

Analysis of Mathematics Literacy Ability

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Abstract

Education can develop students' potential, while mathematics education is an effort to improve students' mathematical abilities and increase students' intelligence. Mathematics is used as a tool to develop these mathematical abilities, this shows that mathematics is a very important science, but many students view mathematics as the most difficult field of study, this is because students often have difficulty understanding math problems so they often do mistakes in solving the given questions. Mathematical Literacy Ability is an ability that supports the development of the five mathematical abilities termed as mathematical power. Therefore, mathematical literacy is referred to as the minimum ability that someone has in the field of mathematics. The type of research used is qualitative research with a descriptive approach. Based on the results of the acquisition of the score for each student given, the score of the results of the mathematical literacy ability test in solving PISA questions for students is in the less category as many as 25 people, 5 is enough and not in the Good category. The overall average is 58.5. It can be seen that the average score of the results of the mathematical literacy ability test is in the Less category.

Keywords: *Mathematical Literacy; Mathematical Literacy Ability.*

Abstrak

Pendidikan dapat mengembangkan potensi yang dimiliki siswa, sementara Pendidikan matematika merupakan upaya untuk meningkatkan kemampuan matematis peserta didik dan meningkatkan kecerdasan peserta didik. Matematika digunakan sebagai alat untuk mengembangkan kemampuan matematis tersebut, hal ini menunjukkan bahwa matematika merupakan ilmu yang sangat penting, namun banyak siswa yang memandang matematika sebagai bidang studi yang paling sulit, hal ini dikarenakan siswa sering mengalami kesulitan dalam memahami soal-soal matematika sehingga sering melakukan kesalahan dalam menyelesaikan soal yang diberikan. Kemampuan Literasi matematika adalah kemampuan yang mendukung pengembangan kelima kemampuan matematis yang diistilahkan sebagai daya matematis. Oleh sebab itu, literasi matematika disebut sebagai kemampuan minimal yang dimiliki seseorang dibidang matematika. Jenis penelitian yang digunakan adalah penelitian kualitatif dengan pendekatan deskriptif. Berdasarkan hasil perolehan skor setiap siswa yang diberikan maka skor hasil tes kemampuan literasi matematika dalam menyelesaikan soal PISA pada peserta didik ada

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pada kategori kurang sebanyak 25 orang, cukup 5 dan tidak ada dalam kategori Baik Rata-rata secara keseluruhan sebesar 58.5. Terlihat bahwa skor rata-rata hasil tes kemampuan literasi matematika ada dalam kategori Kurang.

Kata Kunci: Literasi Matematika; Kemampuan Literasi Matematika.

INTRODUCTION

Education is something that is very important in the foundation of the country. Education can also develop the potential of students, so that humans are faithful and pious, and become human beings with knowledge. Education is a term that cannot be separated from learning exercises. Learning exercises are an educational cycle that gives students the freedom to shape their potential into growing capacities. There are various types of abilities that must be possessed by students, one of which is literacy skills. The term literacy originally implied the ability to read and write, over time in the long term, the term proficiency has evolved. literacy is often characterized as proficient with a condition.

Mathematics education is an effort to improve students' mathematical abilities and improve students' intelligence. In this case, mathematical concepts are used as a tool to develop these mathematical abilities. According to the National Council of Teachers of Mathematics NCTM (2000), there were five mathematical abilities in learning mathematics. These five abilities are abilities that must be mastered by students after learning mathematics, namely mathematical reasoning, mathematical representation, mathematical connections, mathematical communication and mathematical problem solving. These five abilities are very important to master in relation to the need to solve problems faced in everyday life.

It appears that mathematics is a very important science, but many students view mathematics as the most difficult field of study. The number of students who consider mathematics as a difficult field of study because they often have difficulty in understanding mathematical problems so that students often make mistakes in solving the questions given. The difficulties experienced by students must really be a concern of the teacher because the difficulties of these students cause a lack of interest and motivation of students in mathematics. Mathematical

literacy is the ability that supports the development of the five mathematical abilities which are termed mathematical power. Therefore, mathematical literacy is referred to as the minimum ability that a person has in the field of mathematics that can be used to survive in the face of tasks in his field of expertise. This mathematical literacy makes it easier for someone to understand the use of mathematics and apply it to make the right decisions as someone who thinks. Literacy for All is a slogan echoed by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), an international organization engaged in education. This slogan emphasizes the right of every human being to become “literate” as a capital to welcome life (Mahdiansyah, 2014). Literacy empowers individuals, families and communities to improve their quality of life. Furthermore, literacy has many effects, namely eradicating poverty, reducing child mortality, curbing population growth, achieving gender equality and ensuring sustainable development, peace and democracy.

Students' Mathematical Literacy Ability is assessed using an international level assessment study, namely PISA (Program for International Student Assessment). PISA is a survey conducted every three years that assesses the literacy ability of students aged 15 years (OECD, 2016). The PISA survey is organized by the OECD (Organization for Economic Cooperation Development), an organization formed by the United Nations which is engaged in world economic development and is headquartered in Paris, France. Indonesia has joined as a member of PISA (specifically in the assessment of mathematical literacy) along with other countries, such as Singapore, China and the UK.

Looking at the results of the mathematical literacy ability survey issued by PISA, we can reflect that so far the ability of Indonesian students aged 15 years in mathematical literacy is still far from the average achievement of the survey participating countries. This is an indicator that the mathematical literacy ability of Indonesian students is still considered low. Indonesia, which is a large country with a large population, based on the latest UNESCO research data in January 2020, said that Indonesia ranks second from the bottom in terms of world literacy, meaning that people's interest in reading is very low. According to UNESCO data,

the reading interest of the Indonesian people is very concerning, only 0.001%. This means that out of 1,000 Indonesians, only 1 person is avid reader. A different research entitled *World's Most Literate Nations Ranked* conducted by Central Connecticut State University in March 2016, Indonesia was stated to be ranked 60th out of 61 countries regarding reading interest, just below Thailand (59) and above Botswana (61). In fact, in terms of infrastructure assessment to support reading, Indonesia's ranking is above European countries (Pardosi et al., 2021).

Some Indonesian researchers also stated the low literacy skills of students in various regions of Indonesia, such as research conducted by (Khoiruddin, 2017) the results obtained with the category of mathematical knowledge ability only reached level 1. These results were also influenced by several factors, including; 1) the selected material 2) the learning provided by the teacher 3) the classroom environment 4) the support of the family environment 5) readiness in carrying out the test and 6) the abilities of each student himself. Based on OECD data in PISA 2009, 76.7% of students in Indonesia can only solve math problems at level 2 or below. This indicates that education in Indonesia is still a lot that needs to be addressed related to students' problem-solving abilities, especially mathematics. So that various studies that support the achievement of mastery of problem solving. need to be encouraged and implemented as much as possible, especially those related to algebra (relationships and changes in PISA (Novita, 2014).

In line with what has been described above, the literacy achievements of Indonesian students can be seen from the results of Indonesia's participation in several international comparative studies, such as *Trends in International Mathematics and Science Study (TIMSS)* and the *Program for International Student Assessment (PISA)*. The results of the TIMSS study which aims to determine the development of mathematics and natural sciences (IPA) of students aged 13 years (SMP/MTs class VIII) have not shown satisfactory achievements. Indonesian students in mathematics ability in 1999 were only able to rank 34 out of 38 countries. In 2003 the mathematical ability of Indonesian students was ranked 35 out of 46 countries. Furthermore, in 2007 the achievement of Indonesian students did not show a significant increase, namely their

mathematical ability was ranked 36 out of 49 countries. The results of the latest TIMSS in 2011 also did not go far, namely mathematics was ranked 38 out of 42 countries (Mahdiansyah, 2014).

Literacy is also often compared with other words such as logical ability and numerical ability. Mathematics is a tool to develop a way of thinking. It can be said that Indonesian students' mathematical abilities are still far below those of other countries, in terms of mathematical abilities, the survey results from the Trends in International Mathematics and Science Study (TIMSS) study, which is conducted every 4 years starting in 1999, in 2015 showed students' mathematical abilities. Indonesia has not shown satisfactory achievements as evidenced by the mathematical ability of Indonesian students ranked 45th out of 50 countries, with an achievement score of 397 and still under the average score of 500. Not to be missed from Luwu district, students' mathematical abilities are also still low, as the results of research in Larompong sub-district students' mathematical ability is still below average (Masjaya, 2018).

These results indicate that the mathematical literacy of students in Indonesia based on international studies is still not satisfactory. However, the low literacy rate is measured using internationally applicable instruments and is not specifically adapted to Indonesian conditions. The importance of mathematical literacy for students is not just the ability to count. Mathematical literacy focuses on students' ability to analyze, reason, and convey ideas effectively, formulate, solve and interpret mathematical problems in various forms and situations. Mathematical literacy requires students to use relevant skills in a less structured context, where instructions are not very clear to students. Students must be able to determine what knowledge is relevant, what processes are passed to be able to deliver it to a possible solution to the problem, and how to describe the truth and usefulness of the answers or solutions obtained (Buhari, 2014).

According to the PISA study, the mathematical literacy skills of students in Indonesia are still relatively low, so it needs improvement using the CPS model. It was later found that the mathematical literacy abilities of students using the CPS learning model were better than the mathematical literacy abilities of

students using conventional learning. Mathematical literacy skills using the CPS learning model after tests and interview results found that students in the low group were only able to achieve 2 levels of mathematical literacy ability. In the middle group students have been able to reach 4 levels of mathematical literacy ability. Meanwhile, students in the high group have been able to reach 6 levels of mathematical literacy ability (Yuberta et al., 2020).

Qualified human resources are an important factor in development in the current era of globalization. Experience in many countries shows that quality human resources are more important than abundant natural resources. It is realized that the competitiveness of the Indonesian nation among other nations tends to be less encouraging. One of them is reflected in the comparison of the Human Development Index (IPM). Quality human resources can only be realized with quality education, including the mastery of mathematics and its holistic understanding. Therefore, people with all the uniqueness of individual intelligence must have adequate mathematical literacy skills and mathematical connections. A person who is literate in mathematics does not only understand mathematics but is also able to use it in solving everyday problems. In this case mathematical literacy can foster mathematical connection abilities. The problem is, the mathematical literacy skills of Indonesian students, from the results of an assessment of international mathematics ratings, are very poor compared to other countries. There are a number of determining factors in the achievement of mathematical literacy, namely personal factors, instructional factors, and environmental factors. This research answers these questions. This study is to find out and explore theories that support increased literacy and mathematical connections which lead to increased human resources. Based on this study, it can be followed up with research on the development of math learning tools that are valid, practical, and effective for increasing mathematical literacy and mathematical connections (Masjaya & Wardono, 2018).

Several previous studies have shown that students' mathematical literacy skills must be improved for the development of analytical abilities and also mathematical thinking abilities, so that it will have an impact on increasing

mathematical abilities and the goals of learning mathematics will be achieved. To be able to improve an ability, it must be analyzed and understood more regarding to the ability to be analyzed, in this study, namely the ability of mathematical literacy. Researcher feel the need to look at the mathematical literacy skills of high school students in solving math problems. As shown above in the background, to find out errors and analyze students' literacy skills in solving math problems and problems.

RESEARCH METHODS

The type of research used is descriptive quantitative research. Descriptive research is a research method that describes and interprets objects according to what they are. Descriptive research is also a collection of data to prove from questions related to current circumstances and events. Quantitative research is methods for testing certain theories by examining the relationship between variables, usually measured by research instruments so that the data obtained consists of numbers that can be analyzed in accordance with procedures. The use of quantitative descriptive methods is adapted to research objectives that focus on related problems with what is happening at the moment. The purpose of quantitative descriptive research in this study is to explain students' literacy skills so that they can strengthen the researcher's analysis in making conclusions. The research results obtained from calculations on aspects of mathematical literacy skills were then presented by the researchers.

RESULTS AND DISCUSSION

This research was conducted with the aim of knowing the mathematical literacy ability of students in solving PISA math problems in class IX students. The questions used are PISA questions consisting of level 1 to level 6. The test given is in the form of PISA questions. The questions given are 6 questions according to the level of the questions and are done for 90 minutes. The composition of the questions is as follows:

- Level 1 consists of 1 number, which is question number 1: In question number one, students are asked to answer questions based on the pictures that have been provided in the questions, students are asked to find the average height of each rung listed in the picture. This problem deals with simple mathematical operations.
- Question number 2 can be categorized as a level 2 question because in this question students are no longer given assistance in the form of concrete information such as numbers that can be directly calculated or operated, but on this question students are asked to answer it with their reasoning. Students are asked to process the information contained in the questions so that they get the correct answer. This problem still uses simple mathematical operations.
- In question number 3 students must be able to determine the number of cars that can be made based on the available materials, and this does not require too high reasoning, but in solving this problem must use the right procedure. This question relates to the ability of students to interpret the questions given in the real world. This question is used to measure student connections.
- In question number 4 with question level 4 requires several stages in determining the height of the third tower, which must determine the height of each type of wake that composes a tower. students must interpret the questions given in the real world and also functioned to measure student connections.
- The question is included in level 5 because students' reasoning is higher than the previous questions. In this question, students no longer use one step or one formula in determining the answer, but students need to understand the meaning of the question, this question measures students' reflection competence.
- Question level 6, this question is a number question that has the highest level, because this question requires students to use their reasoning to

determine the steps that must be used in solving the problem. This question is also to test students' reflection.

Based on the results of the students' mathematical ability test data in solving PISA math problems for Class IX students, the average for the first question all students answered correctly so the average was 100, this average continued to decline until the sixth level questions averaged to 1.3. with a drastic decrease in level 4 questions, in questions 2 and 3 the average score was still above 80, but at level 4.5 it was below 40, even on the 5th question it was only 8.5. Based on the results of each student's score per question given, the following is the score data of the mathematical literacy ability test results in solving PISA questions for students in the less category as many as 25 people, enough 5 and not in the Good category with an average overall a total of 58.5. It can be seen that the average score of the mathematical literacy ability test results in solving PISA math problems in class IX varies from a score of 30 to the highest score of 80 from the ideal score of 100. With a score range of up to 50, this indicates mathematical literacy ability in solving PISA math problems. in the Less category. The data obtained above is then analyzed based on the level of the PISA questions given and will be described according to the existing data with the help of interview results to strengthen the data from the existing tests. The results of this written test will be categorized according to the level and analyzed based on that level.

Table 1 Achievement Criteria Based on the Percentage of Scores for Each Question

Question Number	Skor (in %)	Achievement criteria
1	100	Excellent
2	83.33	Excellent
3	83.35	Excellent
4	48.9	Enough
5	8.5	Poor
6	1.3	Poor

Based on Table 1, it can be seen that the score of each student per question is given. Each question has different difficulties, and also the ability of students to solve it is different. With regard to students' abilities, in accordance with the purpose of this study, namely wanting to know the literacy abilities of students for each level. Based on the explanation above, if you look at the percentage score at each level, it can be said that the higher the level, the lower the percentage score obtained as well as the characteristics of students' abilities. The higher the level of the question, the more students have difficulty understanding the meaning of the question. And for questions that require high reasoning and analysis, the tendency is that the number of students who have difficulty understanding and analyzing the meaning of the questions increases from the previous levels. Not a few students also prefer not to do the problem if the question is considered difficult.

Based on the results of tests, interviews and observations of students in question number 1, it shows that students are able to answer questions correctly. In addition, students also know that this question must use the right strategy in order to be able to relate some information and concepts. Students are able to understand what is asked in the question, and students also understand the basic mathematical concepts that are appropriate to use. Students' ability to understand the PISA model of mathematical literacy in number 2, Based on the results of tests, interviews and observations of undergraduate students in question number 2, it shows that students are able to answer questions correctly. In problem solving, it can be categorized as good because they are able to mention and Write down what is known and what is asked of the problem correctly to present the correct sequence of completion steps and how to use certain correct procedures and correct results. Based on the answers from students, it can be seen that students are able to solve the PISA math problems, and are able to understand what the questions are asking. However, there seems to be a student error in answering the questions. Students are able to answer questions correctly but in the process of completing the steps the answer is not clear.

In question number 3, based on the answers from students, it can be seen that students are able to solve the PISA math problems, because students are able

to understand what the questions are asking. This can be seen in the answers where students in answering questions do not just answer and solve them according to the procedures and instructions for the right questions, it can also be seen that students are careful in reading the questions because what is asked in the questions matches the answers. In addition, students are able to analyze the problem so that they know the formula that can be used in solving the problem. Based on the results of the tests, interviews and observations of the students above, it can be said that students are able to answer questions related to the concept. In these questions, students are expected to be able to develop strategies to connect two pieces of information from each component, namely the number components provided and the numbers needed to make each toy car. The cause of the ability of these students is because students still understand the concept of basic mathematics.

In question number 4, the ability to solve this problem can be seen from the way students plan or formulate questions. Based on students' answers, it can be seen that students are able to understand the questions, are able to describe the illustrations that are known in the questions, students are also careful in using formulas. It can be seen that students understand the concept of the formula rules used. So that it can solve the problem well. Based on students' answers, it can be seen that students are less able to understand the questions, able to describe the illustrations that are known in the questions, but students do not know how to use the right formula. It can be seen that students do not understand the concept of the rules of a two-variable linear equation system, so that they are wrong in their solution and produce the wrong answer to the test results.

In questions number 5 and 6, the ability of students to solve these problems can be seen from the way students plan or formulate questions. Very few students answered the question, but the researchers found the students' answers, where based on the results of observations and interviews, it can be seen that the students' errors in the answers to this question were still inaccurate. Students only write or mention what is known and what is asked from the problem but the presentation of the sequence of steps for completion is not appropriate. We

can see from the students' answers above that mathematical literacy skills are still lacking. From various student answers, it can be seen that teachers still need to guide their students again in working on mathematical literacy problems in problem solving. This is because there are no students who have mathematical literacy skills in problem solving in the very good category, and there are also no students who have mathematical literacy skills in problem solving in the good category. The results obtained are in accordance with the theory put forward by Lencher which states that problem solving is a skill that needs to be taught, and mathematics teachers should make an effort to do so. Efforts can be made by learning comprehensive problem-solving skills that include four steps of problem-solving strategies, namely understanding problems, making problem-solving plans, problem-solving, and reviewing problem-solving plans.

To improve students' mathematical literacy skills, an active role of the teacher is needed as one of the factors from outside the students that greatly influences the learning outcomes of students. Teachers must be able to choose techniques, methods, models, strategies or learning approaches that can improve students' mathematical abilities, including mathematical literacy skills. Currently there are various kinds of techniques, methods, models, strategies and approaches in learning. Each technique, method, model, strategy and approach has its own advantages and disadvantages. A person is said to have a good level of mathematical literacy if he is able to analyze, reason, and communicate his mathematical knowledge and skills effectively, and is able to solve and interpret mathematical solutions. Thus knowledge and understanding of mathematical literacy is very important in the daily lives of students.

It can be seen that the students' mathematical literacy abilities in this study were only at level 1,2,3 while at levels 4,5,6 it was seen that students' mathematical literacy abilities were in the very low category. In accordance with research conducted by Nabilah & Wardono (2021) which stated that based on the results of a preliminary study in one of the junior high schools, it was found that more than 90% of students had not reached the Actual Completed Limit. In addition, students lack good motivation in learning where learning is still teacher-

centered. So it is necessary to update the learning model in class to improve mathematical literacy skills. CIRC learning with SPUR nuance assisted by Google Classroom is expected to be a solution to improve mathematical literacy skills. This shows that the ability of mathematical literacy is very important to be improved and well owned by students. In accordance with what was stated by Masjaya & Wardono (2018) this research was conducted to find out and explore theories that support increased literacy and mathematical connections which lead to increased human resources. Based on this study, it can be followed up with research on the development of math learning tools that are valid, practical, and effective for increasing mathematical literacy and mathematical connections.

CONCLUSION

Based on the results of the students' mathematical ability test data in solving PISA math problems for Class IX students, the average for the first question all students answered correctly so the average was 100, this average continued to decline until the sixth level questions averaged to 1.3. with a drastic decrease in level 4 questions, in questions 2 and 3 the average score was still above 80, but at level 4.5 it was below 40, even on the 5th question it was only 8.5. Based on the results of each student's score per question given, the following is the score data of the mathematical literacy ability test results in solving PISA questions for students in the less category as many as 25 people, enough 5 and not in the Good category with an average overall a total of 58.5.

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