



## Metacognitive skills of student in solving problems of two-variable linear equation systems in terms of self-regulated learning

Nining Setyaningsih<sup>1\*</sup>, Erlina Zulva Rahmawati<sup>2</sup>

Program Studi Pendidikan Matematika, Univeristas Muhammadiyah Surakarta

Jl. A. Yani, Mendungan, Pabelan, Kecamatan Kartasura, Kabupaten Sukoharjo, Jawa Tengah 57169

E-mail: [ns259@ums.ac.id](mailto:ns259@ums.ac.id)<sup>1</sup>, [a410180084@student.ums.ac.id](mailto:a410180084@student.ums.ac.id)<sup>2</sup>

\* Corresponding Author

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### ABSTRACT

*This research was aimed to describe students' metacognitive skills in solving problems of a two-variable linear equation system in VIII grade in terms of learning independence. The research subjects were 32 students from SMP Negeri 3 Jatisrono. This type of research was descriptive qualitative research. Data collection using questionnaire was analyzed to obtain the level of learning independence ability of each student, while the test data collection was to determine metacognitive ability. In this research, there were three indicators used in metacognition skills, including planning indicators, monitoring indicators, and evaluation indicators. The results showed that metacognitive abilities were different at each level of students' learning independence. Students with high learning independence fulfill three indicators; Planning indicators, monitoring indicators, and evaluation indicators. Students were able to solve problems from beginning to end and the answers were obtained correctly so it can be said that these students were able to use their metacognitive abilities well. Students of moderate learning independence were able to meet two indicators, including planning indicators and monitoring indicators. Students could not solve the problem, by making mistakes in the calculation process to determine the final value. Students with low learning independence can maximally fulfill one metacognitive indicator; Planning indicators. Students make a calculation error in the strategy that has been designed so it results in the final result of the answer.*

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### INTRODUCTION

In science and technology, mathematics occupies an important place in developing a person's critical, logical and systematic mindset as a resulted that it can improve the ability to do problem solving. This is in accordance with the objectives of learning mathematics in the Regulation of the Ministry of National Education Number 22 of 2006 (Ministerial Regulation Number 22, 2006). The ability to solve problems is needed by students in solving mathematical problems. The results of the 2015 TIMSS survey from 49 participating countries, Indonesia was ranked 44. (Hadi & Novaliyosi, 2019 p. 2). Such is the result of the PISA study from 79 participating countries, Indonesia was in position 74. (Schleicher, 2018 p. 6). This proves that the mathematical competence has not been achieved by Indonesian students.

Problem solving involves higher order thinking skills. Problem solving ability is one of the goals in learning mathematics. This is in accordance with the objectives of learning mathematics at NCTM, including: (1) Communication; (2) Problem solving; (3) Connection; (4); Reasoning (5) Representation. (Nurhayati et al., 2017 p. 2). Harahap (2017) revealed that problem solving is a complex thinking activity with a number of strategies for the process of dealing with and solving problems. Problem solving skills

are one of the basic math skills needed by students. Understanding of students' poor concepts and principles can also lead to weakening of students' ability to solve a problem. (Rahmiati & Fahrurrozi, 2016 p.3). One of the factors that affect the inaccuracy of the external representation used by students to solve the problem of a problem is the students' ability. (Andhani, 2016 p. 180). the process of learning mathematics in the classroom should emphasize the relationship between mathematical concepts and students' everyday experiences. Many students have difficulty when facing math problems that are not common, so they have difficulty in solving mathematical problems. (Amri & Abadi, 2013 p. 57) Problem solving is not just a form of being able to apply the rules that have been learned in past educational activities, but more than the process of moving the rules to the next level. However, the fact that is often found in this field is that there are factors that affect the ability to solve mathematical problems, so it becomes an obstacle to its development. For example, learning mathematics has always been a less desirable study, so the lack of student motivation to learn mathematics, the process of learning mathematics is often used by students. pattern, the tendency of the learning process that only emphasizes access to learning materials in class and the lack of availability of learning materials that make it easier for students to practice their math problems. (Purwasi & Fitriyana, 2019). In solving math problems, students focus on developing their skills, including realizing new mathematical knowledge, performing problem solving in a variety of math-related contexts, using various strategies as needed, and thinking through the mathematical problem-solving process. All these skills can be learned if students are accustomed to solving problems in the right way, therefore the various benefits that can be obtained are not only related to one problem, but can also affect other problems - different problems and broader aspects. in mathematical knowledge.

Perform problem solving with attention to thought processes and self-regulation skills so you can develop a solid and comprehensive understanding of problems with logical reasoning. This kind of concept is something that is always emphasized in the mathematics learning at all levels of education, because of the strong harmonization of mathematical thinking patterns. Kuzle (2013) in his research states that affective behaviors such as diligence, persistence, confidence, interest, and emotions during activities in problem solving are closely related to the process of metacognitive skills. In relation to problem solving, metacognition is related to students' thinking in their ability to determine appropriate problem-solving strategies. (Nurhayati, 2017, p.3).

The concept of metacognition was first introduced by John Flavell. J. H. Flavell, (1979) states Metacognitive experiences are all intelligent and affective experiences that are managed and relevant to any intellectual endeavor. Metacognition refers to the individual's awareness of the consideration and control of their metacognitive processes and strategies. Students with good problem-solving skills have mastered their metacognitive skills. Students with high metacognition are more planned in solving these problems since they are able to manage their cognitive aspects. (Fitrih et.al, 2018). Metacognition skills need to be possessed by students so they can control their thinking patterns effectively and efficiently, which aims those students can find out their learning abilities which have an impact on learning outcomes. Metacognition is knowledge about how to think with established rules and beliefs about a person's thought process, as well as their thinking efforts participate in behavioral and thinking processes in order to improve the learning process and knowledge to control what they know. This awareness is achieved when a person can begin to think planning, monitoring and evaluating the results of cognitive activity. (Pramono, 2017 p. 135). With this metacognitive process, students will have more opportunities to evaluate their processes in the problem-solving process. (Setyadi, 2018 p. 98)

In addition to metacognition skills, solutions to mathematical problems require many complex skills, one of them is independent learning. Through a metacognitive approach, students are encouraged to realize their strengths and weaknesses in learning mathematics and how to control them. Learning using this approach tends to involve students more actively being the center of learning compared to conventional learning. Students can directly master the process of thinking and learning. This activity is expected to optimize students' independence in education (Rahmawati et al., 2018 p. 609). (Suhendri, 2011, p. 34) suggests learning independence is a student's learning activity without depending on others. (Arifin & Herman, 2018) independence is the ability of individuals to carry out learning activities and determine effective learning methods according to their wishes and without depending on others. The relationship between adaptability and mindset with learning independence and its impact on academic

achievement shows that there is a significant correlation between self-adjustment ability, mindset, and learning independence with academic achievement and self-adjustment ability with learning independence. (Fitrih, 2018, p. 44). Learning independence can be used as a predictor to measure mathematical problem-solving ability, the higher the student's independence in learning, the better the problem-solving ability, the better and vice versa, the lower the learning independence, the fewer students who have poor problem-solving skills. (Aldi Anigrah, 2020 p. 10). (Sumarmo, 2010) revealed that there are several indicators that can be used to measure learning independence; (1) learning initiatives, (2) diagnosis of learning needs, (3) setting learning goals and objectives, (4) monitoring, setting and tracking the learning process (5) see the problem as a challenge. (6) find information that can help. relevant, (7) selection and application of strategies or learning concepts, (8) evaluation of the process as well as on learning outcomes, and (9) self-concept.

Based on this description, this research was aimed to analyze the metacognitive ability of junior high school students in terms of student learning independence on the material of a two-variable linear equation system (SPLDV). With the criteria of learning independence in problem solving abilities, they are divided into three groups; High, moderate, and low which then analyzed the students' metacognitive abilities.

## **METHOD**

Based on the approach, this type of research is qualitative research with a descriptive approach. The research was conducted at SMPN 3 Jatisrono which was held in the odd semester of the academic year of 2021/2022. This research procedure began with filling out a questionnaire to determine the level of student learning independence. Furthermore, students carry out tests in the form of description questions in order to obtain information on the extent of students' thinking abilities. Furthermore, the researchers conducted interviews to obtain information related to the results of the tests that had been done.

In this research, the subject is a class VIII A student in the odd semester in the academic year of 2021/2022. The subjects in this research were taken from subjects with high, moderate, and low learning independence, each category taken by one student. Data collection techniques in this research used questionnaires, tests, interviews, and observations.

In this research, the instrument consisted of a primary instrument which was the researcher and supporting instruments were a learning independence questionnaire, thinking ability test questions, and interview guidelines with subjects in order to obtain detailed information related to the results of student work in solving problems.

The thinking ability test instrument used the material for the Two Variable Linear Equation System (SPLDV) which consisted of two questions. Before carrying out the thinking ability test, the validity of the test instrument was tested by two expert validators, namely the Mathematics Education lecturer at Muhammadiyah University of Surakarta and the mathematics teacher at SMP Negeri 3 Jatisrono.

In this research, the test instrument was used to obtain data related to the students' steps in solving problems using their metacognitive skills, including planning, monitoring, and evaluation. Analysis of the data used in this research by performing the stages of data reduction, data presentation, and drawing conclusions. Data reduction was used to focus on the important things. Data presentation was used in classifying data so it can be arranged in an easy-to-understand relationship pattern. Conclusion drawing was aimed to draw conclusions about the metacognitive ability of each research subject.

## **.RESULTS AND DISCUSSION**

The first data collection was in class VIII A where there were 32 students by filling out a learning independence questionnaire. Filling out the questionnaire was aimed to determine students who are classified as high, moderate and low learning independence. Classification of learning independence is presented in Table 1. as follows.

**Table 1.** Classification of Independent Learning Categories

Category	Total	Percentage
High	3	9%
Moderate	27	84%
Low	2	6%
Total	32	100%

Based on Table 1. one research subject was taken for each level of learning independence which then carried out a thinking skills test. S1 subjects represent high learning independence, S2 subjects represent moderate learning independence, and S3 subjects represent low learning independence. Data analysis was carried out by analyzing the metacognitive indicators of each subject of the level of learning independence including planning, monitoring, and evaluation. The following is a description of students' metacognition indicators which are reviewed based on learning independence.

### High Learning Independence (S1)

In the research of Metacognitive Ability of High Learning Independent, the research subject selected 1 student with a high level of learning independence. Based on the results of research in the field, the subject of S1 was able to solve the questions well and fulfilled all metacognitive indicators. The following is an explanation of each metacognition indicator about students' thinking ability tests.

#### Planning Indicators

Planning indicators were considered to be fulfilled if students were able to understand the elements of the questions given, understood the purpose of the questions and determined strategies or initial concepts and were able to develop concepts. The following is presented in Figure 1. the results of work and interviews with the subject of S1.

① Diketahui :
Harga 4 pensil dan 3 buku = 14.500
Harga 2 pensil dan 2 buku = 8.000
Ditanya :
Berapa harga 5 pensil dan 7 buku ?

**Figure 1.** Work Results of S1 Subjects on Planning Indicators

- Q : For number one, do you understand what the question means?  
 S1 : Yes, I do.  
 P : Please explain everything you know about question number one!  
 S1 : 4 pencils and 3 books cost 14,500, 2 pencils and 2 books cost 8,000  
 Q : What are you looking for in this question?  
 S1 : how much is the price for 5 pencils and 7 books.  
 Q : Then, what is the next step you do?  
 S1 : For example, pencil =  $x$  books =  $y$ .  
 Q : Then?  
 S1 :  $4x + 3y = 14,500$ ,  $2x + 2y = 8,000$  equal to find  $5x + 7y$ .  
 Q : What method do you use to solve the number one question?  
 S1 : Elimination by substitution.

According to the results of the work and interviews with the subject of S1 indicated that the planning indicators could be met. The subject understood the elements in the problem by showing what was known and asked in the question. The subject could determine the method to solve the problem and could develop the initial concept to solve the problem.

#### Monitoring Indicators

The fulfillment of monitoring indicators was shown by being able to set steps for completion, analyzed important information, carried out the next steps used, and used the right strategy. The results of the work of the S1 subject are presented in Figure 2. To support these results, the researcher included the results of interviews with the S1 subject.

Jawab :
Misal : Pencil = x
Buku = y
$4x + 3y = 14.500$
$2x + 2y = 8.000$
$\Rightarrow 5x + 7y = \dots ?$
$4x + 3y = 14.500 \quad   \cdot 2 \quad   \quad 8x + 6y = 29.000$
$2x + 2y = 8.000 \quad   \cdot 3 \quad   \quad 6x + 6y = 24.000 \quad -$
$2x = 5.000$
$x = 2.500$ disubst (1)
$x = 2.500$
$4x + 3y = 14.500$
$4(2.500) + 3y = 14.500$
$3y = 14.500 - 10.000$
$3y = 4.500$
$y = 1.500$

**Figure 2.** Work Results of S1 Subjects on Monitoring Indicators

*Q* : What is the first step you take to solve the problem?

*S1* : I will equate the value to 6 so it can be eliminated, the upper one I multiply by 2 and the lower one I multiply 3. Then I find  $x = 5,000$ ,  $x = 5,000 : 2$ , I find  $x = 2,500$ .

*Q* : After knowing the p value, what is the next step?

*S1* : The p value is entered into equation 1 so  $4(2,500) + 3y = 14,500$ , this is 10,000 and then we move the side so  $3y = 14,500 - 10,000$ ,  $3y = 4,500$ ,  $y = 4,500 : 3$  we find  $y = 1,500$ .

From the results of the work accompanied by interviews with researchers with S2 subjects, it showed that the monitoring indicators were fulfilled. Steps to solve problems by S2 subjects were right by being able to analyze important information. S2 subjects could take the next steps and the strategies that have been designed could be carried out properly.

**Indicators of Evaluation**

Evaluation indicators can be met if students can write the final answer and were sure with the answer, and were able to show the final answer. The following is presented in Figure 3. the results of the work of the S1 subject, in order to support these results, the results of the interview with the S1 subject are also included.

$5x + 7y$
$5(2.500) + 7(1.500)$
$= 12.500 + 10.500$
$= 23.000$

**Figure 3.** Work Results of S1 Subjects on Evaluation Indicators

*Q* : After finding the value of x and y, then what is the next step?

*S1* : x and y are added to the equation  $5(2,500) + 7(1,500) = 12,500 + 10,500$  for a total of 23,000.

*Q* : Are you sure about the final answer?

*S1* : Yes, because I recount it.

*Q* : Do you have any difficulties while working on question number one?

*S1* : Yes, it's time to decide which one will be eliminated.

From the results of the work and interviews with the subject of S1 proved that the evaluation indicators were met. Problem solving by subject S1 could be done until the end was indicated by being



able to write down the final answer. The subject of S2 was sure of the answer by re-examining the results of his work.

### Moderate Learning Independence (S2)

In the research of Moderate Learning Independent Metacognitive Ability, the research subject selected 1 student with a moderate level of learning independence. From the results of the research, the S2's subject was able to fulfill two metacognitive indicators; Planning indicators and monitoring indicators. The following is an explanation of each metacognition indicator about students' thinking ability tests on the subject of moderate learning independence.

### Planning Indicators

Figure 4. presents the work results of the S2 subject accompanied by the results of the interview.

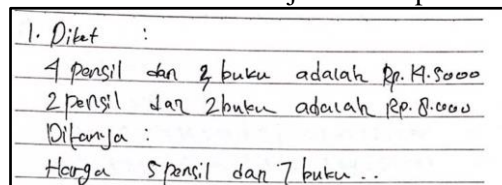


Figure 4. Work Results of S2 Subjects on Planning Indicators

*Q* : For number one, do you understand what the question means?

*S2* : Yes, I do.

*P* : Please explain everything you know about question number one!

*S2* : the price for 4 pencils and 3 books is 14,500, 2 pencils equal 2 books the price is 8,000.

*Q* : What are you looking for in this question?

*S2* : The price of 5 pencils and 7 books

*Q* : After that, what is the next step you do?

*S2* : For example, pencil =  $x$  books =  $y$ .

*Q* : Then?

*S2* :  $4x + 3y = 14,500$  that is equation one,  $2x + 2y = 8,000$  is equation two.

*Q* : What method did you use to solve the number one question?

*S2* : Elimination and then, substitution.

Based on the results of the work and interviews with the subject of S2 planning indicators (planning) can be fulfilled. S2 subjects could understand well the questions given by being able to state what was known and what was being asked in the questions. S2 subjects could determine and developed strategies or concepts used for problem solving steps from the information understood from the questions.

### Monitoring Indicators

The results of the work of the S2 subject are presented in Figure 5. To support these results, the researcher includes the results of interviews with the S2 subject.

Jawab : pensil =  $x$   
 buku =  $y$   
 $4x + 3y = 14.500$   
 $2x + 2y = 8.000$   
 $5x + 7y =$   
 $4x + 3y = 14.500$   $\times 2$   $8x + 6y = 29.000$   
 $2x + 2y = 8.000$   $\times 3$   $6x + 6y = 24.000$   
 $2x = 5.000$   
 $x = 2.500$   
 Di Substitusikan (1)  
 $4x + 3y = 14.500$   
 $4(2.500) + 3y = 14.500$   
 $8.000 + 3y = 14.500$   
 $3y = 14.500 - 8.000$   
 $3y = 6.500$   
 $y = \frac{6.500}{3}$   
 $y = 2.166,67$

Figure 5. Results of S2 Subject Work on Monitoring Indicators

*Q* : What is the first step you take to solve the problem?

*S2* : I will eliminate it. I will multiply equation one by two and multiply by three. The remainder of  $2x=5,000$   $x=5,000:2$  finds the value  $x=2,500$ .

*Q* : After knowing the value of  $x$ , what is the next step?

*S2* : Substituting into equation 1 to find the value of  $y$ , the value of  $p$  finds 1,500.

Based on the results of the work and interviews with researchers with S2 subjects, it showed that the second metacognitive indicator, namely the monitoring indicator, can be fulfilled. The initial step in problem solving by the subject of S1 can be done well. The strategy that has been determined can be done correctly by being able to decide the next steps to solve the problem.

### Indicators of Evaluation

Figure 6. presents the results of the work of the S2 subject, to support these results the researcher includes excerpts from the interview with the S2 subject.

$$\begin{aligned}
 &= 7(2.500) + 5(1.500) \\
 &= 17.500 + 7.500 \\
 &= 25.000
 \end{aligned}$$

Figure 6. Work Results of S2 Subjects on Evaluation Indicators

*Q* : After finding the value of  $x$  and  $y$ , what is the next step?

*S2* : Substituted into equation  $7(2,500) + 5(1,500) = 17,500 + 2,500 = 25,000$ .

*Q* : Are you sure about the final answer?

*S2* : Yes.

*Q* : Try to re-read what was asked in the question!

*S2* : The price of 5 pencils and 7 books.

*Q* : If it is converted into an equation, how much it will be?

*S2* :  $5x + 7y$ .

*P* : Then the final result that you do the equation, how much it will be?

*S2* : Yes, you are wrong, you are not careful.

*P* : This will result in your final answer being the opposite of the  $x$  and  $y$  values you substituted.

*Q* : Do you have any difficulties while working on question number one?

*S2* : Yes, maybe you are not careful enough to read the questions.

Based on the results of the work of the S3 subject, the evaluation indicators have not been met. The final answer can be written by the S3 subject but the final result is not quite right. S3 subjects are less careful by making mistakes in writing variable values.

### Low Learning Independence (S3)

In the research of Low Learning Independent Metacognitive Ability, the research subject selected 1 student with a low level of learning independence. Based on research in the field with the S3 subject, a maximum of one metacognition indicator is the planning indicator. The following is an explanation of each metacognition indicator about the thinking ability test of students with low learning independence.

#### Planning Indicators

Here, the researchers present in Figure 7. the results of the work and excerpts from interviews with the subject of S3 Degree.

① Diket =
Pensil = x
Buku = y
$4x + 3y = 14.500$
$2x + 2y = 8.000$
Ditanya =
$5x + 7y = \dots$

**Figure 7.** Work Results of S3 Subjects on Planning Indicators

- Q* : For number one, do you understand what the question means?  
*S3* : Yes, I do.  
*P* : Please explain everything you know about question number one!  
*S3* : the price of 4 pencils and 3 books is 14,500, the price of 2 pencils and 2 books is 8,000.  
*Q* : What are you looking for in this question?  
*S3* : How much is the price for 5 pencils and 7 books.  
*Q* : After that what is the next step?  
*S3* : Suppose the pencil becomes x, the book is turned into y.  
*Q* : Then?  
*S3* :  $4x + 3y = 14,500$  equals  $2x + 2y = 8,000$   
*Q* : What method do you use to solve the number one question?  
*S3* : Elimination Substitution.

Based on the results of the work and interviews of researchers with the subject of S3, planning indicators could be fulfilled. S3 subjects understand the questions given and could mention a number of facts implied in the questions. S3 subjects could determine strategies or initial concepts and could develop concepts to solve problems.

#### Monitoring Indicators

The results of the work are presented in Figure 8. To support these results, excerpts from the researcher's interview with the subject of S3 are included.

$4x + 3y = 14.500$	2	$8x + 6y = 29.000$
$2x + 2y = 8.000$	3	$6x + 6y = 24.000$
$2y = 5.000$		
$y = \frac{5.000}{2}$		
$y = 2.500$		
$4x + 3(2.500) = 11.500$		
$4x = 11.500 - 7.500$		
$4x = 4.000$		
$x = \frac{4.000}{4} = 1.000$		

**Figure 8.** Work Results of S3 Subjects on Monitoring Indicators



- Q* : What is the first step you take to solve the problem in the problem?  
*S3* : Elimination of the  $y$  value, equation one is multiplied by 2, equation two is multiplied by 3.  
*Q* : The variable you are going to eliminate is  $y$ , but how come the result is the value of  $y$  too?  
*S3* : Yes, I wrote it wrong, it should be  $x$ .  
*Q* : Do you have any difficulties while working on question number one?  
*S3* : Yes, I was not careful enough for the elimination earlier.

From these results, it can be explained that the S3 subject could arrange steps to solve the problem, but was less thorough in eliminating variables. This caused a calculation error in the next step so the monitoring indicators have not been met.

### Indicators of Evaluation

Figure 9. The results of the work of the S3 subject are presented along with interview excerpts to support these results.

$\begin{aligned} \text{Maka harga} &= 5x + 7y \\ &= 5(2500) + 7(2500) \\ &= 12.500 + 17.500 \\ &= 30.000 \end{aligned}$
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Figure 9. Results of S3 Subject Work on Evaluation Indicators

- Q* : After knowing each of the values of  $x$  and  $y$ , what then?  
*S3* : Put it into the equation you are looking for.  $5x+7y$ .

From the results of work and interviews with S3 subjects, it showed that the evaluation indicators have not been met. Errors in eliminating result in the final step being taken, the final answer can be written but the final result was less precise.

Based on the description of each subject for each metacognitive indicator, it was found that subjects with high independence carried out problem solving based on metacognitive skills well. This proved that the subject reads and could understand the questions carefully. This thinking was in line with (Aldi Anigrah, 2020, p. 9) in his research that problem solving does not only depend on knowledge of the concepts they have handled but also an understanding of the problems faced as a result can determine the approach and strategy used. It can be concluded that applying the steps of the planned strategy, accuracy in calculations and re-examining the results of the answers can increase student success. Thus, it can be concluded that subjects with high learning independence can meet the three metacognitive indicators, including planning, monitoring, and evaluation. This statement is in line with the results of research (Widadah et al., 2013) which states that students with metacognitive knowledge are more successful in learning mathematics than students without metacognitive knowledge. This ability will especially be seen when the person is accustomed and trained. (Yani & Margana, 2014).

Subjects with moderate learning independence could fulfill two metacognitive indicators, which was planning indicators and monitoring indicators. Subjects could understand important information in the problem and could determine strategies for solving problems. The preparation of the settlement steps can be carried out appropriately. Subjects can analyze information to carry out the concepts that have been designed in deciding the next steps. The evaluation indicator has not been fulfilled because the subject was not careful in writing the equation variable to determine the final answer value. Amin suyitno (2015) revealed that Newman's method for determining errors has five steps in solving mathematical problems, including; (1) comprehension error (2) transformation error (3) coding error (4) reading error (5) skill processing error. It can be concluded that students do not understand the questions and are less thorough in the calculations and strategies used. This statement was in line with the results of research (Arum, 2017 p. 25) which suggests that metacognitive abilities are related to students' thinking processes to determine strategies and get the right results in solving problems.

Subjects with low learning independence were maximally able to fulfill one metacognitive indicator, which was planning indicators. Subjects could mention important information contained in

the questions. The subject could also determine the concept he uses to solve the problem. The monitoring and evaluation indicators have not been met because the subject was not careful in the elimination process, this results in inaccurate final answers. That problem solving strategies affect students in developing the nature of systematic thinking and cognitive aspects to improve students' ability to solve problems (Sutringsih, 2015 p. 29). This showed that the subject did not understand the steps and strategies or concepts that have been planned. From this description it could be concluded that the lack of awareness of students' thinking processes had an effect on choosing and implementing the chosen strategy on the final result. This agrees with research (Rahmawati et al., 2018) that students with low learning independence had sufficient critical thinking skills. Lack of awareness of students by their abilities made students have difficulty in solving problems.

### CONCLUSION

The research findings indicate that students' problem-solving skills are significantly impacted by their metacognitive abilities in terms of learning independence. Students with high levels of learning independence demonstrate proficient metacognitive skills by effectively planning, monitoring, and evaluating their problem-solving strategies. Moderate-learning independence students demonstrate proficiency in planning and monitoring, but may encounter difficulties with evaluation, as they may overlook details in final calculations. Conversely, low-learning independence students excel only in planning, but struggle with monitoring and evaluation, which can result in errors in problem-solving execution and final outcomes. The proficiency of students in utilizing metacognitive skills to navigate problem-solving tasks is significantly influenced by their level of learning independence.

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