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Mathematical reasoning and self-regulated learning differences by using mathematical literacy-based e-module

Amrina Rosyada, Novita Sari *, Novika Sukmaningthias, Zuli Nuraeni

Department of Mathematics Education, Universitas Sriwijaya, South Sumatera, Indonesia

* Correspondence: novitasari@fkip.unsri.ac.id

Abstract

This research is motivated by the low level of students' mathematical reasoning abilities related to self-regulated learning. Several aspects that can support it include an e-module and mathematical literacy. Based on this problem, this research aims to describe students' mathematical reasoning abilities reviewed through self-regulated learning, specifically through a mathematical literacy-based e-module. The method used in this research is descriptive with a qualitative approach. The research participants were 32 8th-graders in one of the junior high schools in Palembang. Meanwhile, the research sample consisted of 4 students, consisting of 2 students with a high level of self-regulated learning and 2 students with a moderate level of self-regulated learning. Data collection techniques used were tests, questionnaires, and interviews. The research results showed that students with high levels of self-regulated learning also have a high level of mathematical reasoning ability by showing 3 out of 3 mathematical reasoning ability indicators. Meanwhile, students with moderate levels of self-regulated learning also have moderate mathematical reasoning ability, as shown by two of the 3 mathematical reasoning ability indicators.

Keywords: e-module; mathematical literacy; mathematical reasoning ability; self-regulated learning

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Introduction

Currently, mathematical reasoning ability is one of the abilities that students must have. According to the National Council of Teachers of Mathematics, mathematical reasoning abilities are included in the five basic abilities that students need to have (Principles, 2000). Furthermore, reasoning ability is one of the supporting features in mathematics learning (Indriati, 2018). Students with good reasoning skills will more easily understand mathematical material and vice versa (Tukaryanto et al., 2018). Based on this background, mathematical reasoning ability is a crucial aspect that must be mastered by students in learning mathematics.

However, the fact is students' mathematical reasoning abilities do not match with the existing reality. The results of the 2022 Program for International Student Assessment (PISA) international study show that Indonesia's mathematics score has decreased compared to the 2018 PISA, from 379 to 366 points (Budiasti et al., 2024). The same thing was also shown in the results of the 2015 Trends in International Mathematics and Science Study (TIMSS) where Indonesia's mathematics results were ranked 46th out of 51 countries with a score of 397 (Retnowati & Ekayanti, 2020). One of the factors is the low mathematical reasoning abilities of students (Megawati et al., 2020). Research by Mulyana and Hakim (2022) and Fisher et al. (2019) also obtained results that students' mathematical reasoning abilities were still relatively low, especially in System of Linear Equation in Two Variables (SLETV) material.

The low mathematical reasoning abilities are related to self-regulated learning. Self-regulated learning is a behavior which needed to achieve reasoning abilities (Hidayati, 2020). Research by Cahya et al. (2021) also states that self-regulated learning has a positive influence on mathematical reasoning abilities. This indicates that if the level of students' self-regulated learning is high then the level of mathematical reasoning ability is also high. Conversely, if a student's level of self-regulated learning is low, then their mathematical reasoning ability will also be low.

One of the factors that caused the low of mathematical reasoning abilities is the lack of learning resources that focus on improving reasoning abilities (Dewi & Harahap, 2016). This indicates that teaching materials are needed to support students' mathematical reasoning abilities (Purwanti et al., 2023). Based on research by Prihatin et al. (2022), teaching materials that can improve mathematical reasoning abilities are e-module. Moreover, the use of e-module can support students' self-regulated learning. This is in line with the opinion of Mulyasari (2021) and (Ramadhani & Fitria, 2021). They show that the characteristic of e-module, specifically not connected by time and place, effectively increases the students' self-regulated learning. Another factor that plays an important role in mathematical reasoning abilities is mathematical literacy. Habituation of the mathematical literacy to students can improve students' reasoning abilities. This is the same as the statement by Vebrian et al. (2021) that getting students used to working on mathematical literacy questions becomes a way to advance their mathematical reasoning abilities. Achieving mathematical literacy requires self-regulated learning (Hidayat et al., 2019). Therefore, it can be concluded that mathematical literacy is one of the supporting factors for mathematical reasoning abilities and self-regulated learning to support its achievement.

Previous research by Khairunnisa et al. (2020) stated that there is a relationship between mathematical reasoning abilities and self-regulated learning. Furthermore, the use of e-module in the learning process can improve reasoning abilities (Prihatin et al., 2022) and self-regulated learning (Ramadhani & Fitria, 2021). Subsequently, students' reasoning abilities can be upgraded by familiarizing mathematical literacy (Vebrian et al., 2021). Reviewing these studies, more specific research regarding to students' reasoning abilities based on self-regulated learning after using mathematical literacy-based e-modules has not been carried out. Accordingly, this study aims to describe how students' mathematical reasoning ability reviewed from self-regulated learning after using a mathematical literacy-based e-module.

Methods

The method used in this research was a descriptive method with a qualitative approach. Students' mathematical reasoning abilities (MRA) can be seen from the indicators in Table 1.

Table 1. Aspects and indicators of MRA

Indicators	Aspects that are Measured
Identifying observed patterns and structures	Identifying the pattern and structure of a statement
	Using the discovered pattern and structure to solve the problem
Proposing assumptions and conjectures	Formulating an assumption before analyzing
	Providing an argument related to the assumption given
Concluding with logical argument	Developing a logical argument for solving the problem
	Making a conclusion based on the answer obtained

The participants in this research were 32 8th-grade students from one private school in Palembang, South Sumatera, Indonesia. They were selected with stratified sampling and then purposive sampling. The stratified sampling technique was carried out by providing self-regulated learning (SRL) questionnaires to students and then classifying them with high, moderate, and low SRL. Afterward, two students from each level of SRL were selected using purposive sampling techniques by considering several criteria to further observe their MRA after participating in learning using a mathematical literacy-based e-module (MLBE-module).

The research procedure was in three stages, i.e. preparation, implementation, and analysis. In the preparation stage, researchers review articles related to the research, determine the location and research participants, and validate research instruments. Afterward, the implementation stage was held in 4 meetings of learning using MLBE-module. The final stage is analyzing data obtained from the implementation stage.

Data collection techniques used were questionnaires, tests, and interviews. Questionnaires were used to see the level of students' SRL. The questionnaire used in this research was a SRL questionnaire modified from Ariyanti's (2019) research with 13 positive and 10 negative statements. The questionnaire was rated based on a four-point Likert scale which included SA (Strongly Agree), A (Agree), D (Disagree), and SD (Strongly Disagree). The results of the students' questionnaire were categorized into three levels of SRL according to Azwar (2009) as seen in Table 2, where X is students' SRL

Table 2. SRL categories

Achievement Score	Category
$X \geq (M_i + SD_i)$	High
$(M_i - SD_i) \leq X < (\bar{x} + SDi)$	Moderate
$X < (M_i - SD_i)$	Low

The next instrument was the test. It was carried out to determine the level of students' MRA. The test is in three reasoning essays with a System of Linear Equations in Two Variables (SLETV) material. All question items are valid, with r-values 0.642, 0.631, and 0.804 for each item. The test is also reliable with Cronbach's Alpha 0.767. The test used in this research can be seen in Figure 1.

Mathematical Reasoning Ability Test

1. Look to the following statements.
   (i) Dio and Raisyah went to the painting shop together. Arriving at the shop, Dio bought four markers and two paint palettes for a total price of IDR55.000 while Raisyah bought three markers and one paint palette for a total price of IDR40.000.
   (ii) A cake shop sells cakes and pastries. This week the cake shop succeeded in selling 100 cakes and 180 pastries and earned an income of IDR14.000.000.
   (iii) Azzam's blocks are three times as many as Varo's blocks. The total of Azzam and Varo blocks is 200 pieces.

   a. Create a mathematical model from the three statements above.
   b. Which statements can form a system of linear equations in two variables? Explain.

2. Look at Figure 1 which is a brochure for a music concert.

Figure 1. A Music Concert Brochure

   The music concert with the brochure in Figure 1 sold out all the tickets with total sales of IDR33.000.000.
   a. Are the gold tickets provided by the committee more than 100?
   b. Give your reasons! (you can use one of the SLETV solving methods).

3. Look at the mall plaza A's parking cost information in Figure 2.

Figure 2. Mall Plaza A Parking Cost Bochure

   On one day there were 100 vehicles consisting of cars and motorbikes parked at mall plaza A with the cost as in Figure 2. The total number of wheels for the total vehicle was 320. If the vehicle pays for parking according to the specified cost, then how much parking money does the mall plaza get that day? Solve using the graphic method.

Figure 1. Mathematical reasoning ability test

Question number 1 is a reasoning question to measure identifying observed patterns and structures. Meanwhile, question number 2 measures the proposing assumptions and conjectures indicator. Lastly, question number 3 measures the concluding with a logical argument indicator.

The MRA was assessed following existing scoring guidelines. After that, the data will be converted into qualitative form and categorized according to the MRA level by Maya (2011) in Table 3, where S is students' MRA achievement.

Table 3. MRA categories

MRA Achievement	Category
$S > 70\%$	High
$55\% < S \leq 70\%$	Moderate
$S \leq 55\%$	Low

The last data collection technique is interviews to support the questionnaire and test data analysis results. Four students (two students from each level of SRL) were interviewed after doing the test. They were selected based on purposive sampling techniques by considering several criteria such as: (1) following the learning process and using a MLBE-module nicely; (2) expressing argument thinking clearly; (3) the mathematical reasoning test result.

Results

The SRL questionnaire was filled out by 32 students at the beginning of the first meeting or before learning using a MLBE-module. The data were assessed according to the guidelines in Table 2. Students were given a mathematical reasoning test in the last meeting after learning using a MLBE-module. The descriptive statistics of the SRL questionnaire results can be seen in Table 4.

Table 4. Descriptive statistics of SRL and MRA

	N	Min	Max	Mean	Standard Deviation
SRL	32	48	82	57.5	11.5
MRA	32	0	100	37.47	25.091

Table 4 shows that the minimum and maximum SRL scores are 48 and 82, respectively. It reveals that the mean of SRL is 57.5 with an 11.5 standard deviation. These values were used to determine the interval of SRL categories as in Table 5. Furthermore, the minimum score for MRA is 0 while the maximum score is 100. The mean value gained is 37.47 with a standard deviation of 25.091. Based on the SRL questionnaire results, students' SRL levels are categorized into three categories as in Table 5, where X is the total score of SRL.

Table 5. Interval to classify students' SRL

Achievement Score	Category
$X \geq 69$	High
$46 \leq X < 69$	Moderate
$X < 46$	Low

The categories of SRL levels include high, moderate, and low levels. First, the SRL score of more than or equal to 69 is categorized as high level. Second, the SRL score of more than or equal to 49 is categorized as moderate level. Last, the SRL score of less than 49 is categorized

as low level. The results found that there are only two levels of students' SRL, which are 6 students with a high level of SRL and 26 students with a moderate level of SRL. Furthermore, two students from each level were selected to become the research sample as in Table 6.

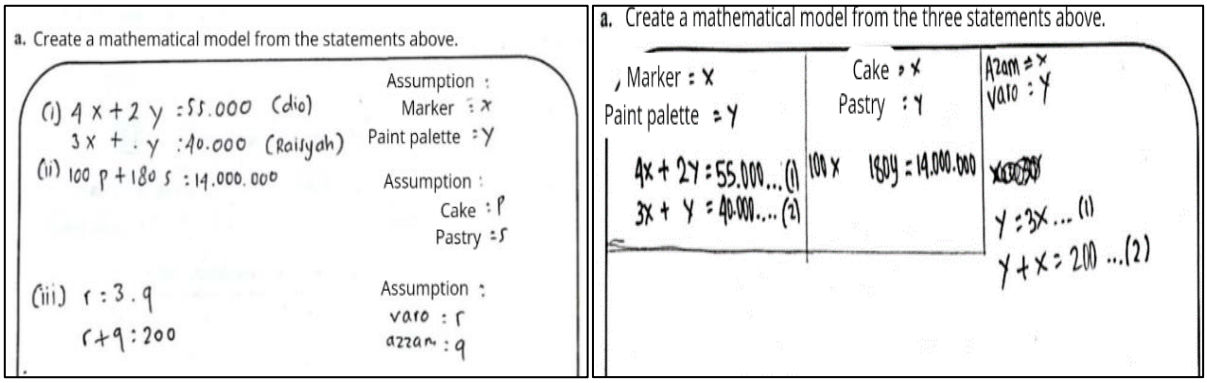
Table 6. Research sample based on SRL

Category	Sample Initial
High	AA and AG
Moderate	AN and HA

Table 6 shows AA and AG as samples for a high-level SRL. On the other hand, AN and HA are samples for moderate level of SRL. They are selected using purposive random sampling to be samples of how their MRA for each indicator is. Subsequently, the results of the MRA test of the four students representing each level of SRL selected based on several criteria were further analyzed as follows.

Students with high level of SRL

In the first indicator, identifying observed patterns and structures, AA and AG can fulfill two measured aspects. This can be seen from their answer to question number 1 in Figure 2.



(a) (b)

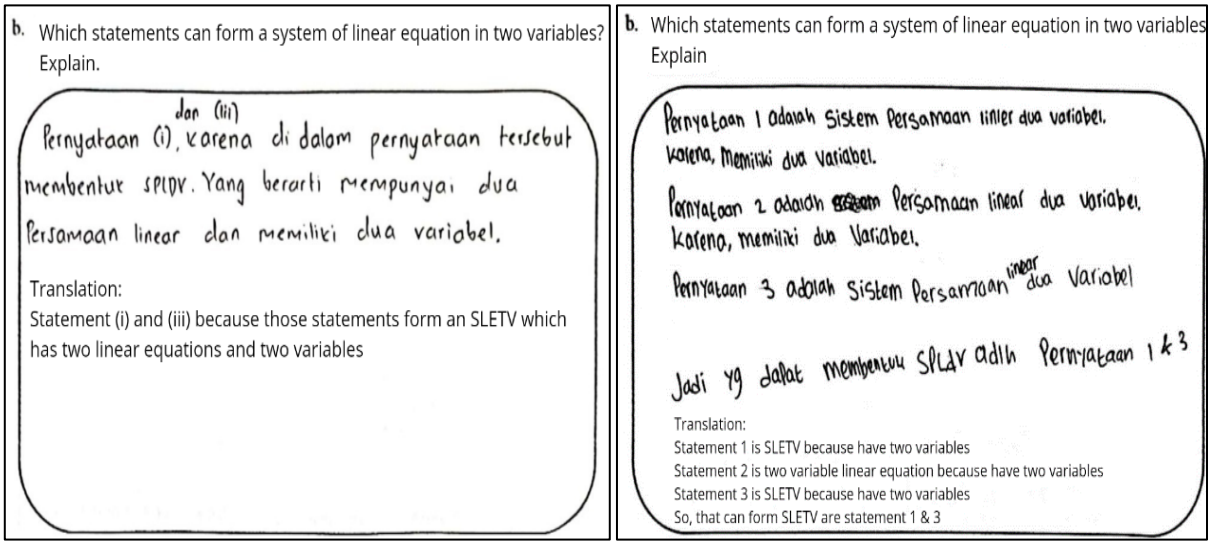
Figure 2. (a) AA's answer to question number 1a; (b) AG's answer to question number 1a

Figure 2 shows that they can identify the pattern and structure of a statement. Both AA and AG succeed in creating a mathematical model from existing statements. Their pattern in creating a mathematical model is clear. First, they change the objects in the statement into formal symbol form using variables then connecting them with the information in the statement. Moreover, their ability to identify the pattern and structure of a statement is also shown during the interview.

R : "What patterns do you find in the problem?"
AA : "Statement (i) and (iii) have two two-variable linear equations, while statement (ii) has only one two-variable linear equation"
R : "What patterns do you find in the problem?"
AG : "Statement (i) has two two-variable linear equations same as a statement (iii), while statement (ii) just has one two-variable linear equation"

Based on the interviews, AA and AG find the patterns and structures from each statement. Thereafter, they conclude that statements (i) and (iii) have two two-variable linear equations, while statement (ii) just has one two-variable linear equation.

They also fulfill by using the discovered pattern and structure to solve problem aspects. This can be seen from their answer to question number 1b in Figure 3.



(a) (b)

Figure 3. (a) AA's answer to question number 1b; (b) AG's answer to question number 1b

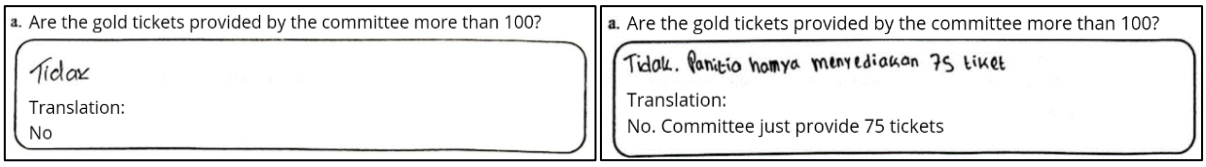
In Figure 3, they use the pattern and structure obtained in answer number 1a and determine which equations can form a SLETV. Both AA and AG identify and generalize statements (i) and (iii) which contain two linear equations in two variables as SLETV. However, in Figure 2(b), AG cannot write down the reasons correctly. Still, in the interview, AG can correctly explain the reasons.

R : "Based on the pattern you found in question number 1a, how do you connect the pattern to solve problem 1b?"

AG : "SLETV has two equations and two variables. Since answer 1a, which has two variables and two equations are statements (i) and (iii), the statements make a SLETV form"

Based on the interview, AG clearly understands that the statements (i) and (ii) form an SLETV since they have two two-variable linear equations.

Furthermore, in proposing assumption and conjectures indicator, they also can fulfill both aspects measured. This is proven by their answer to question number 2 in Figure 4.



(a) (b)

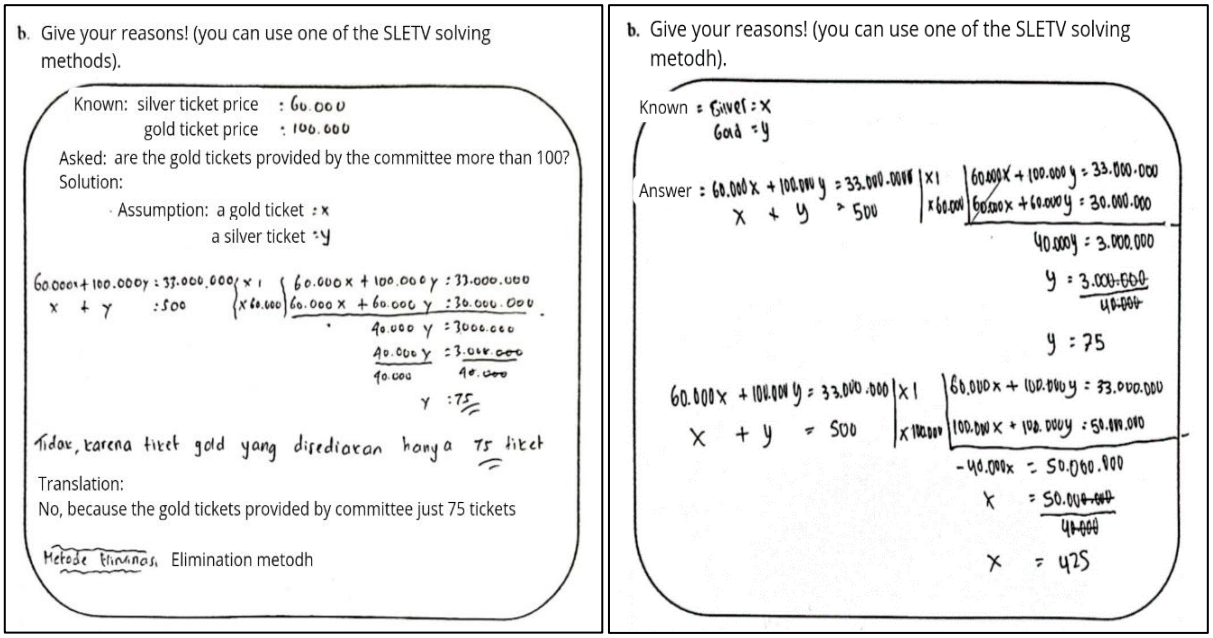
Figure 4. (a) AA's answer to question number 2a; (a) AG's answer to question number 2a

From Figure 4, both AA and AG assume that the gold tickets are no more than 100. Based on the interviews, AA's assumption is based on the fact that usually gold tickets or exclusive tickets are only sold on a limited basis.

R : "Why do you think the gold ticket is not more than 100?"

AA : "Because gold tickets are more expensive, usually expensive tickets are only sold limited"

AA and AG's assumptions expressed during the interview are strengthened by logical reasons where they look for the exact number of gold tickets using the elimination method. They finally find that there are only 75 gold tickets. This can be seen from their answer number 2b in Figure 5.

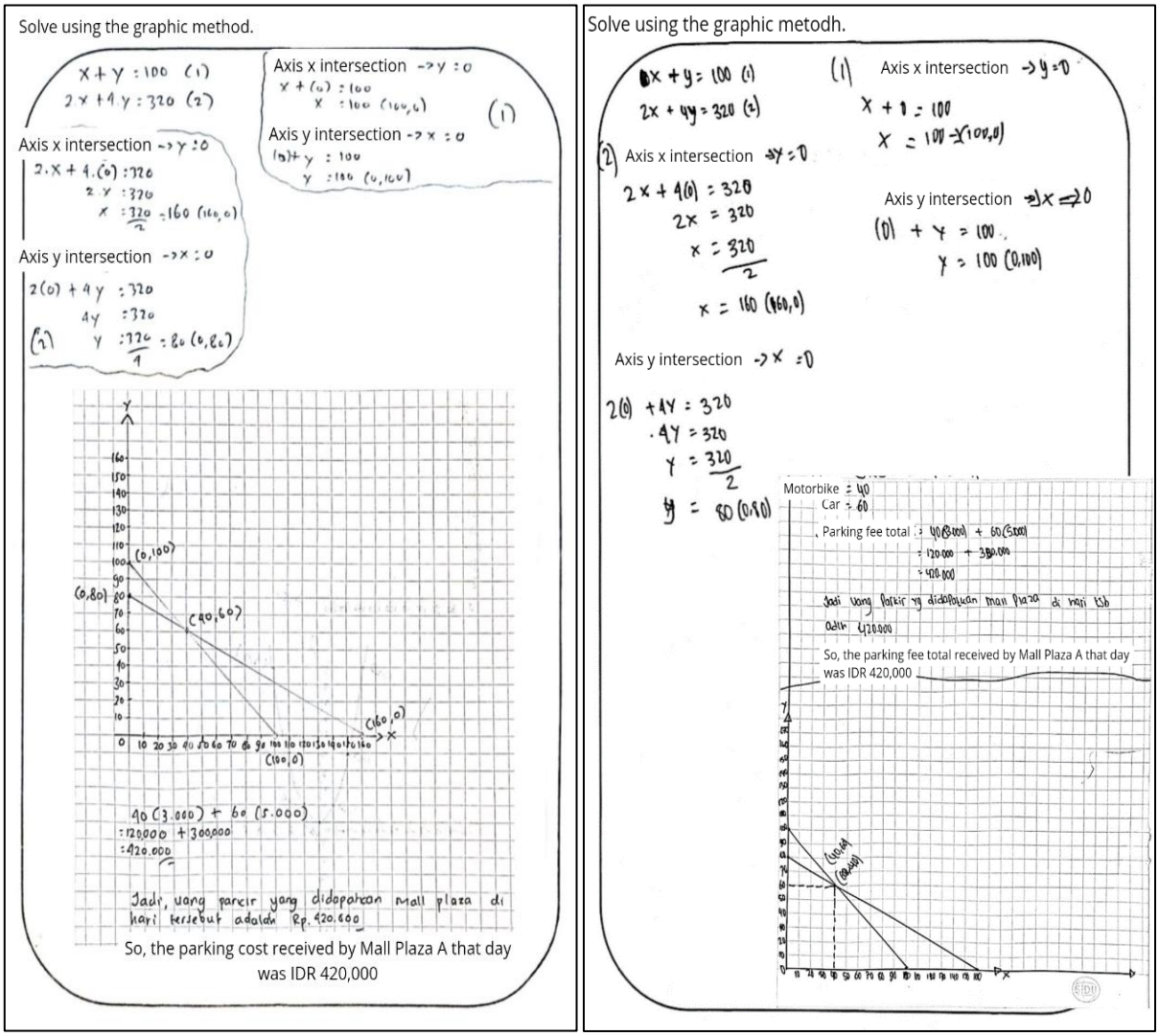


(a) (b)

Figure 5. (a) AA's answer to question number 2b; (a) AG's answer to question number 2b

In Figure 5, it can be seen that they use the elimination method to find the amount of gold tickets. They do the elimination method step by step, such as making a mathematical model, equalizing the coefficients, and eliminating the x variable to get the value of the y variable or the number of gold tickets. Eventually, they discover that there are only 75 gold tickets or no more than 100. This indicates that they can provide arguments or reasons regarding the assumption given.

In making conclusions with logical arguments, AA and AG also fulfill the two aspects measured. The first aspect is developing a logical argument for solving the problem. In solving problem number 3, about finding how much parking money the mall plaza gets, they first look for the number of cars and motorbikes. First, they create the mathematical model and determine the intersection point of each equation. Second, they draw graphs of the two equations. Afterward, they determine the intersection points of the two graphs to get the number of cars and motorbikes. To find the amount of parking cost received by mall plaza A, they multiply the total for each vehicle with the parking cost that had to be paid, then sum up the two together. Last, they conclude. Their steps to solve question number 3 can be seen in Figure 6.



(a) (b)

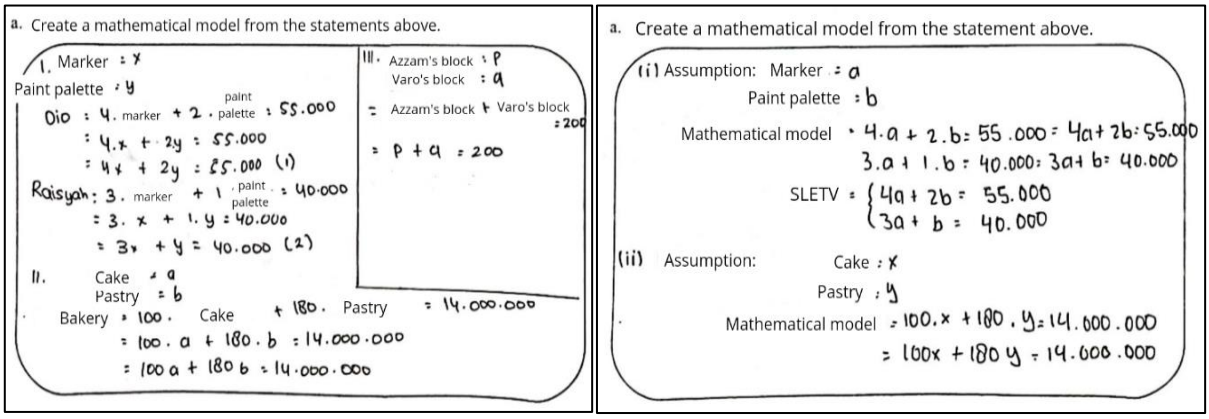
Figure 6. (a) AA's answer to question number 3; (a) AG's answer to question number 3

Based on Figure 6, from the logical arguments and answers obtained, they conclude that the total parking cost received by Mall Plaza A on that day was IDR420,000. Therefore, it indicates that they have fulfilled the aspect of making conclusions based on the answers obtained.

Overall, AA and AG samples representing students with a high level of SRL, have fulfilled all aspects of each indicator of MRA. The total score obtained by AA and AG is 100. Based on the categorization in Table 3, the MRA level of students with high SRL is classified as high.

Students with moderate level of SRL

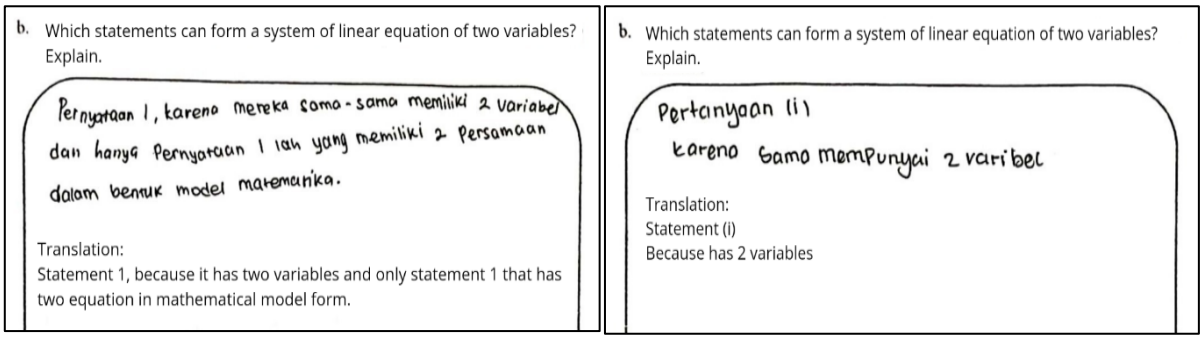
In terms of indicators identifying observed patterns and structures, AN and HA can fulfill both measured aspects. This can be seen from their answer to question number 1 in Figure 7.



(a) (b)

Figure 7. (a) AN's answers to question number 1a; (b) HA's answers to question number 1a

In Figure 7, it can be seen that AN and HA can identify the pattern and structure of a statement. This is proven based on their answer which can recognize the structure of the statement and convert it into a mathematical model. However, their answers are still incomplete. They cannot complete the mathematical model from statement (iii). This has an impact on their answer to question number 1b.



(a) (b)

Figure 8. (a) AN's answers to question number 1b; HA's answers to question number 1b

In Figure 8, they fulfill the using discovered pattern and structure to solve problem aspect. However, because there are still shortcomings in the patterns and structures they found, their answer to question number 1b is incorrect. The same thing was revealed during the interview.

R : "Based on the pattern you found in question number 1a, how do you connect the pattern to solve problem 1b?"

AN : "Because only statement (i) has two two-variable linear equations, so only statement (i) makes up SLETV because that SLETV has two two-variable linear equations"

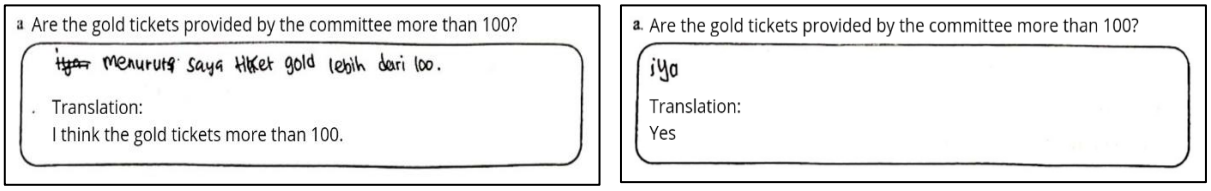
R : "Based on the pattern you found in question number 1a, how do you connect the pattern to solve problem 1b?"

HA : "SLETV is statement (i) because there are 2 equations and has two variables namely 4a + 2b = 55,000 and 3a + b = 40,000, while equations (ii) and (iii) have only one equation"

Based on the interview, AN and HA identify that only statement (i) has two two-variable linear equations and forms an SLETV. They can use the discovered patterns and structures in question number 1a to answer question 1b. They also understand that two linear equations of

two variables can form SLETV. However, due to the lack of mathematical model they made for statement (iii), the solution to problem 1b was incorrect.

Furthermore, proposing an assumption and conjectures indicator, AN and HA samples fulfilled the aspect of formulating an assumption before analysis. Before solving the problem in question number 2, AN and HA put forward the assumption as seen in Figure 9.



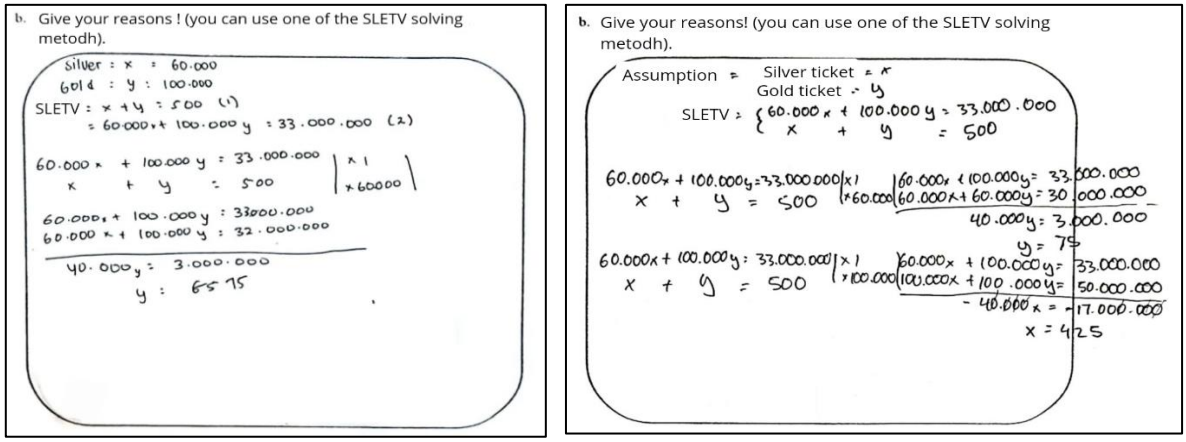
(a) (b)

Figure 9. (a) AN's answers to question number 2a; (b) HA's answers to question number 2a

In Figure 9, it can be seen that they assume that the gold was more than 100. Based on interviews, AN personally said that the gold tickets might be more than 100 because the total sales obtained are IDR33.000.000 whereas if 100 gold tickets are sold, the total sales for gold tickets only reach IDR10.000.000.

R : "Why do you think the gold ticket is more than 100?"
AN : "Because the total sales are IDR33.000.000 and the gold ticket price is only IDR100.000, it is possible that gold tickets are sold for more than 100"

However, the argument given by AN are not relevant to the initial assumption AN's formulated. Whereas, HA gave reasons regarding the assumption given using the elimination method. This can be seen in their answer to number 2b as seen in Figure 10.

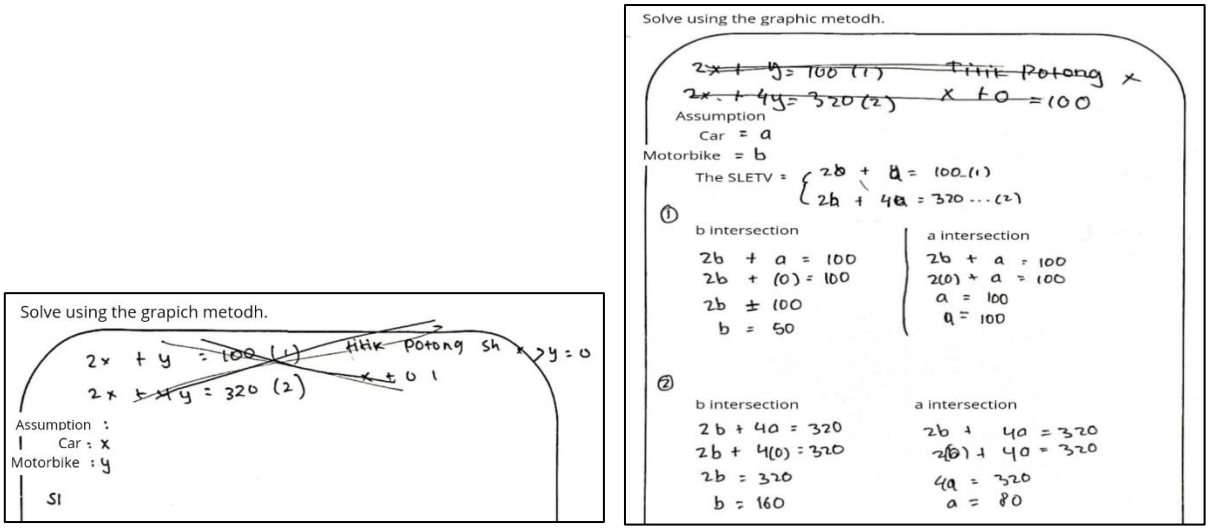


(a) (b)

Figure 10. (a) AN's answers to question number 2b; (b) HA's answers to question number 2b

Figure 10 shows that AN and HA use the elimination method to prove whether the number of gold tickets is more than 100. They carry out elimination method steps to find the exact number of each ticket sold. Their process is started by making an example, creating a mathematical model, and eliminating variable x to get the value of variable y or the number of gold tickets. After carrying out the calculation process, it was found that the gold tickets provided by the committee were no more than 100. Therefore, their initial assumption is incorrect.

The last is making conclusions indicator. They cannot fulfill the two aspects measured, namely developing a logical argument in solving problem and making conclusion based on the answer obtained. This is based on their answer to question number 3 which is not resolved.



(a) (b)

Figure 11. (a) AN's answers to question number 3; (b) HA's answer to question number 3

Based on Figure 11, AN and HA are still confused about formulating logical arguments to solve question number 3. They still have difficulty in converting question number 3 into a mathematical model. It can be seen in Figure 11 that AN could not create a mathematical model, while HA wrote the wrong mathematical model.

Overall, AN and HA as samples with moderate level of SRL fulfill the two indicators of MRA, namely identifying observed patterns and structures and proposing assumptions and conjectures. The MRA test score obtained by AN and HA is 58. Therefore, based on Table 3, AN and HA have MRA at a moderate level.

Data analysis description

Based on the test results and interview analysis from students that represent each level of SRL, it was found that there were differences in the achievement of MRA indicators between students with high level of SRL and students with moderate level of SRL as seen in Table 7.

Table 7. Achievement of MRA

MRA Indicator	Aspects that are Measured	SRL Level			
		High		Moderate	
		AA	AG	AN	HA
Identifying observed patterns and structures	1	✓	✓	✓	✓
	2	✓	✓	✓	✓
Proposing assumptions and conjectures	1	✓	✓	✓	✓
	2	✓	✓	-	-
Making a conclusion with logical argument	1	✓	✓	-	-
	2	✓	✓	-	-

Table 7 shows that students with a high level of SRL can fulfill all aspects measured by each indicator of MRA. Meanwhile, students with a moderate level of SRL have not been able

to fulfill several measured aspects, namely providing an argument related to the assumption given aspect in indicator two, as well as making conclusions based on the answers obtained and developing a logical argument in solving problems aspect in indicator three. The results of MRA tests data analysis after learning using the MLBE-module from four students that represent each SRL level can be summarized that students with a high level of SRL also have a high level of MRA. Likewise, students with moderate SRL level also have moderate MRA.

Discussion

After going through the research stages which include preparation, implementation, and analysis, it is found that the level of students' MRA is in line with the level of SRL. Further explanation is based on MRA of students with high SRL, MRA of students with moderate SRL, and the connection among MRA, SRL, and MLBE-module.

Students with high level of SRL also have a high level of MRA. They also managed to fulfill all indicators of MRA by showing out all aspects measured. Starting from indicators identifying observed patterns and structures, proposing assumptions and conjectures, to making conclusions with logical arguments. In line with the results of the Wahyuni et al. (2019) study students with high MRA can complete all questions given well and show indicators of MRA such as providing conjectures and concluding.

During the class, students with high level of SRL always show attitudes that reflect a high SRL. For example, always initiative to follow the class, pay attention to the teachers, and enthusiastically follow the learning process. This was also expressed by Cahya et al. (2021) that the students' SRL can be seen from the magnitude of their initiative and responsibility in playing an active role in the learning process. The high SRL possessed by these students affects their MRA. Students with high SRL have good mathematical literacy skills which can support their MRA (Sari et al., 2022). In addition, the high intensity of learning using MLBE-module individually during pre-learning activities also supports students' MRA. In line with the study results by Prihatin et al. (2022) that the e-module flexibility supports the students' SRL. Compared to students who have moderate SRL, the achievement of MRA of students with high SRL is the best. This is in line with what was expressed by Fajriyah et al. (2019) that the better SRL owned by students, the better their MRA.

Students with moderate level of SRL also have moderate MRA. They showed two of three MRA indicators, such as identifying observed patterns and structures indicator, and proposing assumption and conjectures indicator. Students with moderate level of SRL can demonstrate all aspects of identifying observed patterns and structure indicators. They also showed one aspect of the proposing assumption and conjectures indicator. In addition, aspects measured from other indicators have not been fulfilled. One of the causes is an error in writing a mathematical model. In line with the research results revealed by Fitni et al. (2020) that the mistake students often make is writing wrong mathematical models, so even though they use the correct working procedures, the answers they get are still wrong.

The achievement of the students' MRA is related to their SRL. Students with moderate SRL follow the class well, but based on the researchers' observations, they are not confident

with their abilities. As explained by Hidayati (2020), students with moderate levels of SRL already have an awareness of learning goals and responsibilities but do not have good self-confidence. This has an impact on their MRA, where students with moderate SRL can control their learning habits and are quite able to fulfill MRL indicators (Syahputri & Febriyanty, 2021).

Based on Table 9, it is known that SRL and MRA are interrelated. This is in line with the results of research by Fajriyah et al. (2019) and Khairunnisa et al. (2020) that there is a significant influence of SRL on MRA. The use of mathematical literacy in the learning process also influences these results. While understanding a material with e-module, students are faced with contextual mathematical literacy problems. The use of contextual questions can support students' MRA (Putra et al., 2016). Mathematical literacy questions are also always given to students at every meeting. Habituation of mathematical literacy in learning can hone students' reasoning skills (Vebrian et al., 2021).

In addition, the discussion of each problem in the e-module that emphasizes aspects of MRA is designed to support students' MRA. For example, at the end of each problem-solving in the e-module used, there is a bold conclusion sentence that aims to support the indicator of making conclusions with logical argumentation. Besides, highlighting the pattern and structure of a statement in creating mathematical model in the e-module aims to train the identify observed patterns and structures ability. In line with Prihatin et al. (2022) opinion, the use of e-module can support students' MRA. Furthermore, the characteristics of e-module that are not limited to space and time can train students to learn independently (Ramadhani & Fitria, 2021). Based on the description above, it can be said that the use of e-module and the mathematical literacy habituation can support students' MRA. However, it needs SRL to obtain this achievement.

Conclusion

Following the completion of the preparation, implementation, and analysis phases, the study's findings showed that the use of a mathematical literacy-based e-module can support students' mathematical reasoning abilities. Specifically, in terms of student learning independence, students with high level of SRL also have high level of MRA by showing 3 out of 3 MRA indicators. Meanwhile, students with moderate level of SRL also have moderate level of MRA by showing 2 of the 3 MRA indicators.

This research is limited to one topic, namely a two-variable linear equation system and the analysis is only on two selected samples. Therefore, further related research can examine the application of the mathematical literacy-based e-module on other topics and use analysis both qualitatively and quantitatively.

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Conflicts of Interest

There is no conflict of interest towards the publication of this manuscript.

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Author Contributions

Amrina Rosyada: Conceptualization, writing - original draft, and visualization; **Novita Sari:** Writing - review & editing, formal analysis, and methodology; **Novika Sukmaningthias:** Validation and supervision; **Zuli Nuraeni**: Validation and supervision.

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