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The Mathematical Problem-Solving Ability of Tadris Mathematics Students In Terms of Initial Ability

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ABSTRACT

Problem-solving skills are indispensable in 21st century learning. The rapid development of technology in the digital era demands the readiness of students to compete and face various problems that arise. These problems require skills in solving problems. This study aims to illustrate how the mathematical problem solving ability of students of the mathematics tadris study program is based on the initial ability of students. This research is a quantitative descriptive research, with the research subjects of mathematics tadris students totaling 15 people. The instruments used in this study were questionnaires, interviews, and documentation in the form of test questions and student answers. The results revealed that mathematical problem solving skills: a) high-ability students were good in all mathematical problem solving indicators and received satisfactory score scores; b) Moderately capable students mostly master 4 to 3 indicators of mathematical problem solving, but the final result of the question answers given by most students is correct; c) Low-ability students are mostly only able to master 2 to 3 indicators of mathematical problem solving, so many problems are solved incorrectly and even incorrectly. Researchers concluded that there are several characters of mastery of mathematical problem solving indicators at each level of students' initial abilities. Lecturers need to present learning methods that are able to accommodate so that students' mathematical problem solving skills can be developed optimally, in each student based on initial abilities.

Keywords: Initial Ability, Mathematical Problem Solving Ability, Mathematics

A. INTRODUCTION

The rapid development of technology in the digital era requires students' readiness to compete and face various problems that arise in real life. Today's rapid technological development requires relevant skills in the field of technology. Skills that can keep pace with us adapting to the digital age. Students are required to master various competencies to be able to compete in the 21st century, especially in the field of human resources (Sari & Atmojo, 2021). The skills required in abd 21 are skills of deep knowledge in the context of problems and events of daily life (Rahayu et al., 2022).

Mathematics that studies abstract concepts, visualization of concepts, reasoning, and so on, can help develop skills in solving problems in everyday life. Through mathematics learning, students can develop intellectual abilities in logical reasoning, spatial visualization, abstract thinking analysis (Akinmola, 2014). Mathematics learning is not limited to learning in class, but mathematical concepts are useful in carrying out daily activities (Utami & Wutsqa, 2017). Mathematics is very necessary in living daily life and the development of science, thus it needs to be taught from an early age (Davita & Pujiastuti, 2020).

Learning mathematics in the 21st century needs to develop the skills of students to adapt to the rapid progress of today's times. Today's progress requires skills in critical thinking, creating something creative, the ability to work together in achieving a goal, conveying ideas and opinions in a good way of communicating, and solving problems appropriately. Teachers are required to develop creativity, critical thinking skills, collaboration skills, and communication skills. in 21st century mathematics learning (Susanta et al., 2023). Students in the 21st century are required to be able to interpret mathematical concepts in various contexts of life (Habibi & Suparman, 2020).

The concept of learning mathematics that is learned should be integrated with problems that are often encountered in everyday life. In mathematics learning, students should be trained with problems that take students to real-world problems. Problems in mathematics learning are shown when students are given questions that are not routine (Siagian et al., 2019). Actively involving students in the teaching and learning process and directing the formation of character needed in real life can produce quality education (Simamora et al., 2018).

These problems require skills in solving mathematical problems. The ability to solve mathematical problems is very helpful for students in dealing with learning in class and is also able to help solve problems in everyday life. Mathematical problems are needed not only to train

thinking skills but also needed to help students in solving everyday problems (Pimta et al., 2009). Solving mathematical problems needs to be pursued so that students are proficient in solving complex everyday problems (Ulya, 2015). Mathematical problem solving can help students in developing problem decisions encountered in everyday life (La'ia & Harefa, 2021).

Mathematical problem-solving abilities need to be identified, in the process of learning mathematics. Identification includes the extent to which students can solve problems with the right solutions and the right results. Identification can also be seen from problem solving indicators which include understanding problems, finding the right solution, solving problems with the right results and reevaluating the results of problem-solving work that has been done. Problem-solving steps according to Polya (1973), include: (1) understanding the problem, students understand the problem by identifying known elements; (2) develop plans, find appropriate solutions in planning steps to solve problems; (3) implement the plan in accordance with the planned solution; (4) re-checking, students double-check the answers that have been made (Zakiah et al., 2019).

Research conducted by Bernard (2018) revealed that mathematical problem solving ability is classified as lacking with a percentage of 53% (Bernard et al., 2018). Syriac research (2020) revealed that students' mathematical problem solving skills through the Problem Based Learning model became better (Suryani et al., 2020). This research reveals how students at various levels of ability, solve problems in terms of problem-solving steps. The level of student ability is seen from the test results, then students are divided into three groups, namely high, medium and low groups. The results of this study are expected to contribute to lecturers and further researchers in determining the model and a suitable learning approach if students' problem-solving skills in a class vary.

B. METHODS

This research is quantitative descriptive research. This study took data on test results given to students, then student test results were given scores, analyzed and described how students solved problems using problem solving steps. The subjects of the study were 20 mathematics tadris students. Students are divided into 3 groups, namely students with high, medium and low initial abilities. Each group was taken by 2 students to analyze the results of student answer sheets in solving problem solving problems.

The instruments used in this study were test questions, interviews, and documentation. Test questions are in the form of essay questions, taken from standard problem-solving test questions. Interviews are conducted to students who have done test questions, in order to complete data that is not obtained from student answer sheets. Documentation in the form of student answer sheets.

C. RESULT AND DISCUSSION

Lecturers need to identify the extent of students' ability to solve problems in the mathematics learning process. Identification is done by giving students problem-based questions, then analyzing the results of student answers. In this study, researchers provided questions to identify students' problem-solving abilities. The problem the researcher presents as follows:

Toni works as a seller of jam in cans. He would arrange a few cans of jam into a cardboard box.

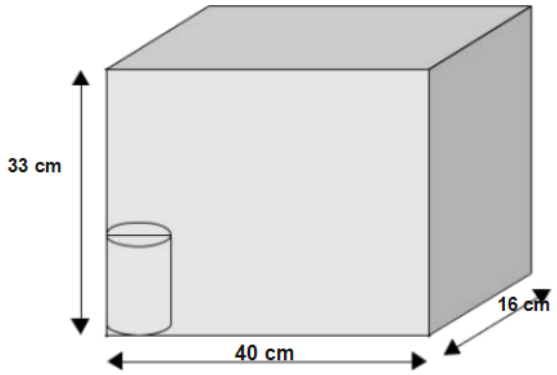

Figure 1. Cardboard Box to be filled with jam cans

1. How many can of jam can fit into such a cardboard box if it is 8 cm in diameter and 11 cm in height?
2. How many boxes would it take, to put 140 cans of jam?
3. Of the 140 cans of jam put in, there are several cans left. What size cardboard can hold the rest of the cans so that they can be inserted and neatly arranged?

The above questions are given to students with a processing time of approximately 15 minutes. After the student answered. Researchers took answer sheets from 2 representatives of each ability level group, to analyze the answers. The selection of representatives of the 2 students, with consideration of answers that are almost similar and can be representatives of several ways of solving the questions found.

The analysis carried out by researchers is how to work on the problem seen from the steps to solve the problem. Which steps have students not done and what improvements will be made in the future if problems are found that must be addressed immediately. Here researchers discuss one by one the results of students' answers based on the level of ability, namely high, medium and low abilities.

Problem Solving Ability of High-Ability Students

The mathematical problem-solving ability that will be analyzed first is in students with high initial ability. In this group, researchers get 2 answer representatives who can represent the overall answers of students with high initial ability. The following are the results of the answer sheet of student 1 with high initial ability:

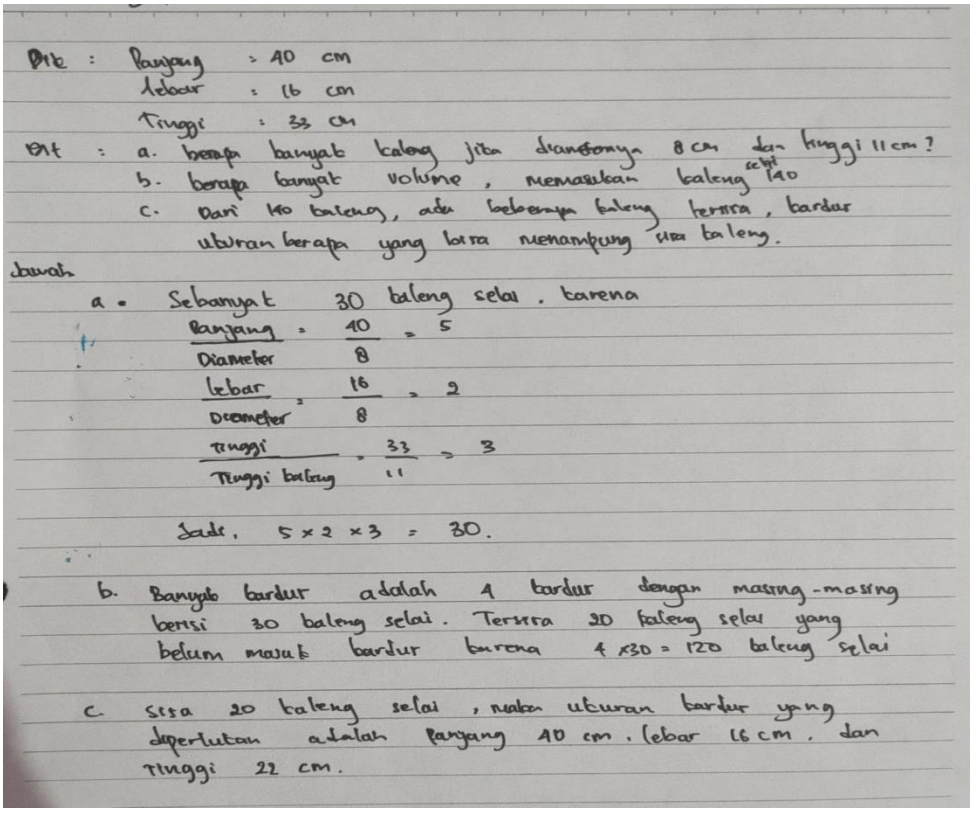

Figure 2. Answer Sheet for High Ability Student 1

In figure 2, it can be seen that the students' answers are correct, both points a, b and point c. Student problem solving steps have met the problem-solving indicators. First, the indicator of understanding the problem, students have presented what is known from the problem in the form of length on each side of the cardboard and what is asked from the problem. Both indicators make a plan, students can already describe the plan, by counting the number of can of jam on each side

of length, width and height. The three indicators solve the problem according to plan, the student solves the problem by multiplying the number of jam cans on each side on the cardboard in the shape of a cube. The four indicators evaluating the answer, students have made a firm conclusion about the answer found is 30 cans of jam.

The next answer sheet that the researcher analyzed was 2 highly capable students. The following are the results of student work 2 seen from the student answer sheet:

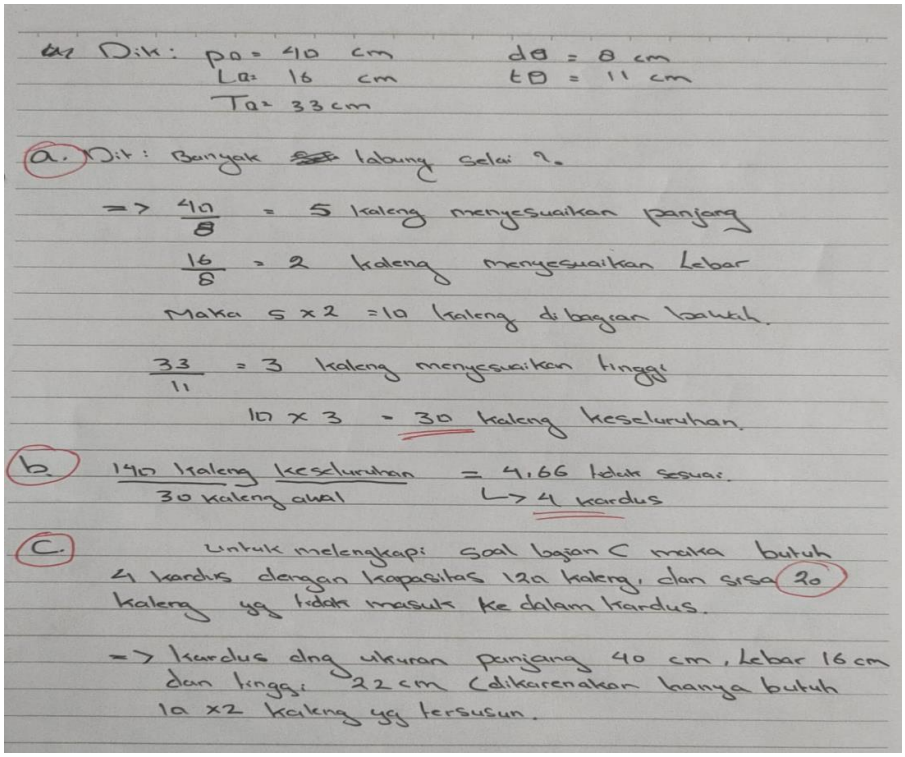

Figure 3. Answer Sheet for High Ability Student 2

Almost the same as student 1, student 2 is able to carry out problem solving by fulfilling several problem-solving steps. It's just that the plans and steps for solving student 2 are slightly different from student 1. The solution to solving the problem carried out by student 2 is to first multiply the cans on the side of the base, then the total number of jam cans on the side of the base is multiplied again on the high side of the cardboard. Nevertheless, the final result was correct.

The process of understanding problems when solving math problems is very important to be mastered by students. By understanding the problems of students, it will be easy to find the right solution to solve the problems presented. Likewise, the results to be achieved in solving mathematical problems will be maximum.

High-ability students are able to solve problems with all problem-solving indicators. The abilities possessed by these students are very influential on their learning outcomes. However, these problem-solving skills must continue to be honed so that they practice higher-order thinking skills, skills that are needed in the 21st century.

The group-based learning process is very effective, if the teachers divides each member of the group, in which there are students who are proficient in solving mathematical problems. Students who are proficient in solving mathematical problems are able to bring an active group atmosphere. In the group, fellow students share ideas, take responsibility and work together. Learning by collaborating encourages active interaction and cooperation in doing the tasks given (Husain, 2020).

Problem Solving Ability of Moderately Capable Students

The next mathematical problem-solving ability that researchers analyze is the problem-solving ability of students with moderate initial ability. Students who became representatives were 2 students. The answers chosen by the researchers already represent the various answers of students at the medium initial ability level. The following are the results of the answer sheet of 3 students with moderate initial ability.

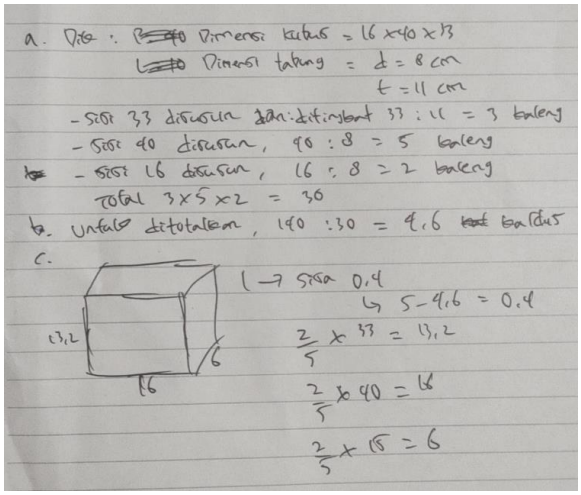

Figure 4. Answer Sheet of Student 3 Medium Ability

Figure 4 above shows the answer sheet of the results of the question work by student 3. On the answer sheet, students have answered the question with the correct results in point a, the answer in point a has shown the steps to solve the problem. Steps to solve problems that have been done

by students include, identifying what is known and what is asked. Then students plan problem solving and solve problems with the correct result, which is 30 cans of jam

Solving the problem in point b, it seems that students have not identified the problem correctly, so the plan for solving the problem has not been appropriate, and the results do not show something requested from the problem. Students should answer how many boxes can contain several cans of jam that are informed in the question. The student's answer to point b, is given a grade of 6 out of a maximum score of 20.

The next problem solving is a question of point c, the student's answer is wrong. The questions of points a, b and c are related to each other. If students are correct in answering questions a and b, then students will easily understand what problems must be solved in the next question, namely question point c. In the answer to question point c, students have misidentified what is known in the question, so students greet in formulating problem solving. Student answers on this point are given a score of 8 out of a maximum score of 20. The following researchers present, details the scores produced by 3 students:

Table 2. Proportion of Student Score 3 with medium initial ability

No	Mathematical Problem-Solving Steps	Question number	Score Max	Score
1	Identify the Problem	a b c	5 5 5	5 2 2
2	Planning Mathematical problem-solving solutions	a b c	5 5 5	5 3 3
3	Carry out mathematical problem solving according to plan	a b c	5 5 5	5 3 3
4	Recheck answers	a b c	5 5 5	5 0 0

From the results of solving the problems of 3 students with moderate abilities above, obstacles and problems were found in students in answering problem solving problems. Students do not understand the problem correctly so in finding the right solution to answer the problem, students choose the wrong strategy, then the results obtained are wrong or not right.

In addition to student 4, the researcher also took a sample of student 5 with medium initial ability, student 5's answer also represented several answers that were almost similar at the level of

students with medium initial ability. Here picture 5 is student 4's answer to question point a, and picture 5 is student 4's answer to point b.

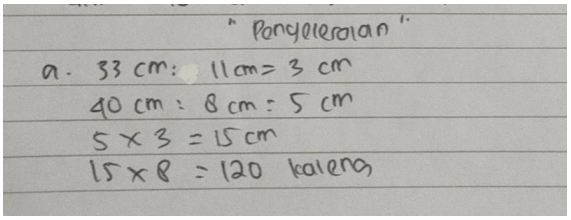

Figure 5. Answer Sheet of Student 4 Medium Ability

From figure 5 students have planned and implemented the appropriate plan to solve the problem. However, in the final result, the student's answer was wrong. The correct answer is 30 cans of jam. Students should multiply 15 by 2, not multiply 15 by 18. This is because students do not identify the questions correctly. The score given by the teacher on ani points is 12 out of a maximum score of 20.

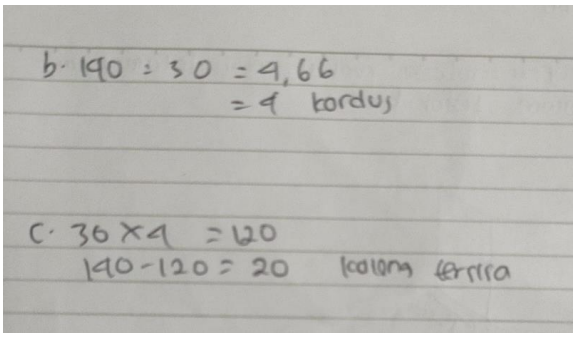

Figure 6. Answer Sheet of Student 4 Medium Ability

Figure 6 is student 4's answer to points b and c. In point b, the answers and steps of students are correct, namely 4 boxes. About point c, want what size cardboard can hold the rest of the can. Answering question point c, students answer only up to 20 boxes. But did not answer the desired size of cardboard to be able to put 20 cans in. This is because, students do not identify what is asked questions well, So the final answer from the students is not right.

Problems like this need to be addressed immediately by educators. Teachers can continue to familiarize or train students in answering problem-based problems, so that students are trained to think critically in understanding problems, and creative in finding solutions to problem solving. Teachers also need to direct students, so that each problem is solved, you should start by identifying any known elements of the question and what the question asks.

Students who have difficulty answering problem-based questions are overcome through problem-based or contextual learning. Where mathematics learning is directed at problems that are close to real life or students' daily lives. This is certainly expected, students more easily understand the problem and identify it then solve the problem given in the learning process.

The habituation of problem-based learning processes in real life, not only affects the cognitive scores of good students. This also affects the good character of students, students will be responsible for answering questions with solutions that have been proposed before carrying out problem solving. In addition, it also trains students in critical thinking and hard work, this is expected in real life, Students are able to solve problems encountered in everyday life, especially problems that can be solved with mathematical concepts that they have learned on campus. Habituation to problem solving with non-routine question exercises forms a mindset and students do not find it difficult (Wijayanti et al., 2023).

Problem Solving Ability of Low-Ability Students

The next identification carried out by the researcher was the answer sheet of students with low initial ability. The low initial ability students taken as a sample were 2 people, whose answers already represented several similar answers in the low initial ability level. The following is the answer sheet of 5 students with low initial ability in solving the problem:

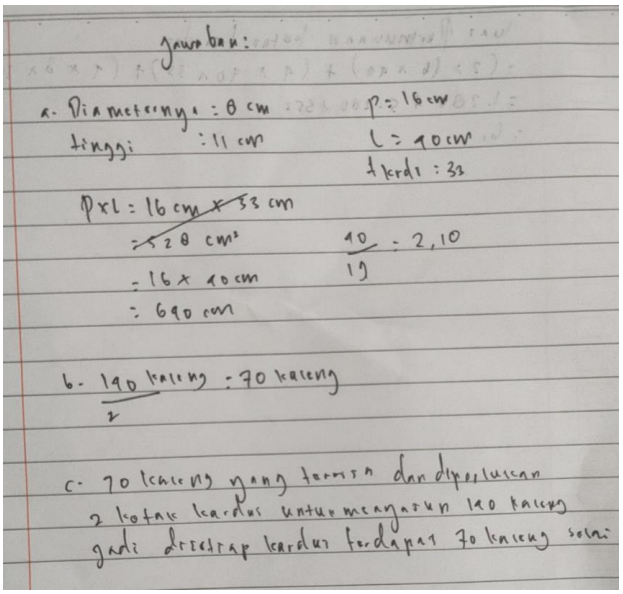

Figure 7. Answer Sheet of 5 Low-Ability Students

Figure 7 is the problem solving of 5 students with low initial ability. From the student answer sheet, it can be seen that students can identify any known elements in the question. But the next step in solving the problem, the solution offered by students in solving the problem presented is not appropriate. This shows that students do not understand the problem well, so the solution offered is not right as well as the end result.

Student 5's answers to questions b and c showed incorrect results. This is the result of an error in understanding point a, so the next step will also be wrong. Such problems are important to be evaluated by lecturers. How important it is to understand the problem from the beginning for the problems presented are interrelated.

The next sample in this researcher was 6 students with low initial ability. Figure 8 below shows student answer sheet 8 in question point a, and figure 9 below is student answer sheet 8 in answering questions point b and c.

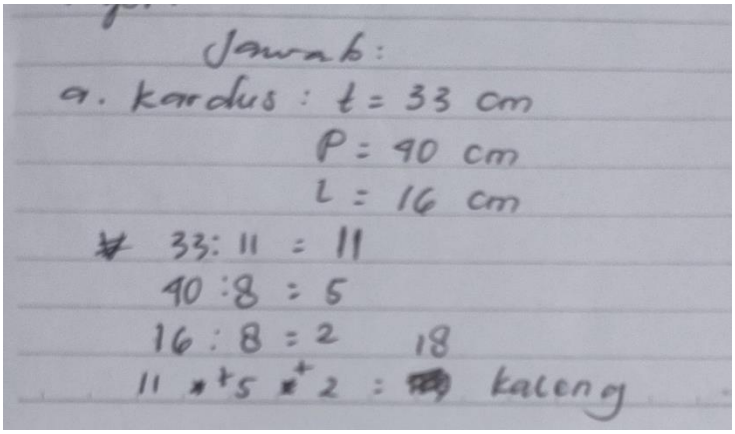

Figure 8. Answer Sheet of 6 Low-Ability Students

In figure 8, it can be seen that the problem solving done by student 6 has a wrong step. The first step in solving the problem, namely the identification of the elements in the problem, has been done correctly. The planning has been done exactly. However, at the step of implementing the plan, the student mistakenly divided 33 by 11, should the quotient of the number be 3. However, students write with 11. This shows that students are not carrying out the "re-check answers" step properly.

Checking the answer again at the end of the problem solving work is very important to do, this is considering that in order to avoid calculations or incorrect writing. In this case, the lecturer can remind students to always check the answers and do the problem solving carefully.

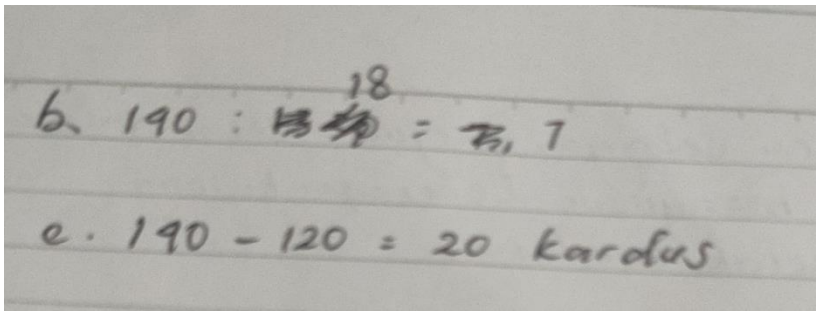

Figure 9. Answer Sheet of 6 Low-Ability Students

The student answer sheet in figure 9 shows the results of students' answers to questions b and c. In point b, the steps to solve student problems are not right. This is because in point a, the student's answer is wrong. So that in understanding and solving the next problem will also result in being wrong. In point c, the students' answers are almost correct, but the question of wanting is not only limited to how many cans of jam are left. Question point c also requires students to identify the size of the cardboard that can contain the rest of the jam can.

Students with low initial ability must continuously train themselves, in answering and solving problem-based problems. This is to hone students' critical thinking skills. Problem-solving skills are very useful for students' daily lives, to face various challenges in today's digital era.

In the teaching and learning process, identification of students' problem-solving abilities is very important. This is a reference material for lecturers to design lecture plans. What approaches, media, steps must be planned and carried out, in order to develop and improve mathematical problem-solving skills. The development of problem-solving skills is carried out, of course, for every student with the initial level of student ability. Solving problems in the teaching and learning process can lead students to be more analytic in making decisions in life (Tanjung & Nababan, 2018).

D. CONCLUSION

Mathematical problem-solving skills are very important to be identified and improved in the lecture process. Students as prospective teachers must have good mathematical problem-solving skills, so that when they become a teacher later, students as prospective teachers are ready to develop their students' mathematical problem-solving skills.

The steps of students in solving mathematical problems based on initial ability are concluded that there are different ways or steps to solve. Students with high initial ability, have solved problem solving problems with good steps. Students with early abilities are doing ways not as well as students with high initial abilities. Then students with low initial ability are only able to maximally solve problems with 3 steps to solve.

The ability of different students in a class also affects the way students solve mathematical problem solving. Identifying how students solve mathematical problems through problem solving can be an evaluation for lecturers. Evaluation in determining learning models, learning media, and so on. The evaluation is expected to improve and develop students' mathematical abilities, especially mathematical problem-solving abilities.

E. ACKNOWLEDGEMENTS

At this point, I would like to express my gratitude to all parties who have been involved and contributed to the successful implementation of OCERI 2023 activities that have taken place. Hopefully this activity will bring good results and give birth to benefits for the wider community.

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