

Analyzing Eighth-grade Students' Numerical Literacy Skills in Problem Solving with Number Concepts

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ABSTRAK

The aim of this study was to assess the numerical literacy abilities of eighth-grade students at MTs Miftahul Ulum in applying problem-solving skills to number concepts on a question-by-question basis. The research followed a qualitative methodology, and the participants consisted of 15 students from the VIIIA class at MTs Miftahul Ulum. The data were analyzed based on Polya's stages of problem-solving and numeracy literacy indicators. Data collection methods included numeracy literacy tests, interviews, and documentation. The results indicated that a significant proportion of students demonstrated a moderate level of numeracy literacy, while some students showed low or high levels of proficiency. Generally, the understanding stage had higher percentages of students who demonstrated comprehension. However, the planning and implementation stages varied across different questions. By focusing on the specific stages where students struggled or excelled, teachers can adapt their instructional approaches to better address students' needs.

ABSTRACT

Tujuan dari penelitian ini adalah untuk menganalisis kemampuan siswa kelas VIII di MTs Miftahul Ulum dalam menerapkan literasi numerasi "pertanyaan per pertanyaan" pada materi bilangan. Metode penelitian yang digunakan dalam penelitian ini adalah metode kualitatif. Subjek penelitian ini adalah siswa kelas VIII, dengan jumlah siswa sebanyak 15 orang. Data dianalisis berdasarkan tahapan Polya dan indikator literasi numerasi. Dalam mengumpulkan data, penelitian ini menggunakan teknik tes literasi numerasi, teknik wawancara, dan teknik dokumentasi. Instrumen tes yang digunakan adalah lembar tes yang berisi tiga pertanyaan cerita mengenai materi bilangan, dan panduan wawancara yang dibuat oleh peneliti. Temuan penelitian ini menunjukkan bahwa sebagian besar siswa menunjukkan tingkat literasi numerasi yang sedang, dengan beberapa siswa menunjukkan tingkat rendah atau tinggi. Analisis tahapan menunjukkan variasi dalam kinerja siswa, dengan tahap pemahaman umumnya memiliki persentase yang lebih tinggi, sementara tahapan perencanaan dan implementasi bervariasi antara pertanyaan yang berbeda. Analisis tahapan menunjukkan variasi dalam kinerja siswa, dengan tahap pemahaman umumnya memiliki persentase yang lebih tinggi, sementara tahapan perencanaan dan implementasi bervariasi antara pertanyaan yang berbeda. Dengan berfokus pada tahapan-tahapan tertentu di mana siswa mengalami kesulitan atau keunggulan, guru dapat mengadaptasi pendekatan pembelajaran untuk lebih memenuhi kebutuhan siswa.

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Introduction

Education is very important and also a necessity in life because the benefits can be felt in various aspects of life (Kaka et al., [2021](#)). Human potential can be developed through education so that it is able to overcome various problems that are seen as obstacles to make the present more profitable. One of the benchmarks in the success of a country is seen from the quality of education. Efforts to develop education in Indonesia are continuously carried out, one of the efforts is through improving the curriculum character and learning model innovations. Education is a place for humans to increase their potential.

One branch of science that is the center of attention and continues to experience development is mathematics. Whether the quality of an education is good or not can be seen from the extent to which students are able to solve various mathematical problems related to the real life. In its scientific approach, mathematics is a science that uses numbers and symbols that can be applied in various contexts to the real life (Puspaningtyas & Ulfa, [2020](#)).

According to Kaka et al. ([2021](#)), the current development of mathematics learning is not only focused on improving numeracy skills, because in reality to solve problems in the real-life condition it is not enough to use numeracy skills only. However, an understanding of mathematical concepts is also needed by linking realistic problems (problems in the real life) as the first step in the process of learning mathematics. This aims to determine students' mathematical abilities in solving their own problems and to provide opportunities for students to find mathematical ideas and concepts. In addition, students must also know and understand basic concepts in mathematics and be able to relate them to solve the problems that are directly related to the real life. This is a capacity referred as numerical literacy capacity.

Literacy is an individual tool for reading, writing, arithmetic and critical thinking. On the contrary, numeracy is the application of mathematical concepts and skills to daily situations. Therefore, literacy in mathematics is the representation and ability to use various numbers and symbols related to mathematics to solve practical problems in various contexts related to everyday life. The ability to analyze information presented in various formats, such as graphs, tables, charts and others. Visual representation and the ability to use the results of the analysis to determine and formulate conclusions. In addition, mathematical literacy serves

as a springboard for other fields of study, such as science, social studies, citizenship, religion, art and others (Ate & Ledo, [2022](#)).

Literacy in mathematics is a skill that humans have that allows them to use various tools to quickly and accurately describe various conditions that may arise during a day as well as easy. Literacy in numbers can be written as a set of guidelines and concepts (Pulungan, [2022](#)).

- a. Apply mathematics as if it were used by students using numbers and symbols in dealing with everyday problems in daily life,
- b. Conducting theoretical experiments using graphical forms, table, and
- c. Making data predictions that are numerical and graphically clear and legible.

The observations above are made from the perspective of the National Literacy Movement Team and focus on the use of number literature that is able and willing to use certain types of notations or symbolic language in conjunction with the most profound for understanding mathematics in order to solve the problems quickly and effectively that may arise in the real life, daily news article, as well as various writing skills.

Generally, literacy is an advantage in terms of reading, writing, speaking, and language usage. Literacy and mathematics can also be linked. Mathematical literacy serves as a basic skill for students to formulate, apply and applying mathematics in contexts that include reasoning, mathematics and the use of facts, principles, concepts, and procedures to describe an event to discuss, illustrate, and apply mathematics in a context including mathematical punishments and the use of facts, principles, concepts, and procedural logic to describe every specific case (Sirate & Ramadhana, [2017](#)).

Meanwhile, according to (Ellefson et al., [2020](#)), the ability to understand, analyze and use images or symbols to solve a problem related to the daily life which is important in the digitalization era is what is meant by the term numeration. So, numeracy literacy ability is a person's reasoning ability in understanding, analyzing, interpreting and applying in solving problems related to the real life critically by using symbols or numbers in mathematical models. According to (Hartatik, [2020](#)), the ability to read graphical and numerical information is needed to make the right decisions.

Numerical language coherence and narrative content encourage students to study, understand, and analyze math problems (Larasaty et al., [2018](#)). Numerology in problem literature is often based on poetry (Ayuningtyas & Sukriyah, [2020](#)). Another factor that causes an inaccuracy of the statement is which states writing

ability both formal and informal Numbers can be expressed in literary terms (Mahmud & Pratiwi, [2019](#)).

So, the keywords are number system literacy and coherent story themes. Therefore, the development of literacy is very necessary because to live in the future everyone needs reasoning abilities to deal with various problems that will come, namely with the literacy ability itself (Lamada et al., [2019](#)). This agrees with Rezky et al. ([2022](#)), who say that it is important to develop students' numeracy literacy skills in education, especially in Indonesia. In improving numeracy literacy skills in Indonesia, this can be done by integrating into the world of education simultaneously to develop numeracy literacy skills (Widiastuti & Kurniasih, [2021](#)). According to Patriana et al. ([2021](#)) in the learning process, numeracy literacy is useful for developing logical and systematic reasoning in solving a problem. Based on the 2018 PISA results it is still classified as very low, in fact Indonesia has experienced a downgrade in its PISA ranking compared to 2015. The following is a comparison of the assessments of the 3 aspects in PISA.

Table 1. PISA Result

Evaluation	Reading	Mathematical	Science
PISA 2015	397	386	403
PISA 2018	371	379	396

From the table above, we can see that Indonesia ranks 74th out of 79 countries surveyed with an average score of 371 in the category of reading ability. Furthermore, for the category of mathematical abilities, Indonesia gets an average score of 379 so that it ranks 73rd. As for the category of science performance abilities, Indonesia ranks 71st with an average score of 396 (Tohir, [2019](#)). Based on the information on numeracy literacy skills above, we are interested in conducting numeracy literacy research on number material. This study aims to describe students' reasoning abilities in solving problems on numeracy literacy-based number material questions, so that teachers can know the level of students' abilities and make it easier to use learning methods that are appropriate for students' ability levels.

Method

The type in this study is a qualitative method research. The purpose of this study is to describe the results of analysis the ability of VIII class students of MTs Miftahul Ulum in solving numeracy literacy questions on number material. While the subjects in this study were VIIIA class students at MTs Miftahul Ulum in academic year 2022/2023 with a total of 15 students. For data collection, this study used numeracy literacy test techniques, interview and documentation techniques. The instrument for the test uses a test sheet that contains numeracy literacy which

consists of 3 story questions on number material and interview guidelines made by the researcher. The test is used to determine the level of students' ability to solve numeracy literacy questions, while to clarify the answers from the test results students use interview guidelines.

Result And Discussion

Based on the research conducted, it was found that the average ability test score of MTs Miftahul Ulum students in the matter of numeracy literacy was 58.26. This shows that the level of literacy and numeracy is still relatively moderate. The test results of 15 students were grouped into 3 categories, namely the categories of students with high, medium and low abilities. Below are diagrams of numerical literacy ability.

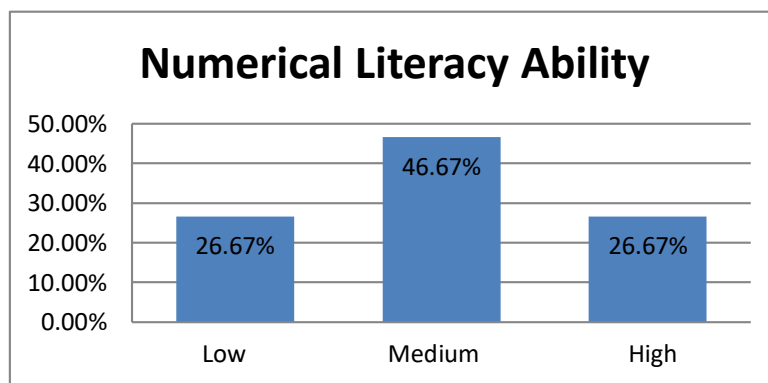


Figure 1. Percentage of Number of Students in Completing the Test

From the percentage data in Figure 1 below, it shows that 26,67% of 15 students are at a low numeracy literacy level. and for the moderate level of numeracy literacy is at a percentage of 46,67% of 15 students. Meanwhile, 26,67% of the 15 students had a high level of numeracy literacy in solving problems on number material.

Numerical Literacy Ability Based on Polya's Stages

Based on the results of student answer tests at the stage of understanding the problem, it shows that students are able to describe the problem by writing down what is known and asked. Only some students who have not able to describe the problem. The following is an explanation of student test results based on the 4 stages of polya.

Understanding

At this stage some students are able to write down what is known and asked from the question test given as the first step in solving the problem. Important information in the problem is written according to the problem. The percentage of students' abilities at the understanding stage is at 73% for question number 1, 47%

for question number 2 and 80% for question number 3. With the overall percentage at the understanding stage, namely 66.67 %. Following are the results of answers to question number 1 of students AN.

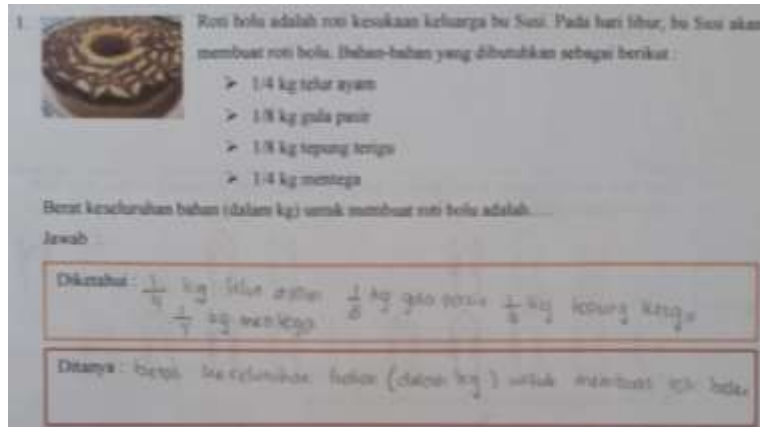


Figure 2. AN's Answer of Question Number 1

Based on the students' answers in Figure 2, the students were able to give detail important information related to the problem by writing down what was known and also explaining the questions correctly. This was also clarified again during the interview, students said that there were no difficulties with the questions and understood what was being asked.

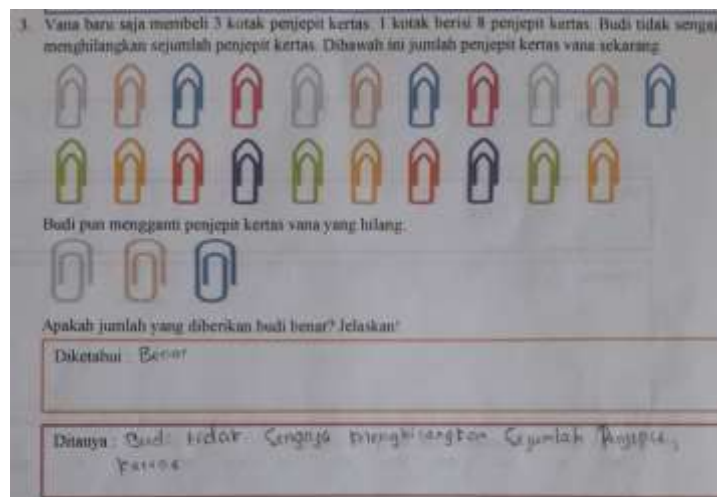


Figure 3. AR's Answer to the Question Number 1

The results shown by Figure 3, AR do not understand information and question which filed. It can be seen from the answers written by AR that they have not been able to write down what is known from the question, and have not understood what was asked in the question. Based on the results of interviews with AR , it was stated that AR did not understand the questions asked, so AR had difficulty writing down what he knew and what was being asked. This is in consistent with research from (Andika Nurussafa et al., 2016), that student errors that occur in

solving problems are found in students' lack of habituation in writing down information that is known and asked.

Planning

At this planning stage, students must be able to plan for the information they know and ask for in solving problems. Students are able to plan problem solving by 73% for question number 1, 47% for question number 2, and 80% for problem number 3. With a total percentage of 66.67% in the planning stage. From this percentage, it can be seen that some students are able to relate the information provided to the questions asked correctly and clearly.

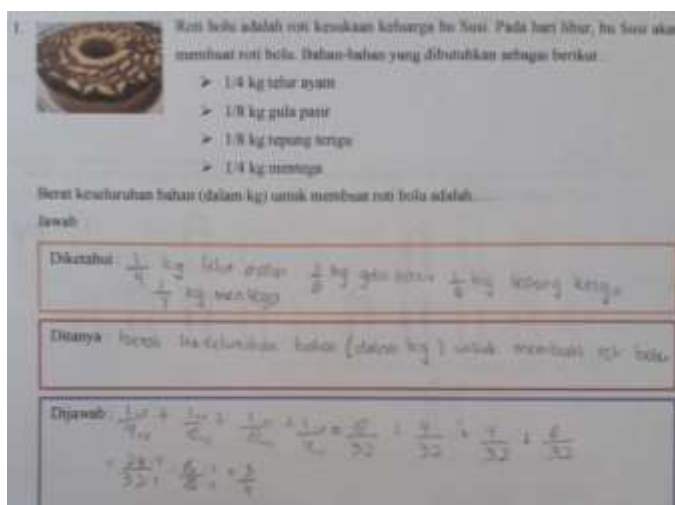


Figure 4. AN's Answer to the Question Number 1

Based on the picture above, AN can relate what is known and what is asked in the question by adding up all the ingredients in kg to make sponge cake to solve the existing problems. Known from the results of the answers above, the researcher concluded that AN was already capable of preparing a plan for working on question number 1. Strengthened by the results of the interviews, AN stated that to find out the total amount of material, it must be calculated by adding up all the materials available.

Implementation Plan

In this stage, students must be able to answer questions correctly according to the correct and correct operating process. For question number 1 students who were able to carry out the plan were equal to 67%, question number 2 was only 33% and question number 3 was 80%. With a total percentage of 60%. Based on the results of these percentages, several students were able to complete the questions correctly according to the correct operation. The student's mistake at this stage lies in the operation of adding fractions by not equating the denominator first.

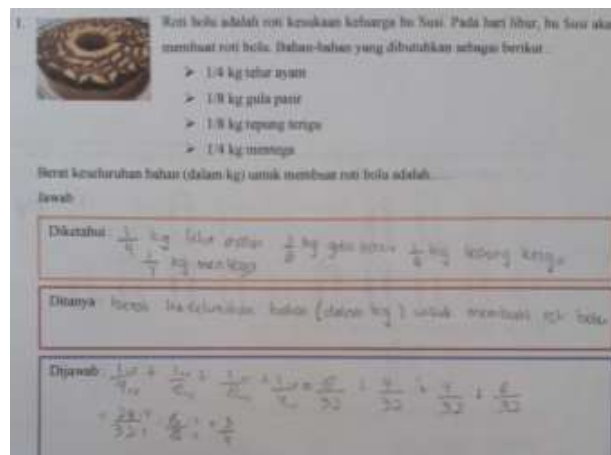


Figure 5. AN's Answer to the Question Number 1

Based on the results of AN's answers figure 5, it can be concluded that AN has been able to formulate the right plan in working on the questions. However, there is an inaccurate step in equating the denominator to the addition. AN equates the denominator by multiplying the denominator, it should be equated by finding the LCM first. AN explained in the interview that AN had difficulties in equating the denominators so to make the denominators equal, AN multiplied the denominator by the denominator. This is in consistent with the research of Utari et al. (2020), that students do not understand the concept so that it can cause formula errors in working on the questions.

Review

At this stage, students should be able to conclude the results of their answers using their own language. In the review stage, most students only re-checked their answers by just reviewing the calculation process, but forgot to conclude answers in their own language. This is consistent with the percentages obtained by students at the review stage, namely 47% for question number 1, 27% for question number 2 and 73% for question number 3. With a total percentage of 48.89%.

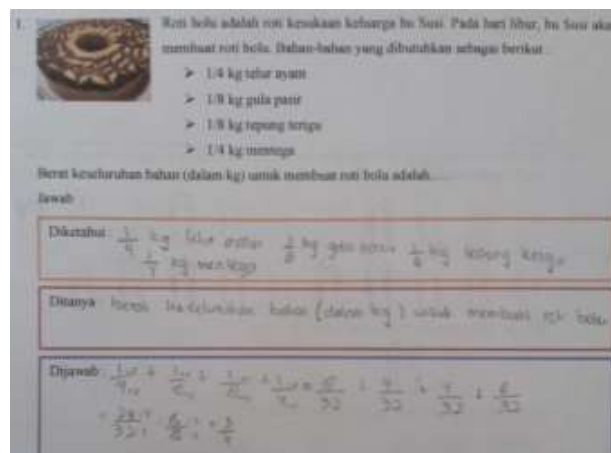


Figure 6. AN's Answer to the Question Number 1

Known from the results of AN's work, it can be concluded that AN is less capable in this review stage because it does not write the conclusion at the end of the answer in its own language.

The results of this study complement the results of research, that the difficulties experienced by students in solving problem-solving questions are thought to have started from understanding the problem, representing the problem in the form of mathematics or an image of a problem, building reasoning in solving problem-solving questions, and develop a solution strategy. Numerical literacy includes the skills to apply mathematical concepts and rules in real everyday situations, when the problems are often unstructured, have many ways of solving, or even no complete solution, and are related to non-mathematical factors.

Numerical Literacy Based on Indicator Literacy Numeration

Students are understand important information and use numbers and symbols in solving problems. The level of students' abilities in this indicator can be seen in the work of students with high abilities and also some students with moderate abilities. Some students have been able to analyze important information to the problem. This can be seen from the percentage gain in the polya stage. Students can describe the results of the analysis in predicting and taking decision. At this stage, only some students are able to complete problem correctly.

Conclusion

In terms of overall numeracy literacy levels, the results indicated that 26.67% of the 15 students demonstrated a low level of numeracy literacy, while 46.67% showed a moderate level, and the remaining 26.67% exhibited a high level of numeracy literacy in solving problems related to number concepts. To further analyze the students' performance based on the stages proposed by Polya's theory, the researcher collected scores from different stages for each question. The understanding stage had the following percentages: 73% for question number 1, 47% for question number 2, and 80% for question number 3. These percentages represent the proportion of students who demonstrated understanding of the given problems. Moving on to the planning stage, the data revealed that 73% of the students successfully executed the planning stage for question number 1, while for question number 2, only 47% of the students were able to plan effectively. However, in question number 3, 80% of the students demonstrated proficiency in the planning stage. Regarding the implementation stage, the results indicated that 67% of the students effectively executed the plan for question number 1. However, for question number 2, only 33% of the students were successful in implementing the plan. In question number 3, 80% of the students demonstrated competence in implementing their plans. Finally, in the review

stage, the percentages of students who engaged in reviewing their solutions were as follows: 47% for question number 1, 27% for question number 2, and 73% for question number 3. These findings provide insights into the numeracy literacy abilities of eighth-grade students at MTs Miftahul Ulum, specifically in problem-solving tasks related to number concepts. The results highlight areas of strength and areas that require improvement in each stage of Polya's theory. This analysis can inform educators about the specific aspects of numeracy literacy that need to be addressed in teaching and designing interventions to enhance students' problem-solving skills.

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