

THE ANALYSIS OF SENIOR HIGH SCHOOL STUDENTS' MATHEMATICAL LITERACY VIEWED FROM PISA PROBLEMS

Elfi Rahmadhani¹, Julia Noviani^{2*}, Hasni Putri³

^{1,2,3} Program Studi Tadris Matematika, Institut Agama Islam Negeri Takengon,
Aceh Tengah, Indonesia

*Corresponding author. Takengon, 24552, Aceh, Indonesia.

E-mail: elfirahmadhani88@gmail.com¹⁾
julianoviani@iaintakengon.ac.id^{2*)}
hasniputri02@gmail.com³⁾

Received 22 August 2023; Received in revised form 17 March 2024; Accepted 27 May 2024

Abstract

Literacy skills are important in learning mathematics. Mathematical literacy skills are able to provide opportunities for students to understand the benefits and practicalities of mathematics in real life, solve real-life problems using mathematics and can also be applied in decision making. This study aims to describe students' mathematical literacy abilities in terms of PISA problems. This research is descriptive qualitative. Selection of research subjects using purposive sampling. The research subjects in this study were students of Al Azhar Takengon Integrated High School, class XII Science, consisting of two students with high abilities. The data collection technique used the PISA problems and interviews. Data were analyzed using data analysis techniques proposed by Miles and Huberman. This study uses time triangulation to check the validity of the data. The research results showed that the profile of the mathematical literacy ability of students with high mathematical ability in solving PISA problems is classified as good. Subjects are able to think at an advanced level and students are able to complete the six levels of PISA problems given by fulfilling each mathematical process in mathematical literacy; formulate, employ, and interpret.

Keywords: Analysis; mathematical literacy; PISA problems.

Abstrak

Kemampuan literasi menjadi hal yang penting dalam pembelajaran matematika. Kemampuan literasi matematika mampu memberikan kesempatan pada siswa untuk memahami manfaat dan kepraktisan matematika dalam kehidupan nyata, memecahkan masalah pada kehidupan nyata dengan menggunakan matematika serta dapat juga diaplikasikan dalam pengambilan keputusan. Penelitian ini bertujuan untuk mendeskripsikan kemampuan literasi matematika siswa ditinjau dari soal PISA. Penelitian ini merupakan penelitian kualitatif deskriptif. Pemilihan subjek penelitian menggunakan purposive sampling. Subjek penelitian pada penelitian ini adalah siswa SMA Terpadu Al Azhar Takengon kelas XII IPA yang terdiri dari dua orang siswa yang berkemampuan tinggi. Pengumpulan data menggunakan tes PISA dan wawancara. Data dianalisis dengan menggunakan teknik analisis data yang dikemukakan oleh Miles dan Huberman. Penelitian ini menggunakan triangulasi waktu untuk pemeriksaan keabsahan data. Hasil penelitian menunjukkan bahwa profil kemampuan literasi matematis siswa berkemampuan matematika tinggi dalam menyelesaikan soal PISA tergolong baik. Subjek sudah mampu berpikir pada tingkat lanjut dan mampu menyelesaikan enam level soal PISA yang diberikan dengan memenuhi setiap proses matematika pada literasi matematis, yaitu memformulasi, menerapkan, dan menginterpretasikan.

Kata kunci: Analisis; literasi matematika; PISA.



This is an open access article under the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

INTRODUCTION

Studying mathematics should provide students the ability to reason, solve problems, and apply concepts in real-world situations. This leads to mathematical literacy skills. The capacity for mathematical literacy enables people to comprehend the function and practicality of mathematics in life and can be utilized to guide informed decision-making. People that acquire mathematical literacy are able to apply mathematics to solve problems in various kinds of real-life situations (Hayati & Kamid, 2019). Therefore, literacy skills are needed in mathematics education.

The ability to use and perform mathematics in a range of contexts is a crucial component of mathematical literacy. Students were given written materials to read about a variety of problems they could encounter in the real world. These materials required them to use their mathematical knowledge, comprehension, or abilities to assess and resolve the situations (Lailiyah, 2017). To answer a problem, mathematical literacy required the use of four prior skills; exploring, connecting, and reasoning also using variety methods (Stacey, 2015).

The importance of mathematical literacy was also acknowledged by the Education and Culture Ministry (Kemdikbud) report, as evidenced by Indonesia's PISA participation (Sari & Wijaya, 2017). According to the Organization for Economic Cooperation and Development (OECD, 2013), the emphasis of PISA is on students' school-acquired abilities and competencies that may be applied in real-life. The PISA report showed in the category of mathematical literacy, Indonesia was ranked 68th out of 74 PISA participants in 2009, 64th out of

65 PISA participants in 2012, 65th out of 72 PISA participants in 2015, and 74th out of 79 PISA participants in 2018 (Hayati & Kamid, 2019; Schleicher, 2019). The results of Indonesia's ranking, which is currently below, show that the country still has low levels of mathematical literacy. This is also stated by several studies (Aisyah & Juandi, 2022; Fery et al., 2017; Fointuna et al., 2020; Mansah & Safitri, 2022; Maslihah et al., 2020; Utami & Nirawati, 2018; Yustitia et al., 2020).

Students fail the PISA survey for a number of reasons, including formalizing their mathematics problems and stopping short of the following step after determining the answers (Jupri et al., 2014). Other studies which state that the majority of students have no trouble using accurate calculations and logical reasoning to solve the PISA problems that have been given, but they struggle to express their thoughts clearly in writing (Rum & Juandi, 2023). Students with low and medium abilities are only able to fulfill 2 indicators of mathematical literacy correctly, namely communication ability and ability to use mathematical tools, so the researcher concludes that these 2 subjects do not have good literacy skills (Setyaningsih & Munawaroh, 2022).

The ability of students' mathematical literacy is still lacking due to the learning process in problem solving that emphasizes more on the results to be obtained not on the problem-solving strategy used (Prasasti & Sumardi, 2022). Some of these studies emphasize the significance of thoroughly assessing a student's challenges with completing mathematical literacy problems. Based on the results of interviews with mathematics teachers at Al-Azhar High

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

School, teachers often start learning activities by directly conveying mathematical ideas in the form of formulas, theorems, definitions, algorithms and principles, so that with this kind of learning process the students' literacy is not good. Therefore, the solution that is expected so that students' literacy skills are good is starting from the mathematics learning process taught by the teacher which must be based on indicators of mathematical literacy and problem solving.

The purpose of this study is to describe students' proficiency with PISA issues in terms of mathematical literacy. This is intended based on the studies previously mentioned, that the mathematical literacy abilities of students in Indonesia are still a cause for concern. Therefore, the ability of mathematical literacy is a cognitive aspect that needs to be considered by mathematics educators. In particular, the research is supposed to improve students' mathematical literacy in completing PISA tasks, which will enhance the quality of mathematics education. Based on Figure 3, it is known that the subject also has good mathematical literacy skills. The subject was able to describe the shape of the dice net according to the rules given in the question, namely the number of dots on opposite sides was 7. This can be seen from the results of observations and the reasons given by the subject for the dice net which is the answer to the fetch problem.

On level 4 problems with change and relationship content, it can be seen that the subject has good mathematical literacy skills. The subject can relate the problem to the material he has studied and choose the right formula to solve the given problem. Subjects used two

variables to help determine the shortest tower height. In level 5 problems with the same content, the subject also appears to have good mathematical literacy skills. The subject was able to describe what the calculation of the addition of pine trees and apple trees in the problem looked like, by making a pattern so that a pattern appeared that would be used to solve the problem. This can also be seen in the level 6 problems with change and relationship content. The subject was able to describe how the calculation of the addition of pine trees and apple trees in the problem looked like. Subjects are also able to determine which trees will grow faster and which trees will grow less quickly by giving the right reasons for the answers given.

Based on the results of the data triangulation that was carried out, it was seen that the subject could answer the same way in giving the first and second problems. The subject still remembers the steps that must be taken in order to solve the given problem. This shows the consistency of responses to the subject's answers in answering students' mathematical literacy worksheets (LKLMS 1 and LKLMS 2). Therefore, it can be concluded that the KS subject data is valid so that the data can be used for analysis.

METHOD

This study used a descriptive qualitative research design. This study was carried out in class XII IPA at SMA Terpadu Al Azhar Takengon. The selection of subjects in this study used purposive sampling. The subjects in this study were two students with high mathematical abilities. Research subjects were obtained based on learning reports discussed by researchers with class teachers who

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

recommended that the two students had high abilities. Data collection in this study used a mathematical literacy ability test which was given twice using the PISA test as well as interviews conducted when students had completed the test problems given. For the interview instrument, the researcher

conducted content validation with two validators who work as lecturers in the field of mathematics education. The test problems are adopted from PISA problems which consist of 6 levels of problems. The problems are shown in Table 1.

Table 1. PISA Problems

Level	Problems				
1 (Uncertainty and Data)	Chris just got a car driver's license and wants to buy a car, here is a detailed list of the cars he saw at the nearest dealer.				
	Model	Nissan March	Honda Freed	Toyota Avanza Veloz	Nissan Serena
	Year	2011	2012	2013	2014
	Price (in Rupiah)	91 million	182 million	159 million	270 million
	Kilometers	44.000	50.000	50.000	22.000
	Machine Capacity	1200 cc	1500 cc	1500 cc	2000 cc

Chris wants a car that meets all of these requirements:

- The distance covered is not higher than 50.000 kilometers
- The advertised price is not higher than 162 million

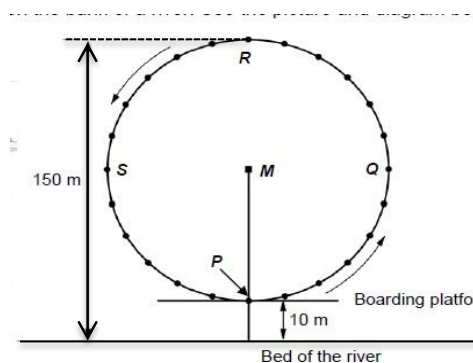
The car that meets Chris' requirements is....

- Nissan March
- Honda Freed
- Toyota Avanza Veloz
- Nissan Serena

Explain your reasons why you chose that answer!

2
(Space and Shape)

A giant Ferris wheel spins by the river. Look at the following pictures and diagrams



The pinwheel rotates at a constant speed counterclockwise. The wheel rotates one full revolution in 40 minutes. Joni rides the wheel at point P. Where is Joni after half an hour?

- At point R
- Between points R and S
- At point S
- Between points S and P

Explain your reasons why you chose that answer!

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

Level	Problems
-------	----------

3
 (Space and Shape)

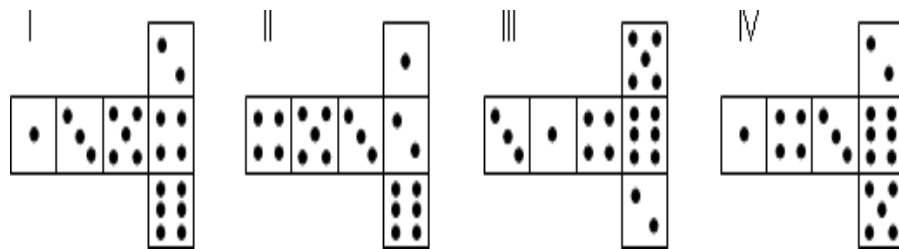
On the right, there is a picture of two dice.

Dice are special number cubes where the following rules apply:
 The sum of the dots on two opposite sides is always seven



You can make a simple number cube by cutting, folding, and pasting cardboard. This work can be done in many ways. In the image below you can see a piece of cardboard that can be used to make a number cube with dotted sides.

Which of the following shapes can be folded to form a cube that obeys the rule that the number of dots on opposite sides is 7?

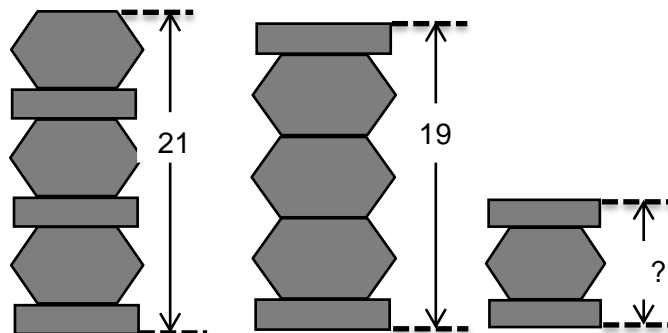


For each form, answer "Yes" or "No" in the table below!

Shape	Satisfies the rule that the number of dots on opposite sides is 7
I	Yes/No
II	Yes/No
III	Yes/No
IV	Yes/No

4
 (Change and Relationship)

The picture below shows 3 towers that have different heights and are composed of two shapes, namely a hexagon and a rectangle



What is the height of the shortest tower? Please explain your answer. Explain your reasons why you chose that answer!

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

Level	Problems
5 (Change and Relationship)	<p>A farmer planted apple trees in a square pattern. To protect the apple tree from the wind he planted pine trees around the orchard. Below is an image of the situation showing the pattern of apple trees and pine trees for any number of columns.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>n = 1</p> <p>X X X</p> <p>X ● X</p> <p>X X X</p> </div> <div style="text-align: center;"> <p>n = 2</p> <p>X X X X X</p> <p>X ● ● X</p> <p>X X X X X</p> </div> <div style="text-align: center;"> <p>n = 3</p> <p>X X X X X X X</p> <p>X ● ● ● X</p> <p>X X X X X X X</p> </div> <div style="text-align: center;"> <p>n = 4</p> <p>X X X X X X X X</p> <p>X ● ● ● ● X</p> <p>X X X X X X X X</p> </div> </div> <div style="margin-top: 10px; border: 1px solid black; padding: 5px; width: fit-content;"> <p>X = conifer tree ● = apple tree</p> </div> <p>There are two formulas you can use to calculate the number of apple trees and the number of pine trees in the pattern described above: Lots of apple trees Lots of pine trees</p> <p>By stating the number of rows of apple trees. There is a value where the number of apple trees equals the number of pine trees. Determine the value and show how you got the answer.</p>
6 (Change and Relationship)	<p>From No. 5 above, suppose the farmer wants to create a larger garden with many rows of trees. As the farmer made the orchard bigger, which would increase faster, the many apple trees or the many pine trees? Explain your answer! Explain your reasons why you chose that answer!</p>

The indicators used in Table 2. are adopted from the notion of mathematical literacy put forward by

the OECD and Ayuningtyas' research (Ayuningtyas, 2017; OECD, 2013).

Table 2. Mathematical process in mathematical literacy

Mathematical Process	Indicators
Formulate	<ul style="list-style-type: none"> Identify the mathematical aspects of the problems found in real context situations and identify important variables Converting problems into mathematical language or models corresponding mathematics into the form of a variable, image or appropriate diagrams
Employ	Applying a mathematical model design to find a mathematical solution
Interpret	Interpret the mathematical results obtained and evaluate the reasonableness of mathematical solutions in the context of real-world problems

Data reduction, data presentation, and verification/conclusion were the stages of qualitative data analysis that

were employed (Miles & Huberman, 1994). In data reduction, students' answers are transcribed. Answers are

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

coded based on the components of the mathematical process on mathematical literacy skills. Coding schemes for mathematical processes on mathematical literacy skills are formulate (FO), employ (EM), and interpret (IN). Data is presented by explaining students' mathematical literacy levels on PISA problems for each level as determined by their responses and interviews. In order to reach conclusions, the researcher examined patterns in student responses and analyzed them with related interviews and studies. Researchers employed time triangulation, a data source technique, to verify the accuracy of the data. Time triangulation refers to a researcher being able to make observations or conduct interviews at different time periods (Natow, 2020).

RESULT AND DISCUSSION

Student answer sheets were analyzed to see students' mathematical literacy skills supported by interview results. Based on the results of the analysis it is known that students' mathematical literacy skills are classified as high and have been able to solve PISA problems for all levels. This can be seen from the results of the analysis of student worksheets and their interviews as follows:

1. Subject WS

On level 1 problems with uncertainty and data content, it can be seen that the subject has good mathematical literacy skills. This is shown from the subject's observation of the problems given, the subject can observe and formulate the problems that exist in these problems, starting from categorizing, reading tables, and determining the results of the problems that exist in these problems. In the level 2 problems with space and shape content, the subject appears to have good mathematical literacy skills. The subject can easily divide the time allotted for the problem by how many dots there are on the wheel so that the time taken to reach each point Joni will pass is obtained. Level 3 problems also use space and shape content. In this question, the subject also appears to have good mathematical literacy skills. Subjects were able to describe what the dice nets in the problem looked like, and were able to rearrange the dice nets to their original shape again. This is shown from the results of the subject's observations of the two dice nets which are the answers to these problems.

On level 4 problems with change and relationship content, it can be seen that the subject has good mathematical literacy skills. This can be seen in Figure 1.

Jawaban serta alasan:

Misalkan : $\square = x$
 $\square = y$

Maka : $3x + 3y = 21 \dots$ Pers 1
 $3x + 2y = 19 \dots$ Pers 2

Ditanya : $x + 2y = \dots ?$

$$\begin{array}{r} 3x + 3y = 21 \\ 3x + 2y = 19 \\ \hline y = 2 \end{array}$$

Substitusi $y = 2$ ke pers 1

$$\begin{array}{l} 3x + 3y = 21 \\ 3x + 3(2) = 21 \\ 3x + 6 = 21 \end{array}$$

$$\begin{array}{l} 3x = 21 - 6 \\ 3x = 15 \\ x = \frac{15}{3} \\ x = 5 \end{array}$$

Jadi, $x + 2y = 5 + 2(2)$
 $= 5 + 4$
 $= 9$

Kesimpulan :
 Tinggi tower ke-3
 adalah 9
 karena terdiri dari
 satu \square dan dua \square

Figure 1. Level 4 problems with Change and Relationship content

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

Based on Figure 1, it can be seen the subject can relate the problem to the material he is studying, and the subject can even easily determine the method he should use to solve the given problem so as to obtain the expected results. Subjects are also able to categorize the variables contained in the image. Meanwhile, on level 5 problems with the same content, the subject appears to have good mathematical literacy skills. Subjects were able to describe what the calculations for adding pine trees and apple trees to the problem looked like. This is shown by the subject making a pattern so that a pattern appears that will be used in calculations using a formula. Subjects are also able to provide information regarding what material is used in the questions. This can also be seen in level 6 problems with change and relationship content, the subject also appears to have good mathematical literacy skills. This is shown by the subject making a pattern so that a pattern appears that will be used in calculations using a formula. Subjects can also determine which trees will grow quickly and which will grow slowly.

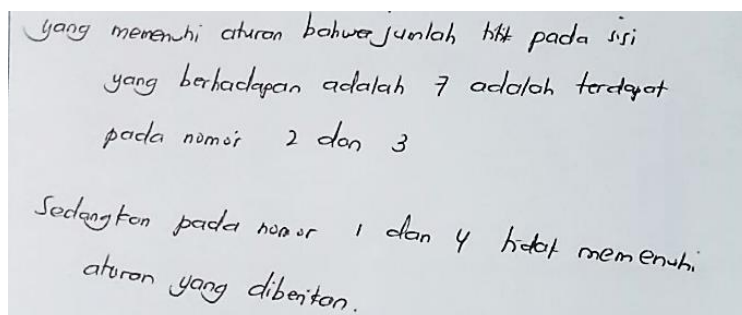
When triangulated, the subjects answered in the same way. The subject still remembers the steps that must be taken in order to be able to solve a problem in the problem, so that the

subject can easily get the answers and information needed in solving them. This shows the consistency of the responses to the high-category subject answers in answering students' mathematical literacy worksheets (LKLMS 1 and LKLMS 2). Therefore, it can be concluded that the WS subject data is valid so that the data can be used for analysis.

2. Subject KS

On level 1 problems with uncertainty and data content, the subject appears to have good mathematical literacy skills. This is shown from the subject's observation of the problems given, the subject can observe and formulate the problems that exist in these problems, starting from categorizing, reading tables, and determining the results of the problems that exist in these problems. In the level 2 problems with space and shape content, the subject also appears to have good mathematical literacy skills. Subjects were able to determine Joni's whereabouts after spinning for half an hour and provide reasons for the answers given.

In level 3 questions, students are asked to solve problems using space content and shapes. Student answers can be seen in Figure 2.



Yang memenuhi aturan bahwa jumlah titik pada sisi yang berhadapan adalah 7 adalah terdapat pada nomor 2 dan 3. Sedangkan pada nomor 1 dan 4 tidak memenuhi aturan yang diberikan.

Figure 2. Level 3 problems with Space and Shape content

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

Based on Figure 2, it is known that the subject also has good mathematical literacy skills. The subject was able to describe the shape of the dice net according to the rules given in the question, namely the number of dots on opposite sides was 7. This can be seen from the results of observations and the reasons given by the subject for the dice net which is the answer to the fetch problem.

On level 4 problems with change and relationship content, it can be seen that the subject has good mathematical literacy skills. The subject can relate the problem to the material he has studied and choose the right formula to solve the given problem. Subjects used two variables to help determine the shortest tower height. In level 5 problems with the same content, the subject also appears to have good mathematical literacy skills. The subject was able to describe what the calculation of the addition of pine trees and apple trees in the problem looked like, by making a pattern so that a pattern appeared that would be used to solve the problem. This can also be seen in the level 6 problems with change and relationship content. The subject was able to describe how the calculation of the addition of pine trees and apple trees in the problem looked like. Subjects are also able to determine which trees will grow faster and which trees will grow less quickly by giving the right reasons for the answers given.

Based on the results of the data triangulation that was carried out, it was seen that the subject could answer the same way in giving the first and second problems. The subject still remembers the steps that must be taken in order to solve the given problem. This shows the consistency of responses to the subject's answers in answering students' mathe-

tical literacy worksheets (LKLMS 1 and 2). Therefore, it can be concluded that the KS subject data is valid so that the data can be used for analysis.

Mathematical literacy ability is a person's ability to solve mathematical problems in daily life in various contexts. Based on the analysis that was carried out on the WS and KS subjects, it was found that the subjects had good mathematical literacy skills in solving the six levels of the given PISA problems which consisted of 3 contents, namely uncertainty and data, space and shape, and change and relationship. In mathematical literacy skills, there are three supporting process components, namely formulate, employ, and interpret (Ayuningtyas, 2017; Novalia & Rochmad, 2017).

In the ability to formulate, the subject seems to have been able to formulate a situation mathematically and produce a mathematical rule or pattern that represents the problem given in the six PISA problems given. According to Ismayanti et al. (2019), if students focus and read the problems repeatedly before determining the steps for solving them, then they can solve the problems given properly without making mistakes. Because several studies have shown that student errors are usually found in the formula components. This happens because students are not focused and are lazy to read the problems repeatedly so they have difficulties continuing the problem-solving process, such as in the problem of change and relationship content (Ayuningtyas, 2017; Wati & Murtiyasa, 2016). In addition, students usually have difficulty interpreting real contexts in their mathematical models or formulating problems (Jupri & Drijvers, 2016; Syawahid, 2019; Tong & Loc, 2017; Wijaya et al., 2014).

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

The ability to employ is to use concepts, facts, procedures, and mathematical reasoning. In this case, students must be able to complete the mathematical patterns/rules obtained into mathematical solutions. In this indicator, it seems that the subject is able to read the data and use the facts contained in the PISA problems given so that the subject can easily solve the problems and solve the problems that exist in these problems, although in different ways. In accordance with the opinion of Mena et al. (2016); Nilasari & Anggreini (2019) and Nurhanurawati et al. (2022) which say that the literacy ability of each student is different. There are several factors that affect students' mathematical literacy abilities, including personal factors such as student intelligence, instructional factors, and the environment around students (Rahmawati et al., 2015; Syawahid & Putrawangsa, 2017).

The ability to interpret is interpreting, applying, and evaluating the results obtained. In this case, students must be able to check and justify that the mathematical solution obtained is correct (Syawahid, 2019). Students must also be able to transfer mathematical solutions into actual solutions according to real problems. In this indicator, the subject is able to choose and evaluate the results that have been obtained from what has been done and the subject can prove the method that has been used in working on the problem, so that the solution given in solving the problem is correct. Subjects also include logical reasons and present problems in real-world contexts. This is in accordance with the opinion of Mawardhiyah & Manoy (2018) that the subject in the process of formulating or interpreting will find out what is known from the problem and

then determine the solution to be used in solving the given problem. However Rellensmann & Schukajlow (2017) reveals something different. They say that students are more interested in solving problems that are not related to the real world.

Based on the results of data analysis, it can be seen that the subject has good mathematical literacy skills because the subject is already able to fulfill the procedures in each item given, namely the ability to formulate, the ability to employ and the ability to interpret. This is in line with the opinion of Murtiyasa & Perwita (2020) and Oktiningrum et al. (2016) that high-ability students are able to fulfill indicators of mathematical literacy ability on PISA problems level 1 to 6 such as mathematical communication skills by formulating and communicating what is contained in the problem, then presents the problem in a mathematical model and determines the right strategy to solve the problem. At this stage, the subject is capable of advanced thinking. They have been able to reflect, formulate and communicate their findings in solving a problem. Furthermore, other research which states that students in the experimental class created strategies for finding the right solutions to mathematical issues, correctly articulated mathematical problems, and reinterpreted mathematical results in contexts from the real-world (Syafitri et al., 2021).

CONCLUSION AND SUGGESTION

Based on the results of the analysis that has been carried out, it can be concluded that the mathematical literacy ability profile of two students who have high ability in solving PISA problems is classified as good. At this stage, the subject is able to think at an

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

advanced level. Because students are able to complete the six levels of PISA problems given by fulfilling each mathematical literacy process, namely formulate, employ, and interpret. This research is only limited to students with high mathematical abilities, the researcher hopes that there will be further research conducted by other researchers on students with moderate and low abilities in researching mathematical literacy. The researcher also recommends that students' mathematical literacy skills must be honed by students with the help of teachers, of course so that students understand the benefits and practicalities of mathematics.

REFERENCES

- Aisyah, A., & Juandi, D. (2022). The description of Indonesian student mathematics literacy in the last decade. *International Journal of Trends in Mathematics Education Research*, 5(1), 105–110. <https://doi.org/10.33122/ijtmr.v5i1.114>
- Ayuningtyas, N. (2017). Profil Literasi Matematis Konten Change and Relationship Siswa Kelas X ditinjau dari Gaya Kognitif Visualizer dan Verbalizer. *Jurnal Edukasi*, 3(1), 99–110. <http://jurnal.stkipgri-sidoarjo.ac.id>
- Fery, M. F., Wahyudin, & Tatang, H. (2017). Improving primary students mathematical literacy through problem based learning and direct instruction. *Educational Research and Reviews*, 12(4), 212–219. <https://doi.org/10.5897/err2016.3072>
- Fointuna, D. W., Kaluge, A. H., & Fernandez, A. J. (2020). An analysis of mathematical literacy of state junior high school students in Kupang. *Journal of Physics: Conference Series*, 1422(1). <https://doi.org/10.1088/1742-6596/1422/1/012025>
- Hayati, T. R., & Kamid, K. (2019). Analysis of Mathematical Literacy Processes in High School Students. *International Journal of Trends in Mathematics Education Research*, 2(3), 116–119. <https://doi.org/10.33122/ijtmr.v2i3.70>
- Ismayanti, N., Fachrudin, A. D., & ... (2019). Profil Literasi Matematika Siswa Berkemampuan Matematis Rendah dalam Menyelesaikan Soal Model PISA Konten Change and Relationship. *Repository STKIP PGRI Sidoarjo*. <https://doi.org/https://doi.org/10.26877/aks.v8i2.1839>
- Jupri, A., & Drijvers, P. (2016). Student difficulties in mathematizing word problems in algebra. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(9), 2481–2502. <https://doi.org/https://doi.org/10.12973/eurasia.2016.1299a>
- Jupri, A., Drijvers, P., & van den Heuvel-Panhuizen, M. (2014). Difficulties in initial algebra learning in Indonesia. *Mathematics Education Research Journal*, 26(4), 683–710. <https://doi.org/10.1007/s13394-013-0097-0>
- Lailiyah, S. (2017). Mathematical literacy skills of students' in term of gender differences. *AIP Conference Proceedings*, 1868, 1–13. <https://doi.org/10.1063/1.4995146>
- Mansah, H., & Safitri, I. (2022). the

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

- Effectiveness of Improving Student Mathematics Literacy Through the Use of the Facebook Application. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(1), 683. <https://doi.org/10.24127/ajpm.v11i1.4743>
- Maslihah, S., Waluya, S. B., Rochmad, & Suyitno, A. (2020). The Role of Mathematical Literacy to Improve High Order Thinking Skills. *Journal of Physics: Conference Series*, 1539(1). <https://doi.org/10.1088/1742-6596/1539/1/012085>
- Mawardhiyah, K., & Manoy, J. T. (2018). Literasi Matematika Siswa SMP dalam Menyelesaikan Soal Program for International Student Assessment (PISA) Berdasarkan Adversity Quotient (AQ). *MATHEdunesa*, 7(3), 638–643. <https://doi.org/10.26740/mathedunesa.v7n3.p638-643>
- Mena, A. B., Lukito, A., & Siswono, T. Y. E. (2016). Literasi Matematis Siswa SMP dalam Menyelesaikan Masalah Kontekstual Ditinjau dari Adversity Quotient (AQ). *Kreano, Jurnal Matematika Kreatif-Inovatif*, 7(2), 187–198. <https://doi.org/10.15294/kreano.v7i2.6756>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. sage.
- Murtiyasa, B., & Perwita, W. R. G. (2020). Analysis of Mathematics Literation Ability of Students in Completing PISA-Oriented Mathematics Problems with Changes and Relationships Content. *Universal Journal of Educational Research*, 8(7), 3160–3172. <https://doi.org/10.13189/ujer.2020.080745>
- Natow, R. S. (2020). The use of triangulation in qualitative studies employing elite interviews. *Qualitative Research*, 20(2), 160–173. <https://doi.org/10.1177/1468794119830077>
- Nilasari, N. T., & Anggreini, D. (2019). Kemampuan Literasi Matematika Siswa dalam Menyelesaikan Soal PISA Ditinjau dari Adversity Quotient. *Jurnal Elemen*, 5(2), 206. <https://doi.org/10.29408/jel.v5i2.1342>
- Novalia, E., & Rochmad. (2017). Analisis Kemampuan Literasi Matematika dan Karakter Kreatif pada Pembelajaran Synectics Materi Bangun Ruang Kelas VIII. *UJMER: Unnes Journal of Mathematics Education Research*, 6(2), 225–232. <https://journal.unnes.ac.id/sju/ujmer/article/view/20601>
- Nurhanurawati, N., Caswita, C., Bharata, H., & Widyastuti, W. (2022). The analysis of junior high school students' mathematical literacy: Field study in Bandar Lampung. *Al-Jabar: Jurnal Pendidikan Matematika*, 13(1), 199–209. <https://doi.org/10.24042/ajpm.v13i1.11659>
- OECD. (2013). PISA 2012 Financial Literacy Framework. In *PISA 2012 Assessment and Analytical Framework* (pp. 139–165). OECD Publishing Paris, France. <https://doi.org/10.1787/9789264190511-en>
- Oktiningrum, W., Zulkardi, & Hartono, Y. (2016). Developing PISA-Like Mathematics Task with Indonesia

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

- Natural and Cultural Heritage as Context to Assess Students' Mathematical Literacy. *Journal on Mathematics Education*, 7(1), 1–8.
<https://doi.org/10.22342/jme.7.1.2812.1-8>
- Prasasti, N. Y., & Sumardi, S. (2022). Kemampuan Literasi Matematika Siswa Dalam Menyelesaikan Soal Cerita Tipe Hots Materi Statistika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(4), 3052.
<https://doi.org/10.24127/ajpm.v11i4.5552>
- Rahmawati, N. D., Mardiyana, & Usodo, B. (2015). Profil Siswa SMP Dalam Pemecahan Masalah Yang Berkaitan Dengan Literasi Matematis Ditinjau Dari Adversity Quotient(AQ). *Jurnal Elektronik Pembelajaran Matematika*, 3(5), 510.
<http://jurnal.fkip.uns.ac.id>
- Rellensmann, J., & Schukajlow, S. (2017). Does Students' Interest in a Mathematical Problem Depend on the Problem's Connection to Reality? An Analysis of Students' Interest and Pre-Service Teachers' Judgments of Students' Interest in Problems With and Without a Connection to Reality. *ZDM - Mathematics Education*, 49(3), 367–378.
<https://doi.org/10.1007/s11858-016-0819-3>
- Rum, A. M., & Juandi, D. (2023). Students' Mathematical Representation Ability in Solving PISA Problem. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(2), 1692–1703.
<https://doi.org/https://doi.org/10.24127/ajpm.v12i2.7283>
- Sari, R. H. N., & Wijaya, A. (2017). Mathematical Literacy of Senior High School Students in Yogyakarta. *Jurnal Riset Pendidikan Matematika*, 4(1), 100–107.
<https://doi.org/10.21831/jrpm.v4i1.10649>
- Schleicher, A. (2019). *PISA 2018: Insights and Interpretations Improving*.
<https://eric.ed.gov/?id=ED601150>
- Setyaningsih, R., & Munawaroh, L. (2022). Analisis Kemampuan Literasi Matematis Siswa Dalam Menyelesaikan Soal Berorientasi Pisa Konten Uncertainty and Data. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(3), 1656.
<https://doi.org/10.24127/ajpm.v11i3.4948>
- Stacey, K. (2015). *The International Assessment of Mathematical Literacy: PISA 2012 Framework and Items BT - Selected Regular Lectures from the 12th International Congress on Mathematical Education* (S. J. Cho (ed.); pp. 771–790). Springer International Publishing.
https://doi.org/10.1007/978-3-319-17187-6_43
- Syafitri, A., Huda, N., & Haryanto, H. (2021). Problem-based learning model: It's effect on mathematical literacy ability based on students' visual verbal ability. *Al-Jabar : Jurnal Pendidikan Matematika*, 12(2), 427–436.
<https://doi.org/10.24042/ajpm.v12i2.10366>
- Syawahid, M. (2019). Mathematical Literacy in Algebra Reasoning. *International Journal of Insights for Mathematics Teaching*, 02(1), 33–46.
<https://journal2.um.ac.id/index.ph>

DOI: <https://doi.org/10.24127/ajpm.v13i2.8624>

- p/ijoint/article/view/7113/pdf
Syawahid, M., & Putrawangsa, S. (2017). Kemampuan Literasi Matematika Siswa SMP Ditinjau dari Gaya Belajar. *Beta, Jurnal Tadris Matematika*, 10(2), 222–240.
<https://doi.org/10.31004/cendekia.v6i1.1093>
- Tong, D. H., & Loc, N. P. (2017). Students' Errors in Solving Mathematical Word Problems and Their Ability in Identifying Errors in Wrong Solutions. *European Journal of Education Studies*, 3(6).
<https://doi.org/10.5281/zenodo.581482>
- Utami, C., & Nirawati, R. (2018). Pengembangan Kemampuan Literasi Matematis melalui Model PJBL dengan Pendekatan Realistic Saintific dan Pengukuran Berbasis PISA. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 7(3), 103–107.
<https://doi.org/10.24127/ajpm.v7i3.1543>
- Wati, E. H., & Murtiyasa, B. (2016). Kesalahan Siswa SMP dalam Menyelesaikan Soal Matematika Berbasis PISA Pada Konten Change and Relationship. *Konferensi Nasional Penelitian Matematika Dan Pembelajarannya (KNPMP I), Knpmp I*, 199–209.
<https://proceedings.ums.ac.id/index.php/knpmp/article/view/2592/2547>
- Wijaya, A., van den Heuvel-Panhuizen, M., Doorman, M., & Robitzsch, A. (2014). Difficulties in solving context-based PISA mathematics tasks: An analysis of students' errors. *The Mathematics Enthusiast*, 11(3), 555–584.
<https://doi.org/https://doi.org/10.54870/1551-3440.1317>
- Yustitia, V., Amin, S. M., & Abadi. (2020). Mathematical literacy in pre-service elementary school teacher: A case study. *Journal of Physics: Conference Series*, 1613(1).
<https://doi.org/10.1088/1742-6596/1613/1/012054>