

## STUDENTS' MATHEMATICAL LITERACY IN SOLVING PLANE GEOMETRY PROBLEMS IN VIEW OF SELF EFFICACY

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### ABSTRACT

*This study aims to analyze students' mathematical literacy in solving Plane Geometry problems in terms of their self-efficacy. Self efficacy refers to an individual's belief in the abilities that students have. In the context of mathematics learning, self efficacy can influence students in overcoming mathematical challenges. The method used in this research is a descriptive study with a quantitative approach. Data were collected through a mathematical literacy test that focuses on solving flat shape problems and a self efficacy questionnaire filled out by students. The research was conducted on senior high school students with a sample size of 30 students. The results showed that there was a positive correlation between students' self efficacy level and their mathematical literacy in solving flat shape problems. Students who have higher levels of self-efficacy tend to have better mathematical literacy skills in that context. In addition, the data analysis also identified that students with low self efficacy tended to have difficulties in understanding, planning and solving flat shape problems. The results of this study indicate the importance of considering students' self efficacy in mathematics teaching. Teachers and mathematics educators can design learning strategies that enable students to improve their self-efficacy..*

*Keywords: Mathematical Literacy; Plane Geometry; Self Efficacy*

### 1. Introduction

The Industrial Revolution 4.0 has had a significant impact, especially in the world of education with rapid technological developments in various sectors of life (Iskandar et al., 2019). As the Industrial Revolution 4.0 progresses, Indonesia is faced with the development of Society 5.0, which is a further impact of the revolution (Darmiyanti & Taufik, 2021). Research conducted by Muhtadin in 2020 confirmed that mathematical literacy is very important and must be mastered by society in facing the era of society 5.0. Unfortunately, education in Indonesia has not yet fully implemented the concept of society 5.0 (Puspita et al., 2020). Quality education can be achieved if it is in accordance with the concept of society 5.0. The learning process must experience continuous development and improvement. This will be realized if students have good mathematical literacy (Farida et al., 2021). However, unfortunately, mathematical literacy in Indonesia is still relatively low and this is contrary to the hope that mathematical literacy will become the main program in education in Indonesia. (Astutic). Mathematical literacy in Indonesia is

still low, as evidenced by survey results during this period showing that Indonesia's participation in the PISA survey has not experienced a significant change. PISA (Program for International Student Assessment) is a study designed by countries that are members of the OECD (Organization for Economic Cooperation and Development) (Pratiwi, 2019). PISA assesses various aspects, including reading literacy, science literacy and mathematics literacy. This refers to an individual's ability to formulate, apply, and explain mathematical concepts in a variety of situations, including the use of mathematical reasoning as well as the application of mathematical concepts, procedures, facts, and tools to explain, understand, and predict various phenomena. Students who have good mathematical literacy skills are able to understand, apply and utilize mathematics in their daily lives (Akca et al., 2022). Students who have low mathematical literacy skills may experience difficulty in solving problems. Therefore, mathematical literacy has an important role in helping individuals as they go about their daily activities. The low level of mathematical literacy of students in Indonesia is influenced by several

factors that need to be considered, including personal factors, instructional factors, and environmental factors. (Masjaya & Wardono, 2018)

In mathematical literacy, there are seven components of ability that need to be mastered, namely (1) communication skills, (2) mathematization skills, (3) ability to re-present information, (4) ability to think logically and provide reasons, (5) ability to use solving strategies. problems, (6) the ability to use symbols, formal language, and mathematical techniques, and (7) the ability to use mathematical tools (Komalia et al., 2019). In terms of personal factors, self-efficacy is an aspect that requires special attention, especially because in the current world of education, achieving learning outcomes alone is no longer enough. (Rizkiana, 2017). Thus, self-efficacy is the internal factor that has the most influence on student learning outcomes, especially on students' mathematical literacy abilities. Self-efficacy in this context is defined as an individual's belief in their ability to plan and carry out actions effectively, even when they are faced with challenges or difficulties (Saraswati & Prihatsanti, 2017). Thus, paying full attention to students' self-efficacy is the main key in improving students' mathematical literacy.

In this research, we will see how mathematical literacy skills are viewed from students' self-efficacy in solving flat shape problems. Flat Building material requires a strong level of mathematical literacy, because the concepts in this material are related to situations in everyday life (Dusalan, 2020). Therefore, the main aim of teaching Flat Building material is so that students can apply these concepts in solving problems in their daily lives. This research aims to describe the level of mathematical literacy of students from class VII at Ar-Rofi'iyah Islamic Middle School by considering the level of self-efficacy in the high, medium and low categories when given problems related to Plane Geometry.

## **2. Research Methods**

In this research, data was taken from 30 students in class 7 of Ar-Rofi'iyah Islamic Middle School. This research has a descriptive nature using a qualitative approach. The data collection process was carried out through several methods, namely questionnaires, tests and interviews (Ma'rifah et al., 2016). The instrument used is a self-efficacy questionnaire. This research aims to investigate the relationship between students' self-efficacy (self-confidence) in the

context of mathematical literacy and students' ability to solve flat shape problems. Before being used, these research instruments have gone through a validation process. The validity of research instruments is considered adequate if the validation value ( $V_a$ ) is in the range  $3 \leq V_a \leq 4$ . The instrument validation results show a  $V_a$  value of 3.53 and 3.72 which places it in the valid category. Therefore, these research instruments can be relied on to collect the data needed in this research.

Data was collected by distributing self-efficacy questionnaires to students via Google Form simultaneously and always under the supervision of researchers. Data from this questionnaire will then be analyzed and grouped based on the level of self-efficacy achieved by students (Larasati et al., 2019). After that, the next step was to give a mathematical literacy test to research subjects who had high, medium and low levels of self-efficacy. The mathematical literacy test used was adapted from the PISA problem. After the subject completes the mathematical literacy test, the next stage is to conduct an interview.

The results of the interview session will be converted into verbal data which will then be adjusted or reduced according to needs. In the data analysis process, researchers will identify the extent to which indicators are met at each level of mathematical literacy based on test results and subject interview results. After that, the next step is to triangulate the data by comparing the results of the mathematical literacy test with the results of the interview. In the end, researchers will draw conclusions regarding students' mathematical literacy levels in each self-efficacy category.

The research results will be interpreted to identify the relationship between self-efficacy and students' mathematical literacy. The implications of this research can be used to inform learning strategies that can increase students' self-efficacy and their ability to solve flat shape problems

## **3. Results and Discussion**

The data analysis carried out by researchers is the result of analysis originating from two main sources, namely tests of mathematical literacy skills and interviews with research subjects who represent three categories of self-efficacy, namely high, medium and low. The results of the self-efficacy questionnaire analysis show that students in class VII are able to achieve all

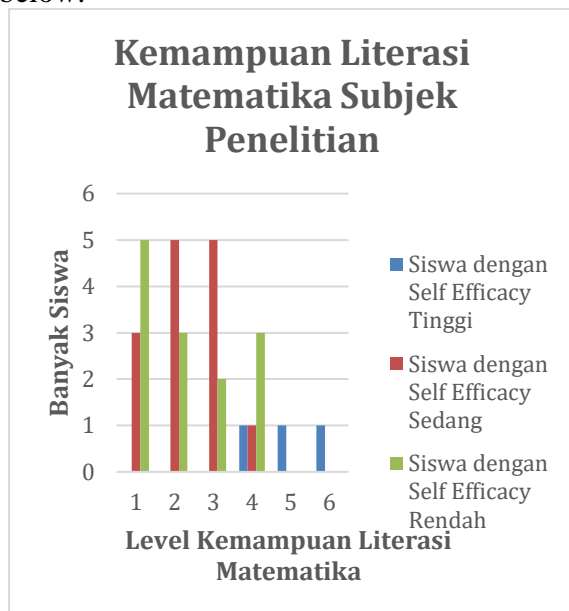
categories of self-efficacy. Details can be found in the attached Table 1.

**Table 1** Data from Self-Efficacy Questionnaire Results

No.	Self Efficacy	The number of students
1.	Hight	6
2.	Currently	13
3.	Low	11

The next step is to give a mathematical literacy test to all subjects belonging to class VII. The mathematical literacy test used is the PISA problem. This test will be given to 30 students. Furthermore, students who have a low level of self-efficacy will be given the code S1, students with a medium level of self-efficacy will be given the code S2, and students with a high level of self-efficacy will be given the code S3.

Based on the results of data analysis, the level of mathematical literacy achieved by students is shown in the diagram in Figure 1 below.

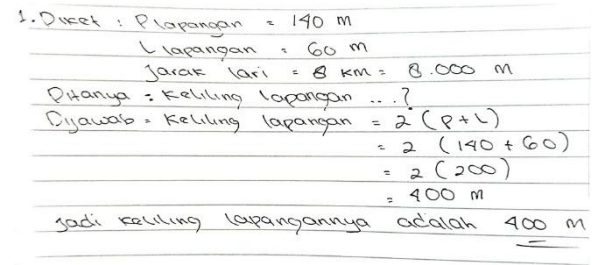


**Figure 1** Mathematical Literacy Level of Research Subjects

### Undergraduate Mathematics Literacy

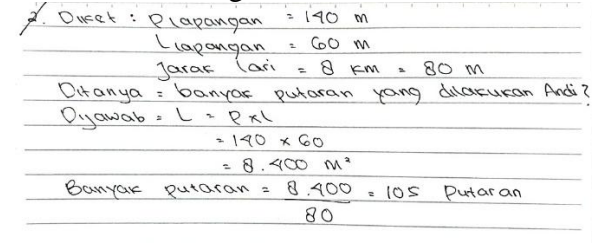
Students with low self-efficacy (S1) are at level 1 of mathematical literacy. S1 can fulfill all indicators at level 1 of mathematical

literacy, as can be seen in the results of S1's answers below



**Figure 2** S1 Answers to Problem 1

Based on table S1 seen in Figure 2 above, it can be concluded that S1 is able to answer questions by understanding the given context. Apart from that, S1 can recognize relevant information in the problem, namely by including information that is already known and requested in problem 1, and using a general approach. S1 also provides appropriate responses to the stimuli given and uses appropriate formulas to solve problem 1 effectively. Therefore, the conclusion is that S1 is at level 1 of mathematical literacy. However, it should be noted that S1 has not met the indicators required at level 2, which can be seen in Figure 3 below.



**Figure 3** S1 Answers to Problem 2

In Figure 3, it can be seen that S1 faces difficulties in identifying how to relate mathematical solutions to the problem context. S1 is unable to fully recognize relevant information and is also unable to apply mathematical concepts and principles correctly, which ultimately results in errors in finding the correct solution. These results are in line with the findings from research conducted by Martalyana and her colleagues in 2018, which stated that students with low levels of self-efficacy in mathematical literacy tend to experience difficulties when faced with questions that focus on high-level thinking (HOTS) and they also have difficulty

using symbolic, formal, technical language and correct mathematical operations.

S1 has attempted to answer problem 2 using mathematical language, as seen in his response on the answer sheet. However, S1's mistake lay in implementing the mathematical operations used in solving problem 2. S1 experienced difficulty in applying mathematical operations correctly and also in understanding the problem correctly, which resulted in the answer given to problem 2 being inaccurate. Apart from that, S1 also seemed to be lacking in checking the answers he had written, which was reflected when the researcher conducted an interview with S1. S1 seems to only make substitutions without understanding or re-checking the answers that have been obtained. (Yanuarisma & Rahaju, 2023). they can design appropriate solution steps but are incomplete so they are unable to carry out the solution steps they have prepared.

S1 is able to answer questions asked to dig up information related to the plan that will be used in solving problem 2. Apart from that, S1 can also identify problems by formulating problem 2. This is in line with research conducted by Geraldine and Wijayanti, which states that students with Low levels of self-efficacy tend to only be able to formulate problems by identifying the information contained in the problem (Geraldine & Wijayanti, 2022). Therefore, it can be concluded that S1 is at level 1 of mathematical literacy.

### Master's Mathematical Literacy

Students with moderate self-efficacy (S2) reach level 2 of mathematical literacy. S2 can meet all the indicators at level 1 and level 2 of mathematical literacy. This can be seen in the following S2 answer.

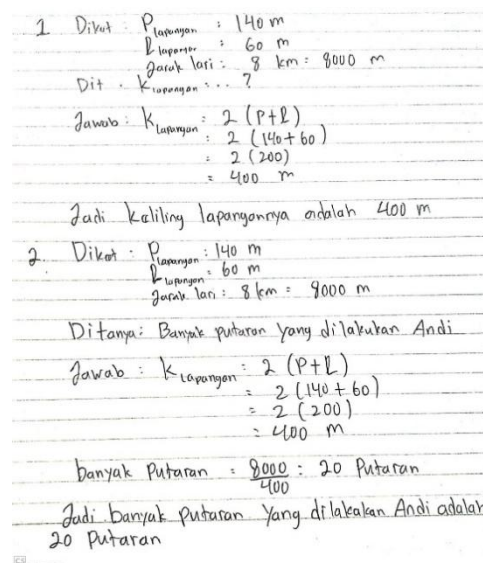


Figure 4 S2 Answers to Problems 1 and 2

At the second level of mathematical literacy, S2 is able to recognize and interpret situations in contexts that require drawing direct conclusions. S2 can include information that is already known and questions asked in problem 2. In addition, S2 can filter relevant information and use it appropriately, using a short and clear presentation method.

In Figure 4, it can be seen that S2 was able to use the basic algorithm and apply the appropriate formula in solving problems 1 and 2, producing the correct answer. Not only providing the correct answer, S2 can also provide a precise explanation regarding the steps taken in the process, as revealed in interviews with researchers. It should be noted that S2 does not yet meet all indicators at level 3, as seen in Figure 5 below.

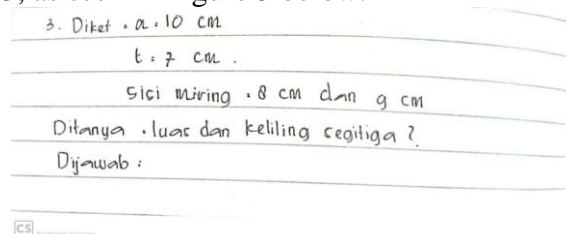


Figure 5 Answers to S2 Problem 3

In Figure 5, it can be seen that S2 only recorded information that was already known and that was the question in problem 3. S2 did not appear to be trying to provide relevant answers to the problems presented in the answer sheet. This finding is in line with research conducted by Hadiat and Karyati

which shows that in general, students in Indonesia tend to have a moderate level of self-efficacy. (Hadiat & Karyati, 2019). The results of data analysis also revealed that most of the students who were research subjects fell into the moderate self-efficacy category. In this research, out of a total of 30 students who were research subjects, 14 students were in the moderate self-efficacy category, 13 students were in the low category, and 3 students were in the high category. Therefore, it can be concluded that the majority of students who are the focus of the research have a moderate level of self-efficacy.

### Doctoral Mathematics Literacy

Students with a high level of self-efficacy (S3) have the ability to reach level 4 in mathematical literacy. S3 is able to meet all indicators from level 1 to level 4 in mathematical literacy. The results of S3's answers show that he has succeeded in reaching level 1 and level 2 in mathematical literacy.

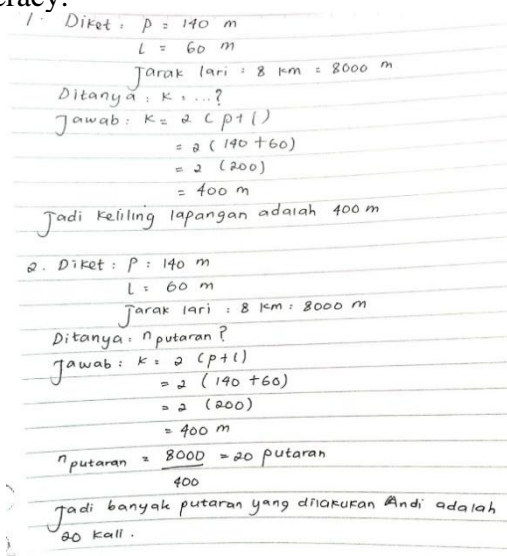


Figure 6. S3 Answers to Problems 1 and 2

At level 3 of mathematical literacy, S3 has the ability to follow procedures clearly, including procedures involving sequential decision making. When answering problems 1 and 2, S3 used a simple approach to solve the problem and succeeded in getting the correct answer. In addition, S3 can understand and apply representations based on various sources of information. During the interview,

S3 was able to clearly explain the reasons behind his interpretation of the results in answering problems 1 and 2. The completeness of each level 3 indicator can be seen in Figure 7 below.

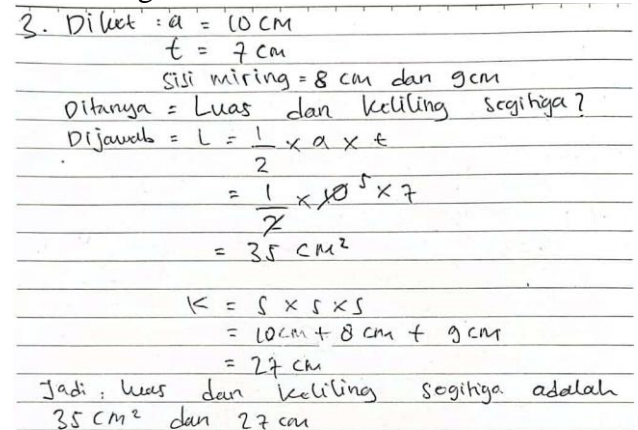


Figure 7 Answers to S3 Problem 3

The fullness of indicators at level 4 of mathematical literacy can be seen from S3 who is able to use models in complex situations, even having to make certain assumptions. In addition, S3 has the ability to identify, sort, and combine different representations, and relate them to real-world context. When interviewed, S3 also revealed that in solving mathematical problems, he combined various skills he had. S3 is able to communicate his thoughts and explanations from various points of view, using clear context, as seen in the way S3 explains his understanding of the problem and the approach used in answering problem 3.

Research conducted by Sufriadin shows that students with a high level of self-efficacy have the ability to use time and strategies effectively, have confidence in the efforts they make, persist in overcoming difficulties, are able to solve conceptual problems, and have strong motivation. (Sufriadin et al., 2022). In S3's answer sheet, it can be seen that S3 can manage time and strategy well in solving problems. In addition, S3 showed a high level of confidence in his work results, as seen in the interview with S3. When asked about S3's confidence in solving problems, S3 was very confident in the answer and continued to try to

overcome difficulties until he found the right answer.

S3 has excellent abilities in solving conceptual problems, including problems 1, 2, 3, and 4. This finding is in line with the results of research conducted by Wasida and Hartono which shows that students with a high level of self-efficacy tend to be better prepared to face various problems. situations and are able to achieve positive achievements in their lives (Wasida & Hartono, 2018). Therefore, students who have high self-efficacy have strong self-confidence and see failure as a step towards success. S3's answer to problem 4 which is used to measure level 4 mathematical literacy is as follows

4. Dikelahui • L. tanah • 45 m

P. tanah : 25 m

$d_1 = 5 \text{ m}$

$d_2 = 20 \text{ m}$

Ditanya : luas tanah yang ditumbuhi pohon mangga?

Dijawab : luas tanah :  $P \times l$

$= 25 \times 45$

$= 1.125 \text{ m}^2$

Luas kolam ikan  $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 5 \times 20$

$= 50 \text{ m}^2$

Luas sisa tanah = Luas tanah - luas kolam ikan

$= 1.125 \text{ m}^2 - 50 \text{ m}^2$

$= 1.075 \text{ m}^2$

Jadi luas tanah yg ditumbuhi pohon mangga adalah  $1.075 \text{ m}^2$

**Figure 8** Answers to S3 Problem 4

S3 does not fill in answer sheets for problems at levels 5 and 6 in mathematical literacy. S3 also did not answer problems 5 and 6, which implies that S3's abilities are limited to reaching level 4 of mathematical literacy

#### 4. Conclusions

In this study, there were 11 students with low self-efficacy, 13 students with moderate self-efficacy, and 6 students with high self-efficacy. Therefore, it can be concluded that the majority of research subjects have a moderate level of self-efficacy. In addition, the level of mathematical literacy varies depending on their level of self-efficacy. Students with low self-efficacy reach a mathematical literacy level from level 1 to level 3, while students with moderate self-efficacy reach a mathematical literacy level from level 1 to level 4. On the other hand, students with high self-efficacy reach a mathematical literacy level from level 4 to level 6.

To continue the research, researchers recommend using more and various types of mathematical problems to dig deeper into students' mathematical literacy. This is expected to provide more comprehensive insight into the relationship between mathematical literacy and students' levels of self-efficacy.

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