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# Mathematical Literacy Ability in HOTS (High Order Thinking Skills) Problem Solving of Class VIII Students

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**Abstract:** This study aimed to find out and describe the mathematical literacy ability of class VIII students of SMP Negeri 7 Mataram for the 2022/2023 academic year in solving HOTS problems. Therefore the type of research used is descriptive research. The sample in this study was students of class VIII SMP Negeri Mataram. The sampling technique used was purposive sampling with a sample of 80 people. Data collection uses written test techniques in descriptions declared valid and feasible. Data collection was carried out directly and implemented by the school. The appropriate question descriptions are given to students to solve so that data on the scores of students' answers in answering the descriptions of HOTS questions and the level of mathematical literacy are obtained. After the data collection of students' answer scores is completed, the data is examined. The data that has been examined is then processed, tabulated, grouped, and analyzed to obtain research results that show that students have not been able to reach level 4 as much as 12.5%. Students who can reach level 4 are only 37.5%, while for levels 5 and 6, only 36.25% and 13.75%, respectively, for the level of mathematical literacy ability of class VIII students of SMPN 7 Mataram for the academic year 2022/2023 in solving HOTS problems the majority are high and very high with 43.75% and 48, 75%. Thus, the higher the problem-solving ability of students, the higher the level of literacy that can be achieved.

**Keywords:** Mathematical Literacy, HOTS problem solving

**Abstrak:** Penelitian ini bertujuan untuk mengetahui dan mendeskripsikan kemampuan literasi matematika siswa kelas VIII SMP Negeri 7 Mataram tahun pelajaran 2022/2023 dalam menyelesaikan soal HOTS. Oleh karena itu jenis penelitian yang digunakan adalah penelitian deskriptif. Sampel dalam penelitian ini adalah siswa kelas VIII SMP Negeri Mataram. Teknik pengambilan sampel yang digunakan adalah purposive sampling dengan jumlah sampel 80 orang. Pengumpulan data menggunakan teknik tes tertulis uraian yang dinyatakan valid dan layak. Pengumpulan data dilakukan secara langsung dan dilaksanakan oleh pihak sekolah. Deskripsi soal yang sesuai diberikan kepada siswa untuk dipecahkan sehingga diperoleh data skor jawaban siswa dalam menjawab uraian soal HOTS dan tingkat literasi matematika. Setelah pendataan skor jawaban siswa selesai dilakukan, data tersebut diperiksa. Data yang telah diteliti kemudian diolah, ditabulasikan, dikelompokkan, dan dianalisis untuk mendapatkan hasil penelitian yang menunjukkan bahwa siswa belum mampu mencapai level 4 sebanyak 12,5%. Siswa yang mampu mencapai level 4 hanya 37,5%, sedangkan untuk level 5 dan 6 masing-masing hanya 36,25% dan 13,75% untuk tingkat kemampuan literasi matematis siswa kelas VIII SMPN 7 Mataram tahun pelajaran 2022/2023 di menyelesaikan soal HOTS mayoritas tinggi dan sangat tinggi dengan 43,75% dan 48,75%. Dengan demikian, semakin tinggi kemampuan pemecahan masalah siswa, maka semakin tinggi pula tingkat literasi yang dapat dicapai.

**Kata kunci:** Literasi Matematika, pemecahan masalah HOTS

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## Introduction

Education is the most basic and has a great influence is math learning. Mathematics is a science important exact and must be mastered by students (Kurniawati et al., 2022). Science in the present century has developed to the demands of life, which are also developing. One effort to deal with the demands of the 21st century is to develop one's literacy abilities or skills that can be used to face challenges in today's life. Literacy is an ability or skill in reading, mathematics, and science. In learning, especially learning mathematics, it is expected that students' abilities are not only counting but it is hoped that students can use mathematics in solving problems in everyday life.

According to the Program for International Student Assessment (PISA), mathematical literacy is a person's ability to formulate, apply and interpret mathematics in various contexts. This includes reasoning mathematically and using concepts, procedures, and facts to describe, explain or estimate a phenomenon. Mathematical literacy helps a person understand mathematics's role in life and use it to make the right decisions as a constructive and caring citizen. There are seven components of ability contained in mathematical literacy, namely (1) communication, (2) mathematization, (3) restating, (4) reasoning and giving reasons, (5) using problem-solving strategies, (6) using symbols, formal language and techniques, (7) using mathematical tools (Nolaputra, Wardono, & Prasetyo, 2018).

Mathematical literacy is the ability to compose a series of questions (problem posing), solve problems (problem-solving), and formulate, solve, and interpret problems based on the existing context. Mathematical literacy is an individual's ability to formulate, use, and interpret mathematics in various contexts. Mathematical literacy ability is the knowledge to understand and be able to use mathematical concepts in helping everyday life (Ojose, 2011; Nusywari et al., 2022 ).

The importance of mathematical literacy has not been matched by the quality of education in Indonesia, and this can be seen from the various types of international assessments that Indonesia has participated in. One of them still ongoing today is the Program for International Student Assessment (PISA) which measures literacy skills in reading, mathematics, and science for students aged 15 years or equivalent to junior high school education. The PISA results show that Indonesian students' mathematical literacy skills are not optimal. Even though there is compatibility between literacy in mathematics and standardized subject matter because, in essence, the ability to be achieved in the content standard for learning objectives in mathematics is mathematical literacy. Seeing the importance of literacy skills in learning mathematics, students must have this ability (Madyaratri, et al., 2019).

Education is the front line that has a role in creating a society that is innovative, creative, critical, logical, collaborative, and can solve problems in life. Currently, the education students need is not related to knowledge alone, but more importantly, is creating activities that enable students to solve, assess, formulate, use, and interpret problems. These activities can be developed in education through subjects.

The importance of the relationship between mathematical literacy skills and higher-order thinking skills is in line with the three types of competencies needed in the 21st century. These competencies are: a) having good character (religious, nationalist, integrity, mutual cooperation, and independence); b) having 4C abilities (critical thinking, creativity, collaboration, and communication); c) mastering literacy, includes thinking skills using knowledge sources in digital, visual, print and audio form. Presentation of questions in the form of HOTS can train students to hone their mathematical literacy abilities and skills in accordance with the demands of the 21st century competencies (Wayan et al., 2019). HOTS-based questions require high-level thinking skills and involve reasoning processes, so as to hone critical, logical, reflective, metacognitive, and creative thinking skills and train students to think at the levels of analysis, evaluation and creation which are the basis of high-level thinking according to Bloom's Taxonomy .

Research on mathematical literacy skills in HOTS problem solving has never existed at SMP Negeri 7 Mataram. The results of interviews with educators at the school show that knowledge of students' literacy recognition alone is still lacking and cannot be applied by students, let alone to apply mathematical literacy skills. Even educators themselves are still confused about the meaning of mathematical literacy, so it is necessary to research the level of mathematical literacy in this school to broaden educators' insights about the importance of mathematical literacy and to determine the level of mathematical literacy ability of students in the school. SMP Negeri 7 Mataram is also a school with various students from different backgrounds because it is located in the middle of Mataram, with residents from various regions.

## Method

This type of research is descriptive research which aims to obtain an overview of students' literacy abilities in solving HOTS problems. In this study, the researcher wanted to describe and describe the level of mathematical literacy skills possessed by class VIII students who were an average of 15 years old in solving HOTS problems.

The time for data collection was carried out in March 2023. This research will be carried out at SMP Negeri 7 Mataram with the address at Jalan Bung Karno No. 88, West Pagutan, Mataram District, Mataram City, West Nusa Tenggara.

The population in this study were all 438 grade VIII students who were divided into 11 classes at SMP Negeri 7 Mataram in the 2022/2023 academic year. The population is adjusted to the research criteria using students with an average age of 15 years or junior high school students. SMP Negeri 7 Mataram was chosen because it met the criteria for an experienced school or a school that already had good output and the diversity of students' backgrounds. The total population of the study was 438 students spread across 8 classes. The samples used in this study were 80 class VIII students at SMP Negeri 7 Mataram. Students who were sampled were students aged 15 years and had various abilities with different backgrounds.

The type of data used is quantitative data. Quantitative data is data presented in the form of numbers. This data was obtained from the results of HOTS test questions with the PISA standard. The data collection technique is done by giving a test.

The instrument used in this study was the HOTS standard question description test, namely questions with a level of reasoning ability. The level of reasoning includes the dimensions of the thinking process analyzing (C4), evaluating (C5), and creating (C6). In the analytical thinking process dimension (C4) requires students to specify aspects/elements, describe, organize, compare, and find implied meanings. In the evaluating thinking process dimension (C5) requires the ability of students to formulate hypotheses, criticize, predict, assess, test, justify or blame. Whereas in the creative thinking process dimension (C6) requires the ability of students to design, build, plan, produce, discover, update, perfect, strengthen, beautify, and compose (Widana. 2017: 8; Basri, 2021). The types of test questions given are in the form of HOTS question descriptions which contain 3 (three) levels of mathematical literacy, namely the Connection and Reflection competency level, where this ability level is the same level of literacy ability as the HOTS question reasoning ability level which is at level (C6), ( C5), (C4). So that the description questions given are HOTS questions with a PISA literacy level of 4, 5, and 6. The questions given are also adjusted to the description of the content and context of each level.

The data was obtained from the HOTS test results for quantitative data analysis. This data is in the form of quantitative data. Next is to calculate the percentage of students' mathematical literacy levels for each literacy ability level, calculated by the following formula.

$$a_i = \frac{ni}{N} x100\%$$

Information:
ai = percentage of students who are at level i
ni = the number of students who are at level i
i = 1,2,3,4,5,6
N = number of students who took the test

In this study, it is necessary to have a qualitative analysis to fulfill the objective of describing students' mathematical literacy abilities. In other words, the qualitative analysis aims to understand the object examined deeply. In this study, the object that will be examined in depth is the literacy ability of students at levels 4, 5 and 6 based on the results of quantitative data analysis and the results of observations made by researchers.

## Result and Discussion

The test questions given to class VIII students at SMP Negeri 7 Mataram are HOTS questions that have been adjusted to standard questions based on the three main constructs of PISA, namely content, context, and competence. Of the three items, each item has a high-order thinking ability level and a competency level from PISA in connection and reflection competence. Based on the analysis of each student's answer based on the Levels of Mathematics Literacy that have been carried out, it can be seen that the literacy level of class VIII students at SMP Negeri 7 Mataram. The level of mathematical literacy of class VIII students at SMP Negeri 7 Mataram for the 2022/2023 academic year can generally be seen in Figure 1.

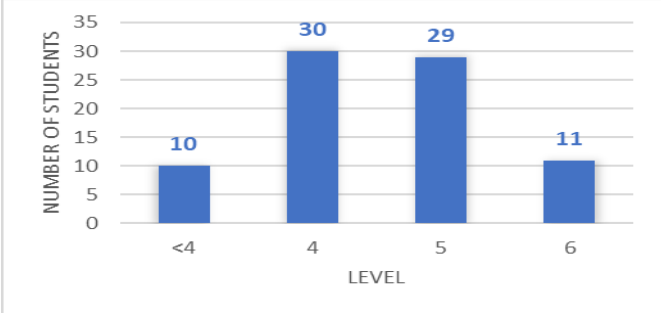


**Figure 1.** Literacy Level of Class VIII Students of SMPN 7 Mataram by Level

The literacy level of Grade VIII students at SMP Negeri 7 Mataram consists of 4 levels. As many as 30 (37.5%) students were able to reach level 4, as many as 29 (36.25%) students reached level 5, and 11 (13.75%) students were able to reach level 6. While there were 10 (12, 5%) students whose mathematical literacy is still below level 4 are sure to have difficulty solving questions at a higher level.

Next is data analysis using the Analytical Scale For Problem-Solving. Based on the analysis of the answers of class VIII students at SMP Negeri 7 Mataram, it can be seen that the problem-solving ability of the majority of students is very low. The literacy level can be seen in Figure 2.

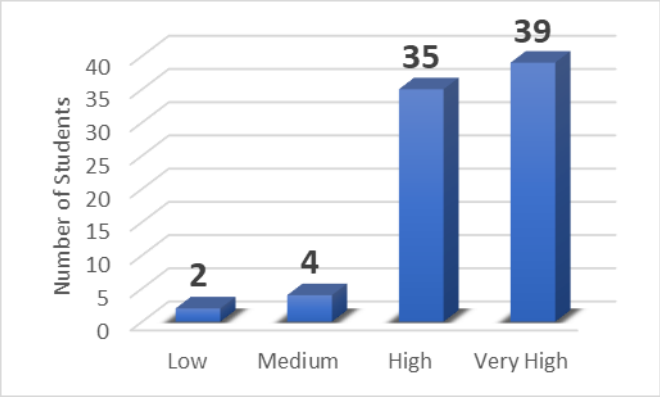


**Figure 2.** Literacy Level of Class VIII Students of SMPN 7 Mataram Based on the Analytic Scale for Problem-Solving

Based on the presentation of the findings data, most students had high and very high abilities in solving questions, with very high levels of 35 (43.75%) and 39 (48.75%) students. For the low and medium categories, only 2 (2 .5%) and 4 (5%) students. These results interpret that students can plan solutions and make problem-solving procedures.

The main PISA domains in the form of content, context, and competence are the three main PISA constructs in assessing the extent to which students have been able to understand the knowledge they have. The content itself is a mathematical activity or content used to solve problems using mathematical ideas, and this content follows the applicable curriculum. Meanwhile, the context itself is part of students' lives, which is loaded with problems often encountered by students in everyday life. In this case, content and context are two interconnected constructs because the mathematical content contained in the questions is always placed with the context that applies to students' lives.

Competence is a category of mathematical ability that shows students' cognitive abilities compiled by PISA and divided into reproduction, connection, and reflection competencies. Reproduction competence is a group of questions with a lower scale that measures students. Connection competence is a group of questions with a medium scale that measures connection competence with students' interpretation abilities of new situations or problems contained in the problem. Group of questions with a large scale that measures reflection competence.

The test questions given to students consist of 3 questions containing mathematical literacy content according to PISA: Space and Shape, Quantity, and Uncertainty and data. Space and Shape content is mathematical content that includes geometry in mathematics; to measure the literacy level of this content, question number 1, Quantity content related to the relationship between numbers and number patterns, is measured using problem number 2. In contrast, for Uncertainty and data, content includes knowledge about measurements, odds, and statistics are measured using the number 3.

According to the PISA standard, there are four contexts of mathematical literacy. The four contexts are personal, social, scientific, and occupational contexts. The questions given to students in this study only contained 3 contexts, namely personal, scientific, and occupational. To measure the level of mathematical literacy in class VIII based on the personal context, question number 1 was used for the mathematical literacy test. Then, question number 2 was used to measure the level of mathematical literacy in class VIII students based on the scientific context. Meanwhile, math literacy question number 3 is used to measure the level of mathematical literacy based on the occupational context.

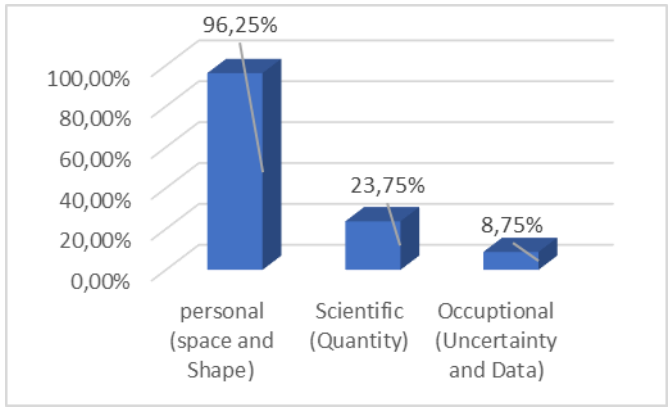


**Figure 3.** Literacy Level of Class VIII Students of SMPN 7 Mataram by Level

B Based on the analysis of the answers of class VIII students of SMP Negeri 7 Mataram based on the content and context of PISA, it can be seen by looking at the data presented in Figure 3. The content selected

in this study was three of the four contents in the PISA assessment. Each content in this study has different levels, so the results of the study show that students can solve level 4 questions with Space and Shape content with a personal context having a percentage of 96.25%, while for level 5 questions with Quantity content and a scientific context as much as 23.75 % and level 6 questions with Uncertainty and data content with an occupational context of 8.75%. Based on the observations and analysis carried out in this study, students will understand the content and context of the questions according to the level of analysis of the questions given. In this study, the data from the analysis of the literacy level will be the same as the data from the analysis based on content and context, bearing in mind that in this study, there were only three questions as research instruments used, and each question represented a different level, content and context.

The ability of Mathematical Literacy in question is an individual's ability to formulate, use and interpret mathematics in various contexts. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. This helps individuals recognize mathematics's role in the world and make the judgments and decisions required by society. From this definition, there are at least three main things that are the main ideas of the concept of mathematical literacy based on the OECD (2019: 75-78), namely (1) the ability to formulate, apply, and interpret mathematics in various contexts, starting now referred to as the process of mathematics, (2) the involvement of mathematical reasoning and the use of mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena, and (3) the benefits of mathematical literacy skills are that they can help someone apply mathematics to the everyday world as a form of constructive and reflective community engagement.

Based on the results of the PISA, students in Indonesia only master mathematics at levels 1 to 3, while in developed countries, students have started to master mathematics at levels 4, 5, and 6 (OECD, 2019: 1). The results from PISA are not much different from research on the level of mathematical literacy in Mataram, which shows that the literacy level of students in Mataram is still low. The low level of literacy, according to Hasnawati et al. (2016), is caused by the low basic ability of students' mathematics, as seen by the inability of students to work on word problems and translate them into mathematical models. This opinion is in line with the results of research, which shows the lack of ability of students to answer story questions from the middle to the highest level.

In this study, mathematical literacy was demonstrated by students' answers to the three questions that had been worked on. This indicates that most of the students in class VIII have not used their knowledge and skills to the fullest and have been unable to apply them to solve unusual problems or find problem-solving patterns.

From some of the descriptions above, class VIII students are able to complete the research instrument in the form of HOTS questions related to standard content, and students also have fairly good basic skills. However, the weaknesses of students are in solving problems that require the ability to reason, argue, communicate, and solve problems which are still weak. Students are also less interested in questions that require understanding by interpreting some information that is unusual. There are also those who are less thorough in working on questions that require accuracy and calculation. Furthermore, using the analytical scale scoring guide for problem-solving) shows that most of the students' mathematical literacy level is still relatively high. From these data, it can be said that the problem-solving ability of class VIII students in Mataram is high.

Based on some of the explanations above, it can be seen that students' problem-solving abilities can be used to see the level of students' literacy skills because, based on the data above, the higher the problem-solving abilities students have, the higher the literacy level that can be achieved.

## Conclusion

The level of mathematical literacy of class VIII students of SMP Negeri 7 Mataram based on the Level of Mathematical Literacy of students who were unable to reach level 4 was 12.5%, 37.5% of students were able to reach level 4, as many as 36.25% of students able to level 5 and only 13.75% of students were able to reach level 6. Based on Analytical for Problem Solving, students have very low solving abilities in solving questions with a very high level of 2.5%, for the low category only as much as 5%, for medium and high categories as much as 43.75%, and as for the very high category 48.75%.

The results of this study are in the form of a small overview of the level of mathematical literacy of students so that further research can be carried out on the level of mathematical literacy on a larger scale and supplemented by research to find effective methods and models to improve students' mathematical literacy skills.

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