving plan are in the following figure



Seorang anak perempuan mendapatkan bagian  $\frac{1}{4}$ , seorang anak laki-laki mendapatkan bagian dua kali lebih banyak dari anak perempuan dan semuanya akan dibagikan kepada semuanya.  
 banyak bagian anak perempuan =  $\frac{1}{4} \times 20.750.000 = 5.187.500$   
 banyak bagian anak laki-laki =  $\frac{3}{4} \times 20.750.000 = 15.562.500$   
 Banyak bagian yang dibagikan ke anak perempuan = 5.187.500  
 Banyak bagian yang dibagikan ke anak laki-laki = 15.562.500

**Figure 2.**FD subject's written answer in carrying out the M1 solving plan

Figure 2 shows FD subjects carrying out the planning process by writing down the formula to be used so that they can carry out the strategy that has been prepared in detail. FD subjects are looking for more inheritance that daughters receive than sons. However, the formula for finding multiple inheritance of daughters and sons is still not quite right.

Excerpts from the researcher's interview with the subject of FD at M1 for planning metacognitive skills in carrying out the solving plan are presented as follows:

IRM122 : After making a plan, what next do you do?

- FDM122 : Do formulas.  
 IRM123 : Explain how bro?  
 FDM123 : Many daughters inherit= $14 \times 28.750.000 = 10.000.000$ .  
 IRM124 : From where  $14 \times 28.750.000$   
 FDM124 : 14 girls section and  $28.750.000$  husband's inheritance.  
 IRM125 : Furthermore.  
 FDM125 : Boy= $34 \times 28.750.000 = 38.750.000$ . 34 boys section and  $28.750.000$  husband's inheritance.  
 IRM126 : Why the boys section 34?  
 FDM126 : Hmm.... Just think about it and write it down  
 IRM127 : From the question, how many shares do the men get?  
 FDM127 : In terms of a boy getting twice as much as a girl, that's why I think 34 sister  
 IRM129 : Oh yes deck. Why must the inheritance of daughters and sons be multiplied by the husband's inheritance?  
 FDM129 : Because sis that's all there is in the question.

Based on the results of M1's written assignments and interviews, it was found that the FD subject carried out the planning process by writing down the formula to be used and implementing the strategy drawn up to get the desired results. FD subjects think about and express about the plans they think about when carrying out various possible problem-solving strategies.

Excerpts from the researcher's interview with the subject of FD on M1 for monitoring metacognitive skills in implementing the solution plan are presented as follows:

- IRM130 : There are some correction ink, why?  
 FDM130 : I wrote it wrong.

Based on the results of M1's written assignments and interviews, it was found that the FD subject checked and corrected writing errors when solving problems. This can be seen because there are several x-types and numbers that are replaced, but the calculation results obtained by the FD subject are not correct.

Excerpts from the researcher's interview with the subject of FD at M1 for metacognitive skills assessment in implementing the solution plan are presented as follows:

- IRM131 : Means the answer is obtained?  
 FDM131 : Many inheritances given by Dewi's mother to her daughter are similar to  $10.000.000$  and boys are equal  $38.750.000$ .  
 IRM132 : Why is the answer like that?  
 FDM132 : Because that's what you get.  
 IRM133 : The answer you got is correct?  
 FDM133 : Maybe it's true.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject made conclusions but had not checked the suitability of the results obtained. It can be seen that the FD subject does not believe that the results obtained are correct because the FD subject also does not believe that the strategy that has been prepared can be used to solve the problem correctly. The subject of FA also could not give a precise reason for the implementation of the problem solving steps carried out.

Excerpts from the researcher's interview with the subject of FD at M1 for planning metacognitive skills in re-examining the results obtained are presented as follows:

- IRM134 : After solving the problem, what else do you do?  
 FDM134 : Replay.

- IRM135 : What for?  
FDM135 : Afraid something is wrong.  
IRM136 : How long did you look at it again?  
FDM136 : 1 minute.  
IRM137 : Is such time enough?  
FDM137 : Yes, because it's short.

Based on the results of the M1 written assignment and interviews, it was found that the FD subject thought about and expressed how to check the steps that had been taken. The FD subject plans to re-check by reviewing the steps that have been taken and estimating that it will take around 1 minute to re-check on the grounds that this time is sufficient.

Excerpts from the researcher's interview with the subject of FD at M1 for monitoring metacognitive skills in re-examining the results obtained are presented as follows:

- IRM138 : How do you check that you are not wrong?  
FDM138 : Read from top to end.  
IRM139 : What does it mean from top to end?  
FDM139 : From what is known to the final answer sis.

Based on the results of M1's written assignments and interviews, it was found that to check whether the completion steps were on the right track or not, the FD subject looked back at the completion steps from start to finish to check for possible errors in writing and calculations.

Excerpts from the researcher's interview with the subject of FD at M1 for metacognitive skills assessment in re-examining the results obtained are presented as follows:

- IRM140 : Is your sister's path correct?  
FDM140 : I'm not too sure bro.  
IRM141 : Do you have another way?  
FDM141 : I don't think there is anymore.

Based on the results of M1's written assignments and interviews, it was found that the FD subject could not judge that the results of the investigations carried out were correct. The FD subject was unsure of the results obtained and did not review the results obtained using other methods

### **3.2. Discussion**

Based on the data analysis conducted by the researcher, the metacognitive skill profiles of SMPN 3 Palu students with high and low mathematical abilities in solving mathematical problems in terms of mathematical abilities were obtained as follows:

**Profile of Students' Metacognitive Skills with High Mathematical Ability in Problem Solving**

At the stage of understanding the problem, the subject consciously determines what must be done to understand the problem by first reading the problem calmly to get the information in the problem. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the steps taken in understanding the problem, namely checking what is understood from the problem by reading the problem carefully and thoroughly. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. Subjects also seemed aware of checking the information obtained from the questions, namely writing and explaining information about what was known orally and in writing and believed that the information obtained was appropriate. Based on this it was concluded that the subject involved his metacognitive skills through assessment.

At the stage of making a problem-solving plan, the subject consciously determines what to do to prepare a settlement plan, namely carrying out the planning process in developing a strategy to be used in solving the problem. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring what is being done in compiling a problem-solving plan, namely checking the flow of problem-solving by reviewing the questions and the strategies used are on the right track. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed conscious to re-check the correctness of the strategy being carried out, namely checking the suitability of the problem-solving flow plan so that the plan that had been prepared could be used to solve the problem. Based on this it was concluded that the subject involved his metacognitive skills through assessment

At the stage of carrying out the problem-solving plan, the subject is aware of planning the implementation of the problem-solving strategy, namely thinking and expressing the plans that are thought of when carrying out the strategy that is prepared in detail to get the desired results. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the implementation of problem solving by checking and correcting calculation errors when solving problems. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed conscious in assessing the suitability of the initial plan with the results obtained, namely checking the suitability of the results obtained with the purpose of the question, and giving the right reasons for implementing the solving steps taken. Based on this it was concluded that the subject involved his metacognitive skills through assessment.

At the stage of re-examining the results obtained, it can be seen that the subject is aware of planning what to do to check the completion steps, namely thinking and expressing how to check the steps that have been taken by re-reading and estimating the time to re-check. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the plan to check the steps for solving the problem, namely looking back at the completion steps from start to finish to check for possible errors in writing and calculations. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed aware of re-examining the problem solving steps, namely assessing the results of the investigation carried out were correct using other methods. Based on this it was concluded that the subject involved his metacognitive skills through assessment.

The results of the study for students with high mathematical abilities showed that all metacognitive skills emerged at each of Polya's steps in solving mathematical problems. This is in line with (Sudia, 2015; Wulandari et al., 2019; Pathuddin et al., 2019) in his research which concluded that high-ability students involve all their metacognitive skills for each stage of problem solving according to Polya.

Profile of Students' Metacognitive Skills with Low Mathematical Ability in Problem Solving. At the stage of understanding the problem, the subject is aware of planning what to do to understand the problem by reading the questions first to get the information in the questions. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the steps taken in understanding the problem, namely checking what is understood from the problem by reading the problem carefully. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed aware of assessing what information was asked; that is checking the information obtained properly and explaining the information regarding the person being asked orally and in writing and making sure

that the information about what is being asked is appropriate. However, the subject is not yet aware of assessing the determination of information about what is known and sufficient conditions to solve the problem; namely not checking the information obtained properly so that information about what is known is not quite right so that it is not enough to be able to solve the problem. Based on this it was concluded that the subject had not fully involved his metacognitive skills through assessment.

At the stage of making a problem solving plan, it can be seen that the subject is aware of planning what to do to solve the problem, namely carrying out the planning process in developing a strategy to be used in solving the problem. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also not aware of monitoring what is being done in preparing a problem-solving plan, that is, he is not aware of checking the suitability of the problem-solving strategy that has been thought of so that the strategy is still insufficient to be able to solve the problem properly. Based on this it was concluded that the subject had not involved his metacognitive skills through monitoring. The subject also seemed not aware of checking again the correctness of the strategy being carried out, namely not checking the suitability of the problem-solving flow plan and not being sure that the strategy that had been prepared could be used to solve the problem properly. Based on this it was concluded that the subject had not involved his metacognitive skills through assessment.

At the stage of implementing the problem-solving plan, it can be seen that the subject is aware that in planning the implementation of the problem-solving strategy, it has been determined in detail, that is, to think about and express the plan that was thought of when carrying out various possible problem-solving strategies. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the implementation of problem solving, namely checking and correcting writing errors when solving problems. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed unaware of assessing the implementation of the problem-solving strategy undertaken, that is, the subject had not been able to provide proper reasons for the implementation of the problem-solving steps carried out and had not checked the suitability of the results obtained so that the subject did not believe the results obtained were correct. Based on this it was concluded that the subject had not involved his metacognitive skills through assessment.

At the stage of re-examining the results obtained, it can be seen that the subject is aware of planning what to do to check the completion steps, namely thinking and expressing how to check the steps that have been taken by re-reading and estimating the time to re-check. Based on this it was concluded that the subject involved his metacognitive skills through planning. The subject is also aware of monitoring the plan, namely looking back at the completion steps from start to finish to check for possible errors in writing and calculations. Based on this it was concluded that the subject involved his metacognitive skills through monitoring. The subject also seemed unaware of assessing the plan to check the steps for solving the problem, namely not being sure of the results obtained and not reviewing the results obtained using other methods. Based on this it was concluded that the subject had not involved his metacognitive skills through assessment.

The results of the research for students with low mathematical abilities show that not all metacognitive skills appear at every step of Polya in solving mathematical problems. This is in line with (Sudia, 2015; Wulandari et al., 2019) in his research which stated that students with low abilities did not involve all of their metacognitive skills for each stage of problem solving according to Polya. Where according to (Sudia, 2015), students who have low abilities only involve their metacognition through planning activities in problem

solving according to Polya. Students who have low mathematical abilities only involve their metacognitive through the monitoring stage (Muliawati, 2016). Wulandari et al. (2019) also stated that students with low ability levels did not involve evaluation activities at each Polya stage.

#### 4. CONCLUSION

When solving mathematical problems, subjects with high mathematical abilities involve all three metacognitive skills (planning, monitoring, and assessing) for each stage of Polya's problem-solving. When solving math problems, subjects with low math abilities involve only one metacognitive skill (planning) for each stage of Polya's problem-solving and involve two metacognitive skills (planning and monitoring) for several stages of Polya's problem-solving (implementing the solving plan and re-checking the results obtained).

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