



## Analysis of Students' Mathematical Problem-Solving Ability on Integers Materials

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### Article Info

Article History:

Recived : 11

November 2022

Accepted : 31

December 2022

Published : Current

Edition, 11(2), 2022,

December.

Keywords:

*Student Ability,*

*Mathematical*

*Problem Solving,*

*Integer*

### Abstrak

Tujuan dari penelitian ini adalah untuk menganalisis dan mengevaluasi kemampuan siswa dalam memecahkan masalah matematika yang melibatkan materi bilangan bulat. Sebanyak 22 siswa kelas VII SMP YPII Bungur Bekasi mengikuti penelitian ini pada tahun ajaran 2022-2023. Lima item ujian tertulis, observasi, dan wawancara dengan siswa dan guru matematika di sekolah digunakan untuk mengumpulkan data. Hasil penelitian ditemukan bahwa siswa di kelas tujuh memiliki kapasitas yang diperlukan untuk memecahkan masalah matematika termasuk materi bilangan bulat. Evaluasi kemampuan siswa untuk menanggapi pertanyaan cukup berhasil. Berdasarkan hasil penelitian, rata-rata kemampuan pemecahan masalah matematis siswa pada materi bilangan bulat memiliki tingkat 63,1% dan berada pada kategori tinggi. Namun, masih ditemukan beberapa siswa yang kesulitan menyelesaikan masalah yang dihadapi. Indikator terendah pada kemampuan pemecahan masalah matematis yang diperoleh siswa yaitu pada indikator pemeriksaan kembali dengan persentase 51,2%.

### Abstract

The purpose of this study is to analyze and evaluate students' ability to solve mathematical problems involving integer material. A total of 22 grade VII students of SMP YPII Bungur Bekasi participated in this research in the 2022-2023 school year. Five items of written examinations, observations, and interviews with students and math teachers in the school were used to collect data. The results of the study found that students in the seventh grade have the necessary capacity to solve mathematical problems including integer material. Evaluation of students' ability to respond to questions is quite successful. Based on the results of the study, the average mathematical problem-solving ability of students on integer material has a rate of 63.1% and is in the high category. However, there are still some students who have difficulty solving the problems encountered. The lowest indicator on mathematical problem-solving ability obtained by students is the re-examination indicator with a percentage of 51.2%.

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## INTRODUCTION

The study of mathematics is very important and is taught at all levels of education. At the elementary, high school, and college levels, mathematics became a compulsory subject. The subject standard for primary and secondary education in Permendiknas Number 22 of 2006 is mathematics. Mathematics is a science that can be used as a foundation or basis in the development of modern technology, plays an important role in many fields, and improves human understanding. Ersoy & esen (2016) says that Most learning occurs as a result of problem solving, which is a key component of mathematics education. In the World Economic Forum (WEF) in 2017, it mentioned 10 skills needed to develop in Revolution 4.0 including, (1) Complex Problem Solving, (2) Critical Thinking, (3) Creativity, (4) People Management, (5) Coordinating with Others, (6) Emotional Intelligence, (7) Assessment and decision making, (8) service orientation, (9) negotiation, and (10) cognitive flexibility (Byun, 2020).

Students will become better able to reason critically and logically because of learning mathematics. The ability to solve problems in everyday life can also be honed and improved by studying mathematics. Having a strong mathematical problem-solving ability can open doors in a person's daily life. (Kipman et al, (2022) Betchs et al (2011), argue bring Cognitive processes that try to eliminate problems that separate the current state from the desired situation are referred to as problem solving. According to (Rio & Pujiastuti, 2020),

mathematical problem-solving ability gives students many ways to see a problem from different angles, allowing them to make decisions quickly based on current problems. In addition, mathematical problem-solving skills are very important for students for several reasons, including critical and analytical thinking skills when making judgments in real life, according to Mulyono (2009).

The Hard Skill that can be acquired and mastered by every learner is the capacity to solve mathematical problems. These skills allow students to learn math in a more fun way. One of the standards of mathematics learning is the capacity to solve mathematical problems. The National Council of Teachers of Mathematics (NCTM) (Rahayu & Aini, 2021) lists five mathematical benchmarks: 1) the ability to communicate ideas; 2) the ability to solve problems; 3) the ability to represent ideas mathematically; 4) the ability to reason mathematically; and 5) the ability to unify mathematical ideas. (Kesumawati, Septiati, and Monika: 2019) Problem solving ability is a skill or ability that students have in overcoming problems and being able to use them in everyday life, according to Gunantara, Suarjana, and Ristiati (2004). Ayu, Nurahmawati, and Deswita (2016) argue that the ability to solve mathematical problems also requires the ability to understand problems, make mathematical models, solve models, and interpret results. According to the definition given above, students must be able to solve mathematical problems rationally, critically, and with appropriate solutions to

be able to apply their knowledge to real-world situations.

The mathematical problem-solving ability that each student has is different. In Nuraini's research, Maimunah & Roza (2019) concluded that students who have excellent abilities, often forget to write what is known and what is asked. In good-level students, students have difficulty understanding and modeling mathematics. students who are at a low level, do miscalculation and mischaracterize mathematics. and students who are at a poor level, have difficulty in understanding making mathematical models and it is difficult to provide solutions.

In line with the research above, in Nurmala, Marian and Bernard (2018) research concluded that students' mathematical problem-solving ability at all stages is still relatively lacking with a percentage achievement of 53%. This happens because of several things, including 1) students are still mistaken in working on number operations and mistakenly calculating and dividing what should be done first, 2) students have not been able to solve problems completely, 3) have not been able to work on the stages of the completion process properly, and 4) students are still unable to implement other forms in daily life.

Based on the results of the two studies above, it can be obtained the fact that indeed the level of mathematical problem-solving ability of students varies. With the existing differences, a solution must be found. To find such a solution, it is necessary to conduct further analysis of mathematical problem-solving capabilities.

Therefore, researchers are interested in analyzing and describing the mathematical problem-solving ability of students of SMP YPII Bungur Bekasi class VII on integer material. This research is also expected to be able to help readers, teachers and other researchers to be able to develop and improve students' mathematical problem-solving skills.

## **METHOD**

For the 2022/2023 academic year, the research is focused on class VIII students at SMP YPII Bungur Bekasi. Class VIII in the school has only one class. There are 22 students in the class, and each of them is randomly selected for the study. This research uses a descriptive qualitative methodology. In terms of research, researchers examine integer-related topics with students in class VIII. In addition, this sub-section of material was chosen because class VIII students had already studied it in the first semester of class VII. A written test with questions about mathematical problem-solving abilities was used to collect data for the study. The five essay questions form a test instrument. In addition, researchers observe pupils and conduct interviews with them. especially about the environment in the classroom, teachers, students, and schools.

The results of the research involving asking test questions will be assessed in accordance with the established assessment guidelines and will subsequently be examined in relation to the marker of mathematical problem-solving proficiency. These indicators are related to indicators at

the polya stage (Rahayu & Aini, 2021), namely the stages of understanding the problem, formulating strategies, implementing strategies, and re-examining. If a person can implement a plan that turns the state of the problem into the desired result and the plan solves the problem, the person is said to have the ability to solve the problem (ijirana & Najmuddin, 2019). The results of the test instrument research will then be combined with the results of observations and interviews of researchers. So that the degree of mathematical problem-solving ability of class VIII students at SMP YPII Bungur Bekasi and the factors that affect the school can be determined and known in this study. In scoring, researchers use a reference for calculating scores based on syah (Rio & Pujiastuti, 2020).

**Tabel 1.** Problem solving achievement percentage category.

| Mastery Level | Criteria |
|---------------|----------|
| 81% - 100%    | Highly   |
| 61% - 80%     | High     |
| 41% - 60%     | Medium   |
| 21% - 40%     | Low      |
| 0% - 20%      | Very low |

## RESULT AND DISCUSSION

The results of research that has been carried out by researchers to junior high school students obtained the ability of students with several categories, namely high, medium, and low. From the results of calculating the score, the percentage of students' problem-solving ability is obtained in each question item. The following is presented a table of student answer percentage.

**Tabel 2.** Percentage of students' mathematical problem-solving ability

| Question                | Understand-<br>ing the<br>Problem | Indicator          |                     |                  |
|-------------------------|-----------------------------------|--------------------|---------------------|------------------|
|                         |                                   | Plan a<br>strategy | Resolving<br>issues | Checking<br>Back |
| 1                       | 100%                              | 72%                | 90%                 | 59%              |
| 2                       | 81%                               | 77%                | 81%                 | 40%              |
| 3                       | 68%                               | 72%                | 68%                 | 72%              |
| 4                       | 45%                               | 54%                | 77%                 | 45%              |
| 5                       | 45%                               | 63%                | 13%                 | 40%              |
| <b>Percentage Total</b> | <b>67,8%</b>                      | <b>67,6%</b>       | <b>65,8%</b>        | <b>51,2%</b>     |

From the table above (table 2), it is obtained that the mathematical problem-solving ability of students belongs to the high category. It can be seen in each indicator, each question item in percentage terms has an average percentage result above 60%. For the highest percentage, it is found in the first indicator, which is a total of 67.8%. And in the second and third indicators, which can still be said to be in the high category, they obtained percentages of 67.6% and 65.8%. And the last indicator is in the medium category, with a percentage reaching 51.2%.

As for if we look at the overall students' answers, there are also many students who can answer correctly but they have not been able to write down the finishing strategy with the correct mathematical language. Most of the students who can write down the available problems but are not able to explain their solution strategies properly so that many of the results or solutions to solve the problems are wrong. It can be seen in the percentage of question item number 5. In question number 5, the overall percentage of each indicator in number 5 is in the medium category. And on the indicator of finding a solution, it is in the very low category of 13%.

Analysis of question items (number 1)

Question: Pak Maman owes a stall of Rp 25,000 because he is in debt. With Rp 18,000, Pak Maman paid off all his debts. How much is Mr. Maman owed now?

The following is an analysis of the answers of students with different ability levels on question No. 1.

Student Answer Analysis 1:

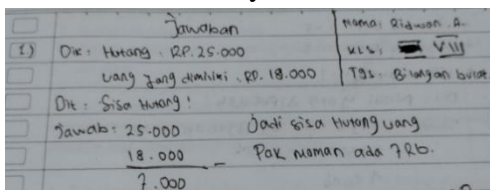


Figure 1. High Ability student Answers

Based on the student's answer above, the student has been able to answer the question properly and correctly. All indicators of problem-solving ability are met. Students can find existing problems, strategize solutions, find solutions and re-examine what has been solved.

Student Answer Analysis 2:

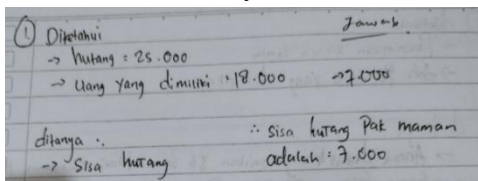


Figure 2. Medium ability student Answers

From the answers above, the student can give the correct answer to the question. However, the student did not provide a series of ways or strategies in answering the question.

Analysis of question items (number 2)

Question: From the 1st floor to the 5th floor, then to the 2nd floor the elevator moves. The elevator set off again from the 2nd floor and traveled to the 4th floor before stopping on the 3rd floor. How far is the elevator travel distance if the distance is 3 meters between floors?

The following is an analysis of the answers of students with different ability levels on question No. 2.

Student Answer Analysis 1:

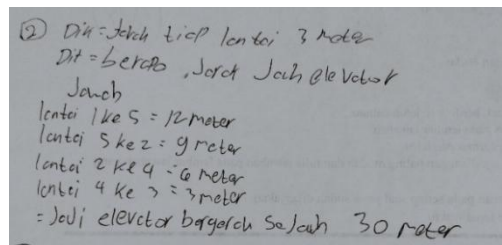


Figure 3. High Ability student Answers

Judging from the answers of the students above, students are able to do well and get the right results. Students know the problems in the problem and know the correct strategy to solve it. and re-examine the appropriateness of the strategy to the problem.

Student Answer Analysis 2:

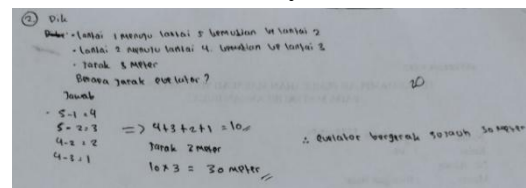


Figure 4. High Ability student Answers

In the student's answer above, the student can answer the question correctly but has a different settlement strategy from the previous student's answer. In student answer 1, students calculate the distance by summing up each movement of the walking

elevator. However, with student answer 2, students can answer by first calculating the total floors passed by the elevator then multiplying by the distance between floors.

Student Answer Analysis 3:

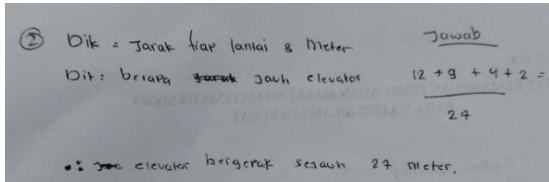


Figure 5. Medium ability student Answers

From the student's answer above, the student is able to understand the question well. Then the student Develop a settlement strategy. The settlement strategy used is the same as the strategy in students 1. However, this student 3 was mistaken at the time of completion of the strategy. Students are wrong in answering questions so that the results obtained are wrong.

Analysis of question items (number 3)

Question: Risna sells baked goods. He suffered a loss of Rp 100,000 on the first day. He earned Rp. 150,000 on the second day. The third day brought another loss for him of Idr 25,000. Risna sold for three days. Did he make a profit or a loss?

The following is an analysis of the answers of students with different ability levels on question No. 3.

Student Answer Analysis 1:

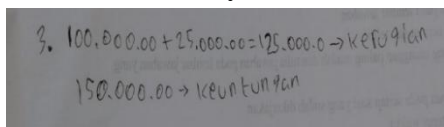


Figure 6. Low ability student Answers

In Figure 6's answer, it can be seen that students have not understood the problem in the question presented. Students only distinguish between money from profits and money from existing losses. Students have not completed question number 3 properly and correctly.

Student Answer Analysis 2:

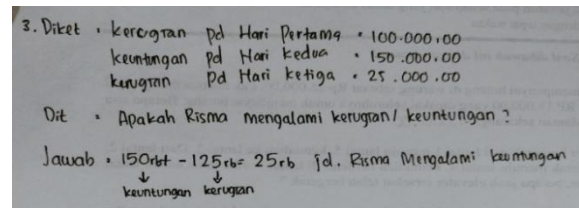


Figure 7. High Ability student Answers

Based on the student's answer above, the student can answer the question well and is able to describe it clearly and in detail. The student meets all the indicators of problem-solving ability on the question. So that the problems in the problem can be solved properly and correctly.

Analysis of question items (number 4)

Question: The cardboard apples that Mrs. Susi bought contained 40 apples. Then it was discovered that there were 6 apples that rotted apparently. He then bought 20 additional apples, selling them at once for Rp 64,800. How much does one apple cost if rotting fruits cannot be sold and the cost of each apple is assumed to be the same?

The following is an analysis of the answers of students with different ability levels on question No. 4.

Student Answer Analysis 1:

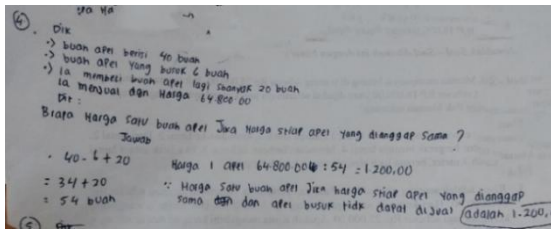


Figure 8. High Ability student Answers

In question number 4, the student is able to answer the question well. Students understand the problem in the question. Then the student strategizes the solution well. So that the student answers the question with the right answer.

Student Answer Analysis 2:

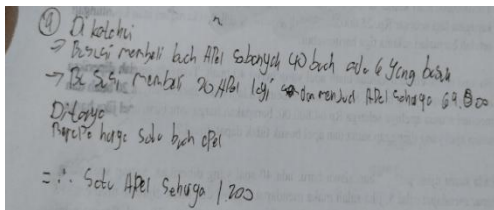


Figure 9. Low ability student Answers

In Figure 9, the student's answer (Figure 8) and the answer above have the same and correct result. However, the students in Figure 9 have not been able to develop a strategy for solving existing problems. The student only writes down what the problem is and what is known about the problem.

Analysis of question items (number 5)

Questions: 40 questions have been provided on the test for admission of new students. Each correct question receives a score of 5, while an incorrect question receives a score of -3 and is left unanswered receiving a score of -1. Anisa can answer 36 questions, but the exact answer is only

30 questions. How much value does anisa get?

The following is an analysis of the answers of students with different ability levels on question No. 5.

Student Answer Analysis 1:

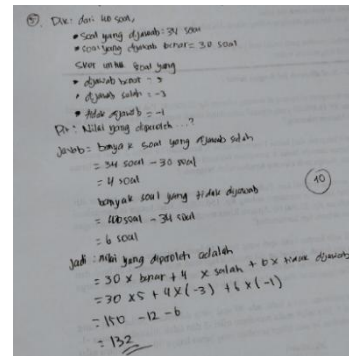


Figure 10. Medium ability student Answers

In Figure 10, the student basically understands what is meant in the question. Students are familiar with the problems presented in the questions. Then the students develop strategies to solve the problem. However, students experience errors in the operation of the strategies drawn up. Thus, the result of solving or solving the problem of the problem is not appropriate.

Student Answer Analysis 2:

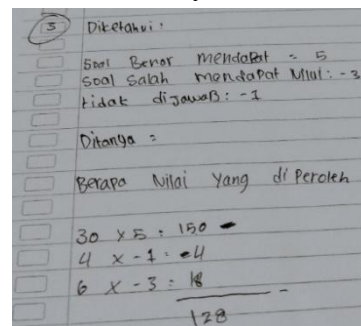


Figure 11. High Ability student Answers

In Figure above (Figure 11), the student answered the question correctly.



Students can describe existing problems, devise solving strategies, find solutions correctly, and re-examine them.

In addition to the research results obtained from the analysis of the question items above, the researcher also conducted interviews with mathematics teachers at the school. Researchers ask teachers several questions about students' abilities and conditions during classroom learning. From the results of the interview, the results were obtained that overall students can understand the problem in this integer well. The learning carried out by the teacher is also carried out by always giving practice questions after the material is explored at each meeting. However, they still underestimate integers and are still in the transition period from elementary to junior high school so that even the teaching and learning process they cannot focus on the classroom. So that at the time of conducting tests such as daily tests, the scores obtained by most students at that time were below KKM.

## CONCLUSION

Based on the results of the research analysis, it can be concluded that students' mathematical problem-solving ability is in the moderate category. At the percentage of each indicator, each question item in percentage terms has an average percentage yield of above 60%. For the highest percentage, it is found in the first indicator, which is a total of 67.8%. And in the second and third indicators, which can still be said to be in the high category, they obtained percentages of 67.6% and 65.8%. And the

last indicator is in the medium category, with a percentage reaching 51.2%. The category explains that students can understand the questions well, able to capture the problems presented in the questions. Students will look for the right strategy to solve the problem of the problem. In this indicator, it is still found that some students have not been able to write down or describe solving strategies in mathematical language. Furthermore, on the indicators of solving solutions, it is still found that many students are mistaken in getting the result right. Some students write down incorrect results even though the strategies compiled are appropriate. And on the re-examining indicator, overall, there are still many students who are not scrupulous about what has been done, many small things go unnoticed.

From the results of the study, researchers suggested to teachers to change the learning method in the classroom. The method used can be a discussion or presentation method. With this method, students can become more active and independent in learning mathematics so that they do not only rely on the material presented by the teacher. With the method of using teaching aids or learning media, it can also improve students' problem-solving abilities and increase students' interest in learning mathematics.

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