Analysis of Mathematic Literacy Ability in Solving Problems in Arithmetic Sequences and Series based on Gender View

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Abstract

This study aims to describe the literacy ability of grade VIII students of SMP N 2 Plantungan in solving row and series problems reviewed from gender. The intended literacy skills are 1) communication skills, 2) mathematical skills, 3) problem-solving strategy skills, 4) symbol, formal, and technical language operation skills, and 5) reasoning and conclusion skills. The subjects of this study were one male student and one female student of grade VIII SMP N 2 Plantungan who were selected based on the highest score, and had good communication skills in solving the test questions that had been given. Research data sources from test results, interviews, and documentation. Data trianggualation is used to test the validity of data. This study showed that female students met all five literacy indicators tested, but male students only met four indicators of mathematical literacy ability. The thing that distinguishes this achievement is that male students have not fulfilled the ability to reason and reason. For the next research, you can conduct research on mathematical literacy skills with a focus on not many indicators so as to provide an in-depth description of the discussion.

Keywords: Arithmetic lines and series; Gender; Mathematical literacy

INTRODUCTION

Mathematics is the same as science that is often used in daily activities. Mathematics has been taught in various levels of education, ranging from the lowest level of education to the highest. The ability in the field of mathematics that students must have is not just the basic ability to calculate, but students must be able to think or reason in solving mathematical problems (Hera & Sari, 2015).

According to Cockroft (Lukman & Zanthy, 2019) The importance of mathematics is given to students on the grounds that mathematics a) is often used in activities, b) appropriate mathematical competence is needed in all aspects, c) symbolizes a set of strong, compact and solid connections, d) information providers in various models, e) analytical opinion skills, accuracy, and spatial understanding, can be developed, and f) bring happiness to efforts to overcome challenging problems.

Problem solving daily activities in the ability to master mathematical science is known as mathematical literacy. Aspects of mathematical literacy have been widely considered in the purpose of mathematics lessons in Indonesia (Janah et al., 2019). According to (OECD, 2017) Mathematical literacy is the ability of individuals to formulate, apply, define mathematics in many forms or circumstances. Things that are included in the realm of mathematical literacy are mathematical reasoning, the use of mathematical rules, steps, facts and media used to describe, describe and predict an event. In daily activities require

mathematical literacy skills to produce rational and constructive, involved and reflective decisions.

Mathematical literacy skills are very important because they have an impact on the value of Indonesian human resources (Masjaya & Wardono, 2018). Mathematical literacy is needed by humans to meet the needs of life both in the world of work and in activities (Ojose, 2011). According to (Muzaki & Masjudin, 2019) The importance of mathematical literacy because it can help someone explore the benefits of mathematics in daily activities. Like the ability to read and write, mathematical literacy skills are also an important key in anticipating changes in the community system (Murtiyasa & Perwita, 2020).

The results of PISA in 2012, regarding the mathematical literacy ability of some students showed a score for mathematics obtained 375, the existence of the score was below the international average of 494, and showed that in this activity the size of Indonesian students was still below level 2 which was 75% (Abidin et al., 2018). According to (Sari & Valentino, 2017) Reading, understanding, transformation, procedural errors and errors and encoding are five student errors in solving problems.

Mathematical literacy skills intended by PISA are mathematical abilities that include several abilities, namely: a) communication, b) Mathematization, c) Representation, d) reasoning and argument, e) formulating strategies to solve problems, f) using symbolic, formal, technical, and operating language. g) using mathematical tools (Abidin et al., 2018). Student skills when formulating, using, and being able to interpret mathematics by using systematic reasoning, procedures, facts, and devices in describing, explaining, and hypothesizing an event that makes students able to recognize the role of mathematical literacy skills in everyday problems.

According to (Rahmawati & Mahdiansyah, 2014) Personal aspects, instructional aspects and environmental aspects are the reasons for achieving mathematical literacy, namely. The personal aspect is reflected in students' understanding of mathematics learning and students' confidence in mastering mathematics, where this aspect cannot be separated from the gender aspect which influences the achievement of mathematical literacy during learning. In the process of teaching and learning mathematics there is a similarity between female students and male students, including reasoning, accuracy, accuracy, and accuracy of thinking (Firmanti, 2017). According to (Robinson & Lubienski, 2011) In mathematics, the achievement of female students is superior to the achievement of male students. In tune with research (Nurani et al., 2020) The literacy skills of female students are superior to male students. (Mahiuddin et al., 2019) It was concluded that the average low was 26.89 on students' mathematical literacy ability.

Arithmetic rows and series are materials that are often used in everyday problems. Therefore, understanding and mastering the material of arithmetic rows and series is very important for students. However, in fact, in solving row and arithmetic series problems, students have difficulty (Annisa & Kartini, 2021). Misconceptions, the use of data, interpretation, technical, and conclusion drawing are a kind of absence for students to do row and arithmetic series material problems (Handayani et al., 2020).

Of the many kinds of errors made by students, these errors are included in several indicators of students' mathematical literacy when solving row and arithmetic series problems. Literacy problems encountered by students in rows and arithmetic series are problems that are reviewed from the ability to formulate strategies and solve problems (Hidayat & Evendi, 2022; Sihotang et al., 2022). Students often make math literacy mistakes, namely students have not planned correctly and do not use formulas correctly (Sihotang et al., 2022).

The purpose of this study is to find students' mathematical literacy skills which are not only observed through the ability to formulate strategies and problem solving but, seen from communication skills, mathematics, reasoning and argument, determine problem-solving strategies, as well as the use of symbolic, formal, technical, and operative language

and also students' mathematical literacy skills are reviewed based on gender. The importance of this research is carried out to improve students' mathematical literacy skills in solving arithmetic row and series material problems and to be able to analyze precisely where students find problems when solving row and row material problems. This is in line with research (Ananda & Wandini, 2022) that mathematical literacy analysis is important to improve students' mathematical literacy skills in order to improve student learning outcomes by analyzing problems faced by students when solving problems.

METHOD

This study used qualitative descriptive research design (Sutama, 2012). The research was carried out for 5 months, from August 2022 to December 2022 at SMP Negeri 2 Plantungan, Kendal. Sources in research are obtained from test results, interviews, and documentation. The test results were used to see students' mathematical literacy skills from solving row and arithmetic series material problems in terms of gender differences in grade VIII students of SMP Negeri 2 Plantungan, Kendal. Interviews are used to obtain information about student work and information about written test answers conducted in advance by researchers. Interviews were conducted by researchers with research subjects, namely one male student and one female student. The research subjects are all grade VIII students who will be selected one subject each gender, which will later be the subject of research for the process of analyzing answers and interviews. Determination of research subjects based on the results of student worksheet answers with the highest scores and based on completeness and good communication from each gender. Documentation was obtained from all photos during the research implementation process. Researchers are the main instrument, while the supporting instruments are questions and interviews. Data reduction, data presentation, and data verification are Miles and Huberman data analysis techniques, techniques used to analyze the results of research (Satori & Komatiah, 2017). Meanwhile, the validity of the data in the following study uses data trianggualasi.

Furthermore, the use of instruments in this study is 3 description questions made based on mathematical literacy indicators, namely 1) communication skills, 2) mathematical skills, 3) problem-solving strategy skills, 4) symbolic, formal, and technical language operation skills, and 5) reasoning and conclusion skills. Here are the 3 description questions used in the test:

1. In the cinema building, audience seats are arranged with the front row consisting of 20 seats, in the second row consisting of 23 seats, the third row consisting of 26 seats and so on, in the cinema consisting of 15 rows, how many seats in the last row?
   a. Is it true that the row pattern in the problem can be solved by arithmetic row pattern? Explain your reasoning!
   b. What information is obtained from the above question?
   c. Determine how many seats on the 15th!
   d. Is it true that many seats in the 15th row are 62? Explain your reasoning!
2. An iron is cut into 6 parts so as to form an arithmetic row. If the shortest iron length is 5 cm, the second iron is , 10 cm, the third iron is 15 cm, and so on. Then the length of the iron before being cut is...
   a. Is it true that the above problem forms an arithmetic series? Give your reasons!
   b. Write down what information you get from the problem above!
   c. Find the initial iron length before cutting it by finding the value S6!
   d. Is it true that the length of the initial iron was 135cm? Explain your reason!
3. Bird migration is the movement of bird populations that occur at certain times of the year, in order to find food, breed, and due to climate change. Cristoper was a migratory bird researcher noting a group of bird movements such as the following:
   a. The first row consists of one bird
   b. The second row consists of three birds

c. The third row consists of five birds, and so on
d. If there are 12 rows in the formation, how many birds in total in the group are ...
a. From the above problems what information is obtained? Explain!
b. Calculate S12 from the above problem to find the total number of birds!
c. Is it true that the total number of birds in the group is 144, give me a reason!
d. Can the problem be solved using arithmetic series? Explain your reasoning!

RESULTS AND DISCUSSION

The results of this research and discussion are the results of tests and interviews of students' mathematical literacy skills analyzed according to their gender. Researchers conducted an analysis of students' mathematical literacy skills when working on row and arithmetic series material problems in terms of gender. The following results of the mathematical literacy ability test are presented in Table 1.

Table 1. Math literacy ability test results

No	Mathematical literacy skills	Female Student Subject (SP)			Male Student Subject (SL)		
		Question Number					
		1	2	3	1	2	3
1	Communication	✓	✓	✓	✓	✓	✓
2	Mathematization	✓	✓	✓	✓	✓	✓
3	Problem-solving strategies	✓	✓	✓	✓	✓	✓
4	Symbol language operations, formal language, and technical language	✓	✓	✓	✓	✓	✓
5	Reasoning and giving conclusions	✓	✓	✓	-	-	-

Information: ✓ = Meet
                 - = Does not meet

The work of female students (SP)

According to figure 1, it can be seen that question number one can be solved by SP. All components of mathematical literacy indicators that have been tested are owned by SP. In the communication indicator, SP is able to provide written and oral explanations and ideas well and communicatively. In the mathematical indicator, SP writes and explains orally when changing contextual sentences on the problem about what is known and asked with the example of the first line, second line and so on with U1, U2,... Un However, SP has not written completely such as "n" as many terms in line, and "a" as the first term, but at the interview when asked to re-mention the subject SP was able to explain and mention completely and correctly. In the problem-solving strategy indicator, the first step of SP is to determine the difference using the U2-U1 formula for the reason that the difference is not yet known, and using the arithmetic sequence formula Un=a+(n-1)b correctly supported by the use of symbol, formal, and technical language operation indicators in solving so that the calculation results are obtained correctly. In the reasoning indicator of giving conclusions, in writing and orally SP gives the "correct" answer and writes the right conclusion and provides evidence in the form of answers to the problems that have been given.
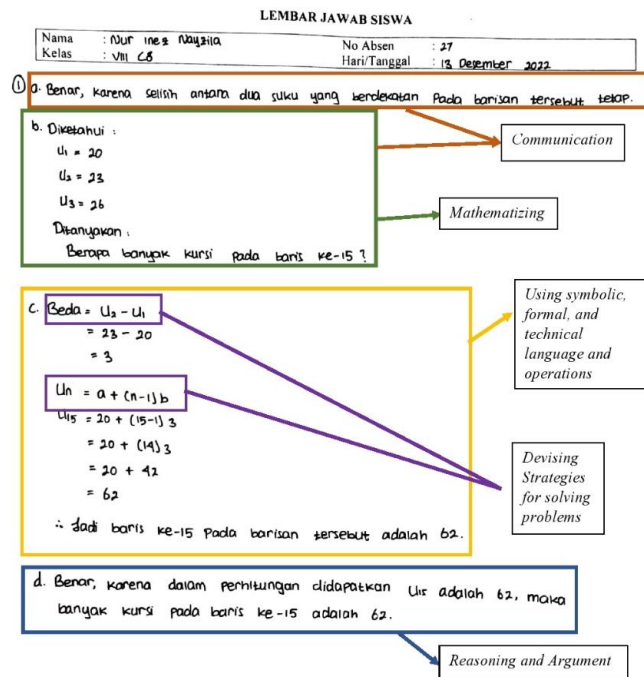
Figure 1. Results of the First Question Answer of SP Subject

Based on figure 2, SP subjects are able to meet all literacy indicators with evidence that in communication indicators SP is able to provide written or oral explanations and ideas well and communicatively. In the mathematical indicator SP writes and explains orally when changing contextual sentences on the problem about what is known and asked with the example of the first line, the second line and so on with $U1, U2, ... Un$, "n" as many tribes in the line, as well as "a" as the first tribe completely and correctly. In the problem-solving strategy indicator, SP determines the difference using the formula $U2 - U1$ for the reason that the difference is unknown, and using the formula for the number of arithmetic series $Sn = \frac{n}{2}[2a + (n-1)b]$ correctly. In the indicators of symbol, formal, and technical language operations in solving question number two, the right calculation results are obtained. In the reasoning indicator of giving conclusions, in writing and orally, SP provides appropriate conclusions and provides evidence in the form of answers to the problems that have been given.
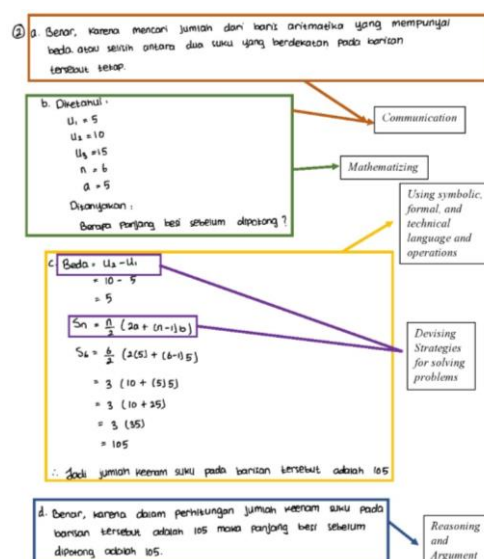

Figure 2. Results of the Answers to the Questions of the Two SP Subjects

According to figure 3, SP subjects were able to meet all literacy indicators. With evidence such as the explanation on the second question. In the reasoning indicator of giving conclusions, in writing and verbally SP answers and provides conclusions appropriately.
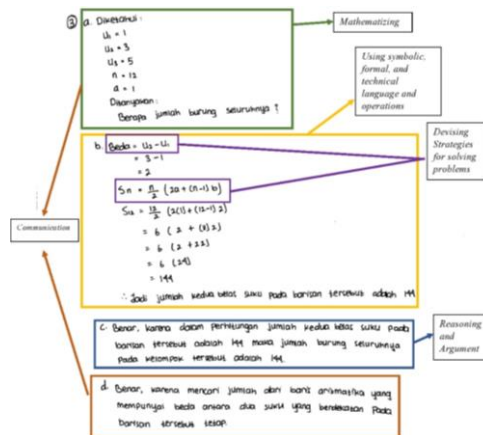

Figure 3. Results of the Answers to the Three SP Subjects

The work of male students (SL)

According to figure 4, SL subjects were able to meet four indicators of mathematical literacy. Evidence on SL communication indicators is able to write ideas in writing and orally well. In the mathematical indicator SL writes contextual sentence changes on the problem about what is known and asked with the example of the first line, second line and so on with $U1, U2, ... Un$ however, SL has not written in full such as "n" as many terms in the line, and "a" as the first term, but at the interview when asked to re-mention and re-explain what is meant in the example SL subject looks confused. In the problem-solving strategy indicator, SL determines the difference using the formula $U2 - U1$ for the reason that the difference is unknown, and using the arithmetic sequence formula $Un = a + (n-1)b$ Correctly supported by the use of symbolic, formal, and technical language operation indicators in solving so that the calculation results are obtained correctly. In the reasoning indicator of giving conclusions, in writing and orally SL only gives answers without giving reasons and conclusions. These results are supported by the following interview results:

P   : So what is the conclusion, is it true that many 15th row seats are 62?
SL   : Yes that's right
P   : Why is it true?
SL   : don't know

From the results of the interview, it can be seen that in the indicators of reasoning and reasoning, SL subjects look confused and cannot give reasons from the answers written.
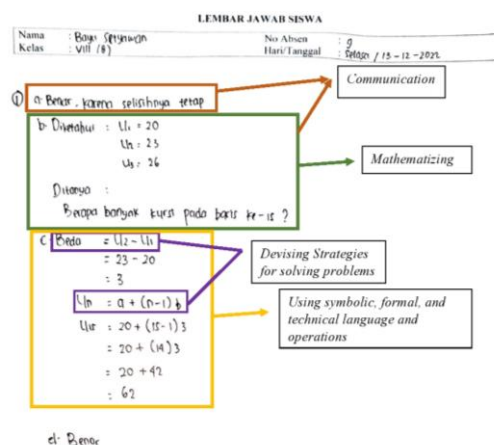

Figure 4. Results of the Answer to the First Question of SL Subject

According to figure 5, four of the indicators of mathematical literacy ability have been met by SL subjects. With evidence that in communication indicators, SL presents ideas in writing and orally well and communicatively. In the mathematical indicator SL writes and explains orally when changing contextual sentences on the problem about what is known and asked with the example of the first line, the second line and so on with $U1, U2, ... Un$, "n" however, SL has not written in full such as "n" as many terms in the line, and "a" as the first term, but at the interview when asked to re-mention and re-explain what is meant in the example SL subject looks confused. In the problem-solving strategy indicator, SL determines the difference using the formula $U2 - U1$ for the reason that the difference is unknown, and using the formula for the number of arithmetic series a $Sn = \frac{n}{2}[2a + (n-1)b]$ correctly. In the indicators of symbol, formal, and technical language operations in solving question number two, precise calculation results are obtained. In the reasoning indicator of giving conclusions, in writing and orally SL only gives answers without giving reasons and conclusions. These results are supported by the results of the interview below:

P   : Well now is it true that the length of iron was originally 105 in length?
SL   : True
P   : Why is it true?
SL   : As far as I know right, the reason is not knowing
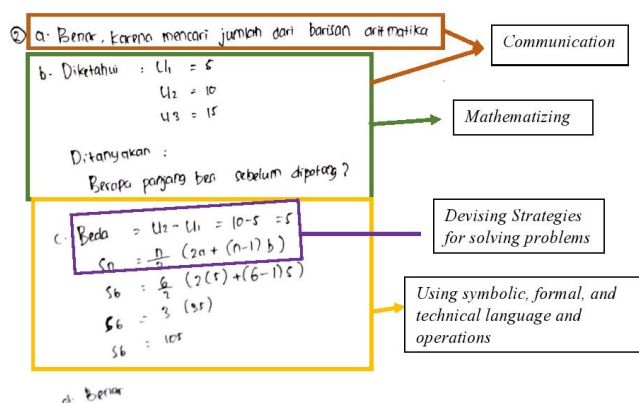

Figure 5. Results of the Answers to the Questions of the Two SL Subjects

From the results of the interview, it can be seen that in the indicators of reasoning and reasoning, SL subjects have not been able to give reasons from the answers.
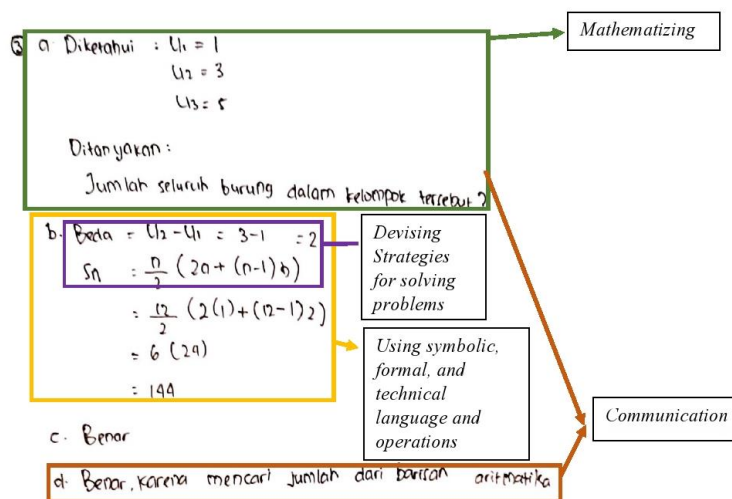

Figure 6. Results of the Answers to the Third Question of SL Subjects

Based on figure 6, four of the indicators of mathematical literacy ability have been met by SL subjects. With evidence such as the explanation on the second question. In the reasoning indicator of giving conclusions, in writing and orally SL only gives answers without giving reasons and conclusions. These results are supported by the results of the interview below:

P   : Well now is it true that finding the number of all birds in the formation is 144?
SL   : True
P   : Why is it true?
Sl   : don't know

From the results of the interview showed that in the indicators of reasoning and reasoning, SL subjects looked confused and could not give reasons from the answers that had been written.

Discussion

Based on the results of the analysis of the two subjects above, the discussion can be described as follows.

Female students

Five indicators of mathematical literacy ability components in the three questions that have been tested can be met by female students. Evidence can be seen in question number one female students are not perfect in mathematization skills because they are not careful in writing all components are well known, but during the interview process when asked to explain again female students are able to answer with all stages known correctly. The ability to determine strategies in problem solving, the ability to operate symbolic, formal, and technical language, as well as the ability to reason and give conclusions possessed by female students seen from female students are able to determine what steps and formulas should be used in solving the three problems, supported by the use of operating skills and understanding of symbolic and technical language appropriately and thoroughly so as to produce precise and able to explain the results of solving back to the operation. Female students have good reasoning and conclusion skills, female students understand the reasons behind each process.

Male students

Of the five indicators of mathematical literacy that have been tested, male students can only meet four abilities in outline, namely communication skills, mathematical skills, problem-solving strategy skills, and symbol, formal and technical language operation skills. Male students have not fulfilled the ability to reason and give reasons, this statement is supported by evidence that When male students have not written down the reasons and conclusions of each question well, and in the interview process also When asked to give reasons in each question male students look confused because they answer "don't know" several time. At the mathematization stage, male students were also less thorough in writing down all components well known, even during the interview process When asked again to explain, the male students looked confused and did not mention what was still lacking in writing. In other indicators of ability, male students are able to write and explain well, although when explaining again the formula used there are some ways of reading that are not right, but overall male students are good at both of these abilities.

From the results of the analysis of SP and SL worksheets, SP can achieve more indicators of mathematical literacy ability compared to SL. Meanwhile, judging from the interview results, SP is more communicative, precise, and fluent in explaining the answers and reasons for each question given compared to SL. Therefore, the conclusion can be drawn that SP achieved all mathematical literacy indicators tested, but SL only achieved four of the five mathematical literacy indicators that have been tested.

The results of the above research are in line with the research (Nurani et al., 2020) That female students master literacy skills superior to male students. This is based on the fulfillment of mathematical literacy indicators. All indicators of mathematical literacy have been met by female students, but male students meet one indicator of mathematical literacy, namely interpreting mathematics in problem solving. Similar results from research (Awalyah et al., 2022) The mathematical literacy ability of male students is in sufficient category, but the mathematical literacy ability of female students is in good category. It's the same from research (Setiawan et al., 2019) Male students have been able to determine the resolution action and draw the right conclusions, based on that the mathematical literacy skills of male students are good, while the skills of female students are also good because female students have also been able to determine steps and explain again about the problems that have been given. In research (Kurniawan & Khotimah, 2022) mentioned that students who can master the six indicators of mathematical literacy are high category students, while low category students have at least four indicators, but low category students only have a minimum of three mathematical literacy indicators. In line with research (Lestari & Effendi, 2022) mentioned that students with mathematical literacy skills are lacking in the process of checking back the answer results and students have not written the correct conclusions from the answer results.

CONCLUSION

From the results and discussion in this study, it was concluded that female students could meet these five indicators. The five indicators of mathematical literacy in question are ability in communication, mathematics, problem-solving strategies, symbolic, formal, and technical language operations, as well as reasoning and giving conclusions. Meanwhile, the mathematical literacy ability of male students is quite good because male students can meet four literacy indicators except for the indicators of giving reasons and conclusions. Therefore, it can be concluded that the mathematical literacy ability of grade VIII students of SMP 2 Plantungan in solving row and arithmetic series material problems there are differences between female and male students, namely in the ability to reason and reason. Female students meet all five indicators of mathematical literacy, but male students meet four mathematical literacy skills. The difference between the acquisition of mathematical literacy skills between female and male students is the ability to reason and reason.

RECOMMENDATION

It is hoped that this research can be a reference or a medium of reflection for teachers to improve students' mathematical literacy skills. Not only that, through this study, researchers propose that the next researcher can conduct research on mathematical literacy skills with a focus on indicators that are not too many so as to be able to provide an in-depth description of the discussion.

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