Analysis of Student's Mathematic Literacy Ability Reviewing from Material Materials Requirements on Square Equations Materials and Square Inequality

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Abstract

The purpose of this study is to see students' mathematical literacy in mastering prerequisite material and prove whether mastery of prerequisite material affects or does not affect students in solving mathematical literacy problems on quadratic equations and inequalities. The type of research used is descriptive qualitative research which aims to describe students' mathematical literacy skills when solving math problems in terms of mastery of prerequisite material. The research was conducted at SMA 02 Rejang Lebong. This school is located on Jl. Ahmad Yani, East Curup District, Rejang Lebong Regency, Bengkulu Province in the even semester of 2022/2023 academic year. The research subjects who became the research sample were all students of class X IPA 4. Data collection instruments included a prerequisite material mastery test combined directly with mathematical literacy and interviews. The results show that the higher the mastery of the prerequisite material, the more possible it is to be able to answer mathematical literacy questions correctly and precisely and vice versa, the lower the mastery of the prerequisite material, the more difficult it is to be able to answer mathematical literacy questions correctly and precisely.

Keywords: *Mathematical Literacy; Mastery of Prerequisite Materials; Quadratic Equations and Inequalities Materia.*

Abstrak

Tujuan penelitian ini adalah untuk melihat kemampuan literasi matematika siswa dalam menguasai materi prasyarat dan membuktikan apakah penguasaan materi prasyarat berpengaruh atau tidak berpengaruh terhadap siswa dalam menyelesaikan soal literasi matematika pada persamaan dan pertidaksamaan kuadrat. Jenis penelitian yang digunakan adalah penelitian kualitatif deskriptif yang bertujuan untuk mendeskripsikan kemampuan literasi matematis siswa saat menyelesaikan soal matematika ditinjau dari penguasaan materi prasyarat. Penelitian dilakukan di SMA 02 Rejang Lebong. Sekolah ini terletak di Jl. Ahmad Yani, Kecamatan Curup Timur, Kabupaten Rejang Lebong, Provinsi Bengkulu pada semester genap tahun pelajaran 2022/2023. Subyek penelitian yang menjadi sampel penelitian adalah seluruh siswa kelas X IPA 4. Instrumen pengumpulan data berupa tes penguasaan materi prasyarat yang dipadukan langsung dengan literasi matematika dan wawancara. Hasil penelitian menunjukkan bahwa semakin tinggi penguasaan materi prasyarat semakin memungkinkan untuk dapat menjawab soal literasi matematika dengan benar

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dan tepat begitu pula sebaliknya, semakin rendah penguasaan materi prasyarat maka semakin sulit untuk dapat menjawab soal literasi matematika dengan benar dan tepat.

Kata Kunci: Literasi Matematika; Penguasaan Materi Prasyarat; Persamaan dan Pertidaksamaan.

INTRODUCTION

Mathematics is a science that is always taught at every level and type of education. Mathematics is the main subject taught at the basic education level to the high school level. According to the National Council of Teachers Mathematics (NCTM) there are 5 (five) competencies in learning mathematics as follows: (1) mathematical problem solving, (2) mathematical communication (mathematical communication), (3) mathematical reasoning (mathematical reasoning), (4) mathematical connection, (5) mathematical representation (Maryanti, 2012). Of the five competencies, it is necessary to support students' lives to become useful and creative citizens in accordance with the objectives of national education in the Minister of National Education Regulation No. 22 of 2006 which is to develop the potential of students so that they become people who believe and are devoted to God Almighty (YME), healthy, have noble character, are knowledgeable, creative, independent and become democratic and responsible citizens. The ability that contains the five competencies is called mathematical literacy ability(Hikmahturrahman, 2018).

Mathematical literacy ability is considered to be one of the most important components needed by students to be able to successfully solve PISA questions. This ability also focuses on the ability of students in terms of analyzing, providing arguments, and conveying ideas effectively, solving, and interpreting problems in mathematics in various forms and situations (Hikmahturrahman, 2018).

Mathematical literacy is very important for students to be able to understand mathematics not only from mastering the material but also to the use of reasoning, concepts, and facts as well as mathematical tools for everyday problem solving and requires students to be able to communicate and explain the phenomena they face using concepts. mathematics. The lack of mathematical literacy skills causes students' abilities in terms of creativity, reasoning and

argumentation which are not open as a result, students find it difficult to solve mathematical problems in everyday life (Rozikin, 2021)

According to results of a survey conducted by Program For International Student Assessment (PISA), the mathematical literacy ability of students in Indonesia is still very low, Indonesia is below the international average (Manoy, J.T. & Sari, 2020). Problems that need attention related to mathematics lessons are the number of mistakes made by students in solving math problems. Common errors that are closely shown by students in solving math problems include errors in interpreting mathematical concepts, errors in applying mathematical formulas, calculation errors, errors in understanding symbols and errors in determining and using the stages of completion. Therefore, to understand the concepts in mathematics, it is necessary to look at the previous concepts (Rosalia Hera Novita Sari, 2015).

Research conducted by Kasma (2019) which aims to determine the difficulties experienced by high, medium, and low ability students in solving mathematical literacy questions in terms of initial abilities student. Produce information that those who have high abilities are not too difficult to work on mathematical literacy problems, but are different from those who have medium and low abilities who find it difficult to work on mathematical literacy problems (Usman, MR., 2022)

As research conducted (Devy Safitri, 2017), when students are given test questions such as: Determine the solution of equation $4x^2 + 23x - 6 = 0$ with step ; factoring, completing perfect squares and quadratic formulas. First, in solving a quadratic equation using the factoring step, it is fast when students can determine the pair of roots. However, students often find the wrong pair of roots. The second is solving by completing the perfect square: Students are still often wrong in the steps to obtain the roots of the quadratic equation. Third, by using the quadratic formula: Many students still make the wrong formulas and solve the equation incorrectly.

The results of initial observations made at SMA 02 REJANG LEBONG with interviews with mathematics teachers and students, obtained data that

students' mathematical literacy skills on quadratic equations material were still very low, seen from the way students explained and worked on basic questions and also seen from the results of daily tests. There are still many students who are below the KKM. The average student has not been able to use, analyze and communicate the solution because students are only glued to the sample questions and if the problem is changed, students will be confused about how to solve it.

The low level of mathematical literacy is not only caused by the infrequent use of questions that lead to mathematical ability, but also because students do not understand the prerequisite material or students have not mastered the previous material and are immediately confronted with the next material which is also related to the previous material (Kholifasari, 2020).

The previous material is often referred to as prerequisite material or is the provision or capital needed to learn and understand new material. In the Big Indonesian Dictionary (KBBI), prerequisites are conditions that must be met before participating in, undertaking, and entering education or any activity. if minimized in the learning itself, prerequisite material is material that must be mastered by students as a condition for studying the next material (Hidayat, 2013).

Mathematical science is likened to a spiral that is connected with an orderly and structured arrangement of matter. The higher the spiral of a mathematical science, the more difficult the material to be learned will be. If any side of the spiral is broken, it can result in not being able to continue to a higher spiral. This is like a mathematical science, where when a basic material cannot be mastered or understood, it cannot or will be difficult to continue learning the next material.

According to Widiyanto (2019: 47) that errors in understanding mathematical concepts are caused by a lack of mastery of the prerequisite material in using mathematical operations, the use of inappropriate rules, errors in doing abstractions and generalizations, and incomplete and less detailed mathematics teaching. The interrelationship between one material concept and

another proves the importance of mastering the prerequisite material (Faisal, 2021).

The importance of a mastery of prerequisite material is also proven by Nurgiyantoro in (Nihayah, 2021) which states that mastery is the ability of a person who is able to manifest either from theory or practice. In other words, students are said to be able to master the prerequisite material if they are able to apply basic concepts.

As Ahmadi (2011) argues, prerequisite knowledge is the provision of knowledge needed to learn a new teaching material. In line with what Gagne said (in Sudjana 2010) states that initial ability is a prerequisite that students must have before taking the next higher subject matter. So, a student who has good initial abilities will understand and understand further material faster than students who do not have initial abilities or do not have provisions for the next learning process. Students who have high initial knowledge will be more enthusiastic and easier to learn and understand the lessons given. Conversely, students who have low initial knowledge will feel less able to follow and understand the lesson well. For this reason, the teacher should strengthen students' prior knowledge of the subject matter to be given (Atika Ulfa Novriani, 2013).

Based on the description above, it is important to conduct an Analysis of Students' Mathematical Literacy Ability in terms of Mastery of Prerequisite Material, with the aim of seeing students' mathematical literacy in mastering prerequisite material and proving whether mastery of prerequisite material affects or does not affect students in solving mathematical literacy problems on equations and quadratic inequalities.

RESEARCH METHODS

The type of research used is descriptive qualitative research which aims to describe students' mathematical literacy skills when solving math problems in terms of mastery of prerequisite material. The research was conducted at SMA 02 Rejang Lebong. This school is located on Jl. Ahmad Yani, East Curup District, Rejang Lebong Regency, Bengkulu Province in the even semester of 2022/2023

academic year. The research subjects who became the research sample were all students of class X IPA 4, totaling 19 students. This study uses a random sampling technique where the class randomly selected and based on the results of interviews with teachers who teach mathematics.

The data were obtained from the results of the mathematical literacy ability test in terms of prerequisite material and interviews with the aim of seeing students' mathematical literacy in mastering prerequisite material and proving whether mastery of prerequisite material affects or does not affect students in solving mathematical literacy problems.

In this study, the researcher did not determine the level of student literacy based on grades but focused more on what aspects were fulfilled or not fulfilled in answering the questions. In line with Kusniati's opinion (2018), the aspect of the study is the index of achievement of basic competencies that can be used as a benchmark to determine the achievement of the objectives of the study. In this study, mathematical literacy was viewed from 4 (four) aspects of ability in each question (Kusniati, 2018),while the 4 aspects are presented in Table 1.

Table 1. Aspects of Mathematical Literacy Research

Ability Aspect	Explanation
Understanding aspect	Is the ability to explore mathematics based on concepts and be able to interpret mathematical problems in various contexts.
Aspects of application	Is a student's ability for practice based on concepts that have been understood as the basis for solving mathematical problems.
Aspect of reasoning	It is the ability of students to think logically and the achievement of distant thinking in order to solve mathematical problems.
Communication aspect	It is the ability of students to relate one problem to another and be able to explain to others how to use or solve mathematical problems in oral and written form.

There are 2 data collection used, namely test techniques in the form of essays with interview techniques aimed at knowing the mindset, reasons, and difficulties of students in solving problems and students are asked to express their

opinions and account for their answers by paying attention to the aspects in Table 1.

The data collection instrument includes a prerequisite material mastery test that is combined directly with the processing time is 50 minutes. Mathematical literacy and interviews. The time of the written test instrument consists of 5 essay questions which adopted and adapted from the questions (Fatwa Maulidatul Akhiroh, 2020) from the easiest to the most difficult questions which are presented in Table 2.

Table 2. Mathematical Literacy Ability Test Questions in Terms of Mastery of Prerequisite Material

No	Theory	Question	Taxonomy Level
1	Equality square	The difference of three times the square of a number with thirteen times the number is negative 4. Then determine the number!	C3
2	Equality square	If the difference between two times the square of a number and three times the number is 9, what is the number?	C3
3	Inequality square	The result of the production of an item is expressed by the equation $p(x)=x^2+28x-60$ units of goods for the required raw materials. If the production yield (p) reaches more than 100 units, then the amount of raw material x needed is?	C3
4	Equality square	The sum of two numbers x and y is 20. If the product of the two numbers is expressed by p, then find the equation for p as a function of x!	C4
5	Inequality square	One of the requirements to become a member of the Indonesian Armed Forces is if the weight and height are ideal. TNI members are said to have an ideal body weight if the person's weight is more than or equal to the height minus 24 units and the height plus 4 units more than or equal to the square of the weight. State the problem in a system of quadratic inequalities and determine the solution area.	C4

The interview guide for the mathematical literacy ability test adapted from the interview guide (Usman, MR., 2022), was used to obtain information about students' mathematical literacy skills in solving test questions. Interview guidelines are presented in Table 3.

Table 3. Mathematical Literacy Ability Test Interview Guidelines

No	Question
1	Do you know the mathematical concepts you use to solve the problems in the problem?
2	What is the first thing you think about in answering the problem in question, what kind of solution do you use?
3	Can you get another problem similar to this or how to solve it like this? If you can try to explain!

The data analysis techniques used were adapted directly from (Fatwa Maulidatul Akhiroh, 2020) and (Usman, MR., 2022) are: a) qualitative data, including data condensation, data presentation and conclusion drawing, and b) quantitative data includes data analysis. Quantitative use in this study aims to calculate the results of the mathematical literacy test in terms of mastery of the prerequisite material and classify the selected students into 3 research subjects. The calculation formula used is as follows:

a. Prerequisite Material Mastery Test and Mathematical Literacy Acquisition Value $= \dfrac{total\ score\ acquisition}{max\ score} x 100$

b. Category Grouping $= \dfrac{100 - kkm}{2}$

$= \dfrac{100 - 75}{2}$

$=$ 13 intervals

The grouping of categories is presented in Table 4.

Table 4. Grouping of Categories

Category	Score
Tall	88 x 100
Currently	74 x 87
low	x < 74

RESULTS AND DISCUSSION

The results of the prerequisite material mastery test obtained are 1 (one) student with high prerequisite material mastery, 11 (eleven) students with moderate prerequisite material mastery, and 7 (seven) students with low prerequisite material mastery.

The following are the research subjects of mastery of prerequisite material and overall mathematical literacy presented in Table 5.

Table 5. Research Subject

Total Students	Prerequisite Material Mastery Category	Subjct Code
1	High	SPT
11	Medium	SPS
7	Low	SPR

In this study, the researcher did not determine the subject's level of mathematical literacy with a value, but focused more on revealing what aspects were fulfilled or not fulfilled in answering mathematical literacy questions. This is because, according to researchers, the level of mathematical literacy of students cannot be rejected by measuring only the value but is measured by revealing what aspects are fulfilled or not in answering mathematical literacy questions. In this study, mathematical literacy in terms of 4 (four) aspects of ability including the aspect of understanding as the ability of students to understand and use mathematical concepts is known. Aspects of reasoning as a student's ability to consider the right way of solving the problems that exist in the problem. The aspect of application is the ability of students to practice or write their answers based on the reasoning process carried out. The aspect of communication is the ability of students to convey or express to others how to use mathematics both orally and in writing (Usman, MR., 2022).
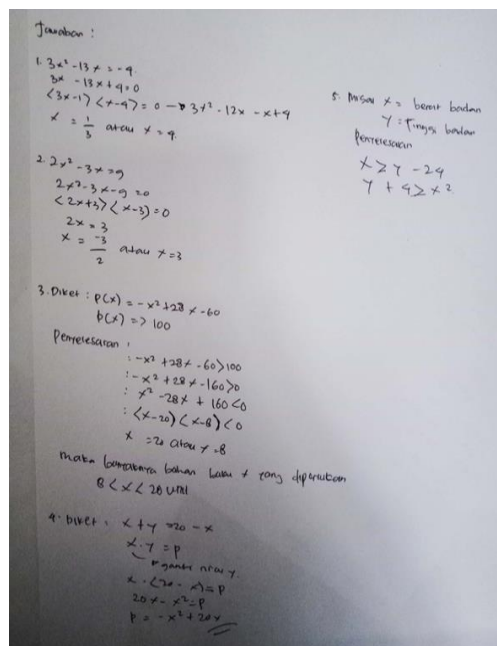
The results of the analysis of the achievement of fulfilled and unfulfilled aspects of each subject seen from mathematical literacy with mastery of high prerequisite material (SPT) in solving mathematical literacy problems are presented in Table 6.

Table 6. The Result of the Research Subject's Mathematical Literacy Ability is High

Initials	Question Number	Aspects of Mathematical Literacy Research			
		I_1	I_2	I_3	I_4
NA	1	√	√	√	√
	2	√	√	√	√
	3	√	√	√	√
	4	√	√	√	√
	5	√	√	-	-

Information:

I_1 = Understanding Aspect

I_2 = Aspect of Reasoning,

I_3 = Implementation Aspect,

I_4 = Communication Aspect,

√ = Fulfilled (able), and

(-) = Not fulfilled (unable)

From Table 6, it can be seen that students who have mastery of high prerequisite material (SPT) have fulfilled the aspects in literacy research mathematically, it's just that the work on problem Number 5 SPT does not meet the aspects of application and communication, this can be seen when students have difficulty in applying the formula to solve the problem.

The results of the test with the subject of mastery of high prerequisite material (SPT) on the mathematical literacy ability test in terms of mastery of prerequisite material, can be seen in Figure 1.

As for the results of interviews on the subject of mastery of prerequisite material (SPT) on question Number 5, the subject has difficulty in explaining the concepts used in answering the question. The following are the results of interviews with SPT subjects:

SPT-01 P : What is the first thing you think about in answering the problem in question Number 5?

SPT-01 S : The first time I did, let's say the height and weight first your body

SPT-02 P : After that what method did you use to solve the problem the?

SPT-02 S : After that, I made the inequality first according to the instructions in the question, Ms

SPT-03 P : Can you explain what the inequality is like?

SPT-03 S : For example, my weight is x, and my height is y, sis. Then the instructions about the question say that a TNI member is said to have an ideal weight if the person's weight is more than or equal to their height minus 24 units and their height is added. 4 units more than or equal to the square of the weight. So, from that sentence, I make the inequality x y-24 and y+4 ≫ *2*

SPT-04 Q: After getting the inequality, how else can you solve it, brother?

SPT-04 S: I don't know, Sis, how to solve the concept, so I don't fill it in, Ms

Figure 1. SPT Subject Answers

The results of the analysis of the achievement of the fulfilled and unfulfilled aspects of each subject seen from mathematical literacy with moderate

mastery of prerequisite material (SPS) in solving mathematical literacy problems are presented in Table 7.

Table 7. The Result of the Research Subject's Mathematical Literacy Ability is Medium

No	Initials	Question Number	Aspects of Mathematical Literacy Research			
			I_1	I_2	I_3	I_4
1	AAR	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
2	AF	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
3	NCP	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
4	AP	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
5	SA	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
6	FDS	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-

No	Initials	Question Number	Aspects of Mathematical Literacy Research			
			I_1	I_2	I_3	I_4
7	DA	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
8	MRS	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
9	FNZ	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
10	LA	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-
11	MWS	1	√	√	√	√
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	√	√
		5	-	-	-	-

Information:

I_1 = Understanding Aspect

I_2 = Aspect of Reasoning,

I_3 = Implementation Aspect,

I_4 = Communication Aspect,

√ = Fulfilled (able), and

(-) = Not fulfilled (unable)

On the subject of moderate prerequisite material mastery (SPS) can be seen in Table 7 shows that students who have moderate mastery of prerequisite material (SPS) are only able to answer questions number 1-3 correctly and fulfill 4 aspects of mathematical literacy, but the subject does not meet the aspects when answering questions number 4 and 5, so that they get the results wrong ending. The following are the results of the test with the subject of moderate prerequisite material mastery (SPS) on the mathematical literacy ability test in Figure 2.
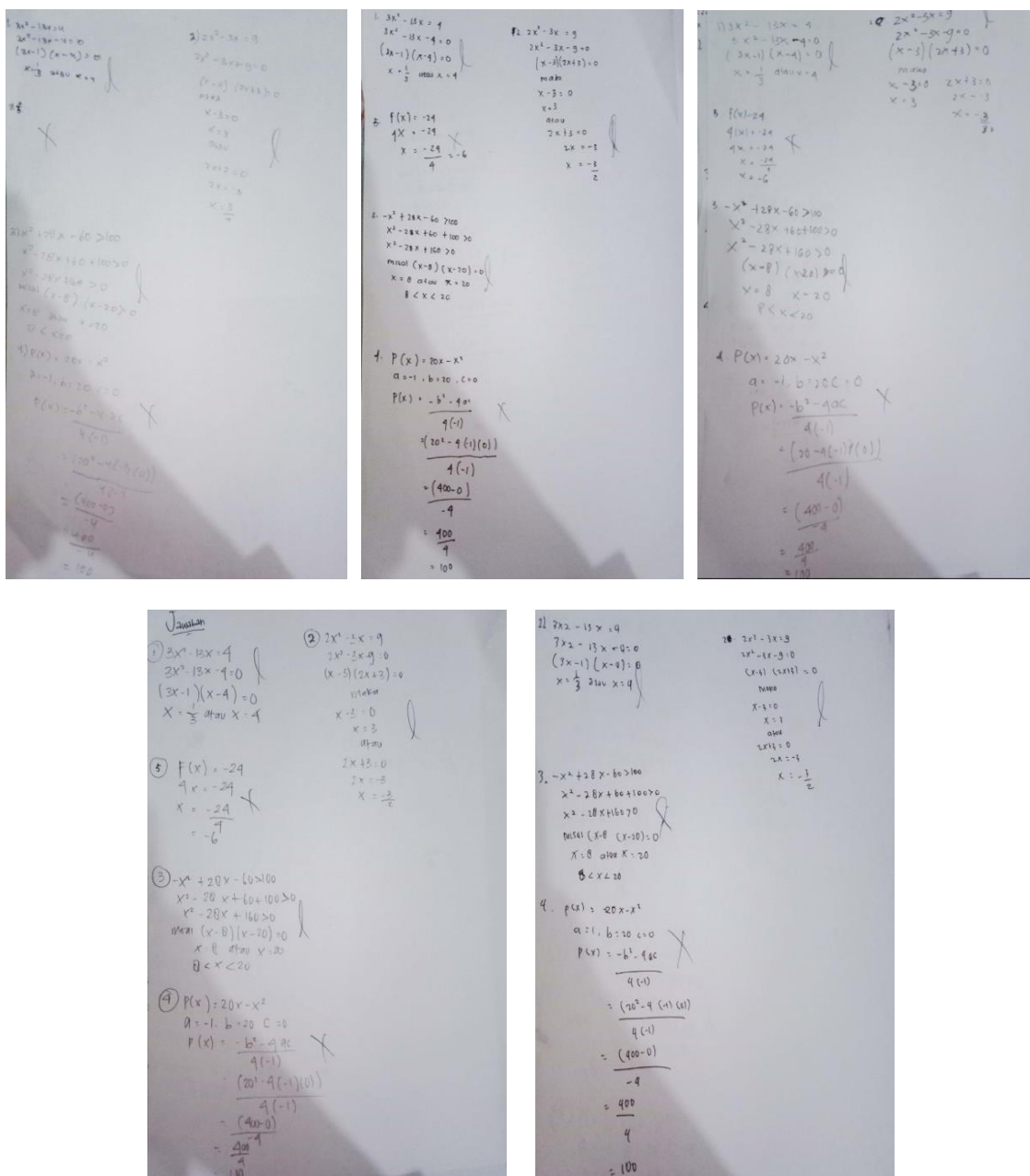
Figure 2. Answers to SPS Subjects

At the time of the interview, the subject of moderate prerequisite material mastery (SPS) was chosen randomly with 1 student of medium prerequisite material mastery (SPS). When the object was interviewed, the object had difficulty in explaining the concepts applied in answering the questions even

though they had been written. The following are the results of interviews with SPS subjects:

SPS-01 Q: What did you do when you first saw question number 4?

SPS-01 S: First, I will make the equation, Ms

SPS-02 Q: Can you explain the similarities?

SPS-02 S : the equation is p(x) = 20x-x^2 ,Ms

SPS-03 Q: So, what else did you do to solve the problem?

SPS-03 S : I use the formula a, b, c bro to get the value of p(x),Ms

SPS-04 Q : Why did you choose that formula, brother? Or have you ever met another similar problem like this brother until you use the formula a, b, c?

SPS-04 S : Yes Ms, what I know to find x is to use the formula a, b, c b

SPS-05 Q: ok, how about number 5, how do you solve it,?

SPS-05 S: I don't understand the number 5, so I answered carelessly Ms

The results of the analysis of the achievement of aspects that are fulfilled and not fulfilled by each subject seen from mathematical literacy with mastery of low prerequisite material (SPR) in solving mathematical literacy problems are presented in Table 8.

Table 8. The Result of the Research Subject's Mathematical Literacy Ability is Low

No	Initials	Question Number	Aspects of Mathematical Literacy Research			
			I_1	I_2	I_3	I_4
1	VMA	1	√	-	-	√
		2	√	-	-	-
		3	√	√	-	-
		4	√	-	-	-
		5	-	-	-	-
2	JRP	1	√	-	-	-
		2	-	-	-	-
		3	√	-	-	-
		4	√	√	-	-
		5	-	-	-	-

No	Initials	Question Number	Aspects of Mathematical Literacy Research			
			I_1	I_2	I_3	I_4
3	SP	1	-	-	-	-
		2	√	√	√	√
		3	√	√	√	√
		4	√	-	-	-
		5	-	-	-	-
4	FS	1	-	-	-	-
		2	-	-	-	-
		3	-	-	-	-
		4	-	-	-	-
		5	-	-	-	-
5	LDS	1	-	-	-	-
		2	√	√	-	√
		3	-	-	-	-
		4	-	-	-	-
		5	-	-	-	-
6	DM	1	-	-	-	-
		2	√	√	√	√
		3	√	√	√	√
		4	-	-	-	-
		5	-	-	-	-
7	TAP	1	-	-	-	-
		2	√	√	√	√
		3	√	√	√	√
		4	√	-	-	-
		5	-	-	-	-

Information:

I_1 = Understanding Aspect

I_2 = Aspect of Reasoning,

I_3 = Implementation Aspect,

I_4 = Communication Aspect,

√ = Fulfilled (able), and

(-) = Not fulfilled (unable)

On the subject of mastery of low prerequisite material (SPR) it can be seen in table 8, that those who have low prerequisite material do not meet the aspects of mathematical literacy research aspects. The following are the results of the test with the subject of low prerequisite material mastery (SPR) on the mathematical literacy ability test in Figure 3.
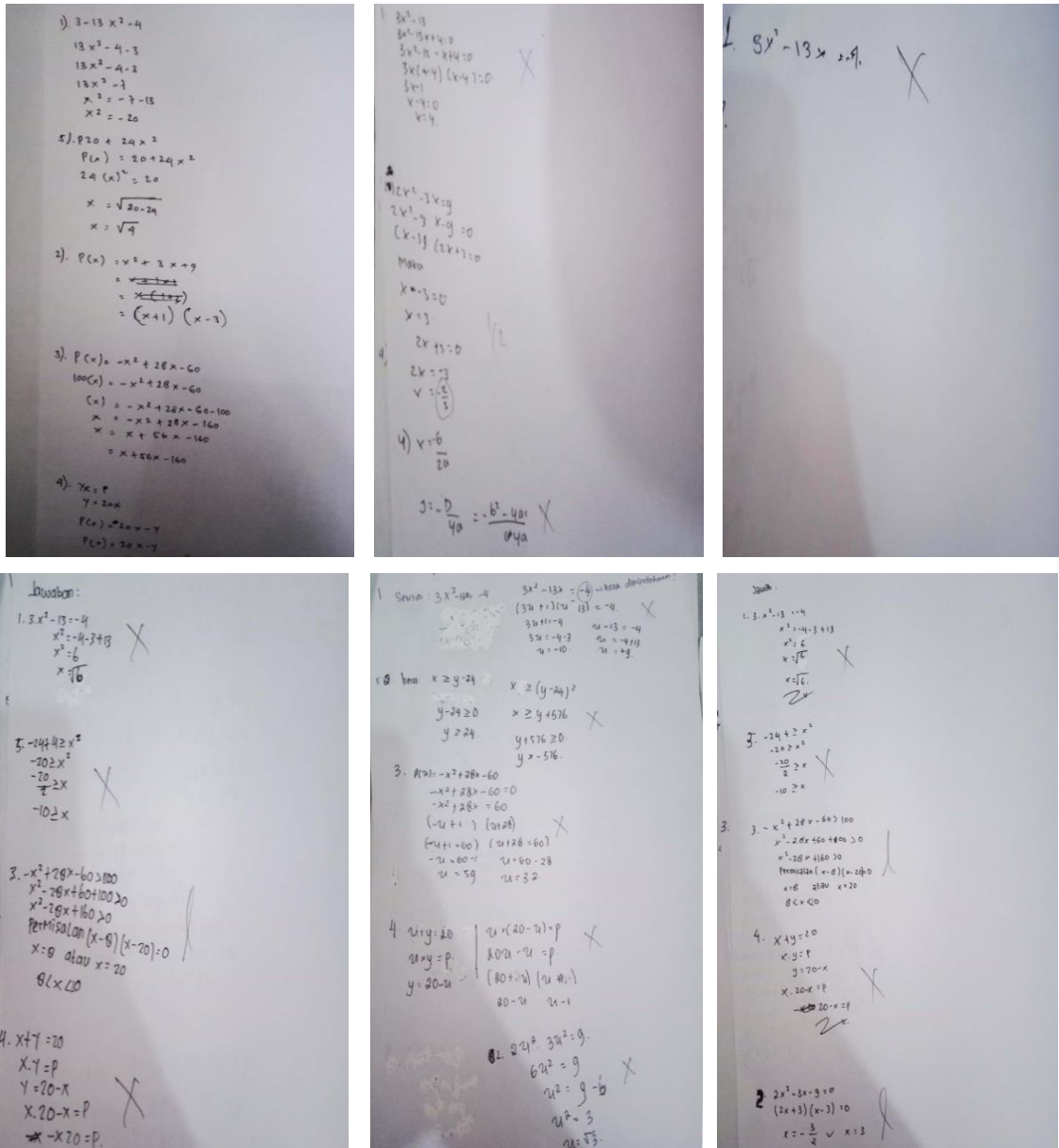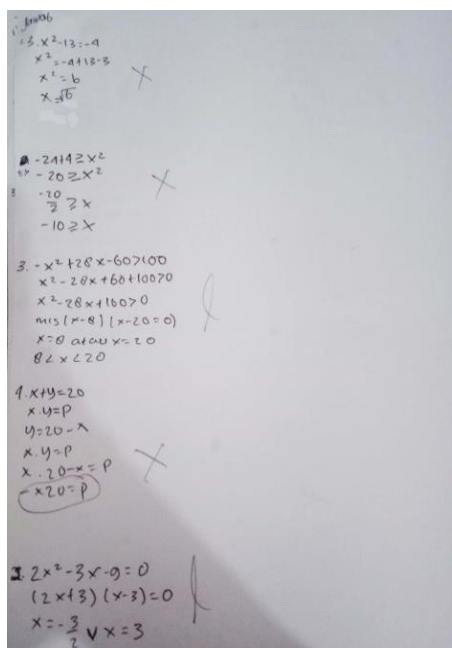
Figure 3. Answers to SPR Subjects

At the time of the interview the subject of mastery of low prerequisite material (SPR) was determined randomly with 1 (one) student of mastery of low prerequisite material (SPR), the subject could not explain the mathematical concepts he used correctly, and the subject was still confused in the concept of adding, subtract and factor. The following are the results of interviews with the subject of low prerequisite material mastery (SPR):

SPR-01 P : What did you do for the first time when you saw this question?

SPR-01 S : I made the equation Ms

SPR-02 Q: after that, how do you solve it?

SPS-02 S : my equationget x2-4-3 then I add up to $13x^2$-7 then I move the x segment to x2= -7-13 get the result x2= -20 Ms

SPS-03 Q : do you know the concept of division and multiplication if there is a variable behind it ?

SPS-03 S : I don't know Ms.

CONCLUSION

After analyzing the data, there are several things that need to be disclosed, namely the higher the mastery of the prerequisite material for students, the more likely it is to be able to answer mathematical literacy questions properly and precisely, this is because someone who has mastery of the prerequisite material must have known a lot about the concept. mathematics, especially on the basic concepts. This is in line with (Widiyanto, 2019) that errors about understanding mathematical concepts are caused by a lack of mastery of prerequisite material in applying mathematical operations, use of inappropriate rules, errors in generalization and abstraction, and incomplete and less detailed mathematics teaching. This is in line with Nurgiyantoro in (Nihayah, 2021) regarding the importance of mastering the prerequisite material that mastery is a person's ability that can be realized both from theory and practice.

The subject of mastery of high prerequisite material (SPT) as a whole can answer the test questions correctly and precisely, only on question number 5, the subject has difficulty applying and reasoning in solving problem solving in literacy questions. The subject of moderate prerequisite material mastery (SPS) even though he has done many correct steps in answering literacy questions, there are still using the wrong solution so that the final result is wrong and it is a little difficult to explain the solution orally even though it has been stated in written form. again with the subject of mastery of low prerequisite material (SPR) which really cannot and is able to explain what mathematical concepts he uses in answering literacy questions.

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