Analysis of Students' Mathematical Problem-Solving Ability in Terms of Gender Differences

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Abstract

This research illustrates students' ability to solve mathematical problems by considering gender differences. This type of research is descriptive qualitative. This research topic is about systems of linear equations with 2 variables. The subjects of this research were 24 students in class VIII of SMP Negeri 3 Malang for the 2023/2024 academic year. The step in collecting research data information is a test. The data analysis technique involves categorizing the level of mathematical problem-solving ability into high, medium problem-solving ability into high, medium, and low. Research findings show that the average score for male students is 89.49, while the average score for female students is 94.47. Based on research findings, it can be concluded that female students' ability to solve mathematical problems is better than male students.

Keywords: Problem-solving ability; gender; Polya

1. Introduction

Education has a crucial role in determining the progress of a country by creating an educated society, which is a prerequisite for the progress and independence of society (Hafidz, Kusumaningsih, &; Aini, 2019). Mathematics is one of the subjects that students learn at school and plays a role in encouraging students' ability to solve problems or problem-solving. Mathematics skills are very important in everyday life and to face the development of science and technology. Therefore, mathematics education needs to be given to every student, starting from the basic education level to an early age (Davita &; Pujiastuti, 2020). Mathematics is closely related to problem-solving. It is undeniable that the steps to solve problems in mathematics learning are important aspects of educators that need attention (Nurcholis, Azhar, &; Miatun, 2021).

The process of solving mathematical problems involves students' efforts when applying their skills and knowledge to find solutions to mathematical problems (Davita &; Pujiastuti, 2020). Overcoming problems is essential in mathematics learning because the skills of solving mathematical problems acquired in the context of learning can often be applied to solve various other problems (Agustina, et al., 2014; Hangar, Aisyah, &; Fitrah, 2022). In mathematics learning, the ability to solve problems is a very important key for students. This is because, in every learning interaction, students are involved in utilizing the skills and understanding they have mastered before and will later apply these in solving problems in new contexts (Lahunda &; Jailani, 2015; Mutiah, Rohman, &; Hasanudin, 2023). Also, when overcoming problems, students must have cognitive skills to understand and represent problems, develop strategies to overcome these situations, process various data, and carry out calculations. On the other hand, they must also be able to recognize and manage a variety of appropriate strategies, including heuristics, techniques, and other approaches (Hafidz et al., 2019). Problem solving based on Polya has 4 steps, including *understanding the problem*, devising *a plan*, *carrying out the plan*, and *looking back* (Susanto; 2015; Nurcholis et al., 2021).

From the evaluation conducted by the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), in essence, the

skills of Indonesian students when facing unusual situations are still below standard. However, they perform better in completing tasks related to factual and procedural information. (Putra &; Novita, 2014; Lestari, Kusmayadi, &; Nurhasanah, 2021). Information from the Trends in International Mathematics and Science Study (TIMSS) in 2015 stated that Indonesia's average score reached 397, ranking it 44th out of 49 countries. The standard average score, according to TIMSS, is 500. TIMSS evaluation shows that Indonesian students perform poorly in several areas of mathematical ability, including understanding complex information, applying theory, analyzing, solving problems, and using tools, procedures, and problem-solving. One of the areas where Indonesian students' performance is low is in problem-solving skills, which is caused by students' habits when solving routine problems (Hanggara et al., 2022).

Basic human principles are created with diversity, also one of which is manifested in male and female gender differences (Davita &; Pujiastuti, 2020). The difference between male students and female students involves the socialization process, religious teachings, and state policies. This causes differences to be considered as inherent characteristics of men as well as women (Kusumaningsih, 2028; Hafidz et al., 2019). Gender differences affect the way a person thinks and makes decisions in solving problems (Nur &; Palobo, 2018; Mutiah, Rohman, &; Hasanudin, 2023). Gender differences are not only related to ability in mathematics but also also with methods of understanding and absorbing mathematical knowledge (Susanto, 2006; Hafidz et al., 2019). Thus, male and female students have various differences in mathematics learning. Referring to this context, the author is interested in conducting research entitled "Analysis of Students' Mathematical Problem Solving Ability in Review of Gender Differences."

2. Method

The research method applied is descriptive qualitative because this study aims to document the real situation and conditions. This research aims to describe information about an event verbally.

This research is expected to understand the differences in problem-solving skills of male and female students. This research was carried out at SMP Negeri 3 Malang for the 2023/2024 school year with a target of grade VIII with a total of 24 students, consisting of 11 male and 13 female students. The subjects of this research were male students and female students of grade VIII with high student ability categories also low.

Problem-solving ability is evaluated with 2 description questions related to 2-variable linear equation systems. The criteria for assessing problem-solving ability can be seen in Table 1 below.

Table 1. Convert to student ability categories

Average Score Range	Criteria
$score < 84,69$	Low
$84,69 \leq score < 99,68$	Average
$99,68 \leq score \leq 100$	High

In this study, students were taught about a system of 2-variable linear equations, where they learned the solution using combined steps (elimination and substance) and were finally given a Student Worksheet (LKPD). The LKPD will be analyzed to compare the problem-solving skills of male and female students based on their average scores.

3. Results and Discussion

The ability to solve mathematical problems can be observed from the scores obtained by male and female students. The highest score obtained by male students is 100.00, while the lowest score is 71.88. Meanwhile, the highest score obtained by female students was 100.00, with the lowest score of 75.00. Therefore, the average values for both groups are listed in Table 2 below.

Table 2. Performance Data

Gender	Average Score	Criteria
Male	89,49	Average
Female	94,47	Average

Based on the comparison of grades listed in Table 2, it was found that, on average, female students performed better than male students. The average score for male students was 89.49, while for female students, it was 94.47.

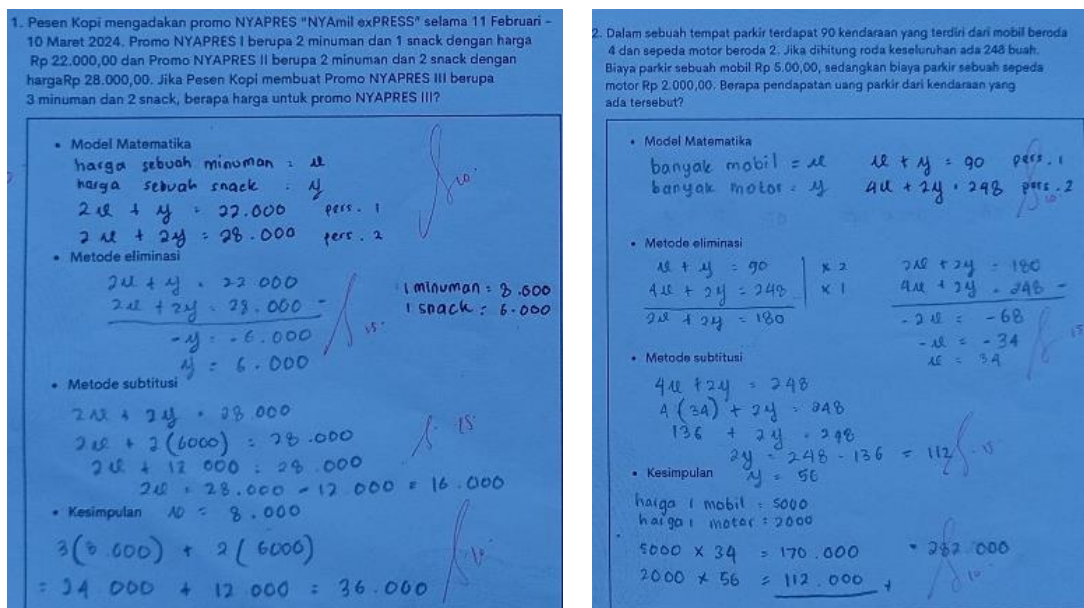The answers from male and female students who got the highest scores and lowest scores as shown in Figure 1:

Figure 1. Answers of Male Students Who Got the Highest Marks

In the responses of the male students who got the highest scores, all questions were answered correctly and sequentially, and they were explored easily. The answer was fulfilled correctly. Based on problem-solving indicators, the answers of male students who get high scores can be described, including (1) Understanding the problem. In this section, students can explore the problem thoroughly to make examples, mathematical models, and steps to get the right answer, (2) determine planning. In this section, students can write mathematical models correctly and completely following the contextual problems given, (3) Implementing the plan, in this section, students can solve contextual problems using the combined method appropriately, namely by eliminating then continuing to substitute for getting the right answer, (4) Looking back, in this section, students write conclusions in the form of answers that are

aligned with the questions given to the questions. In addition, in this section, students also check first to find no errors in the steps and calculations to get the correct answer.
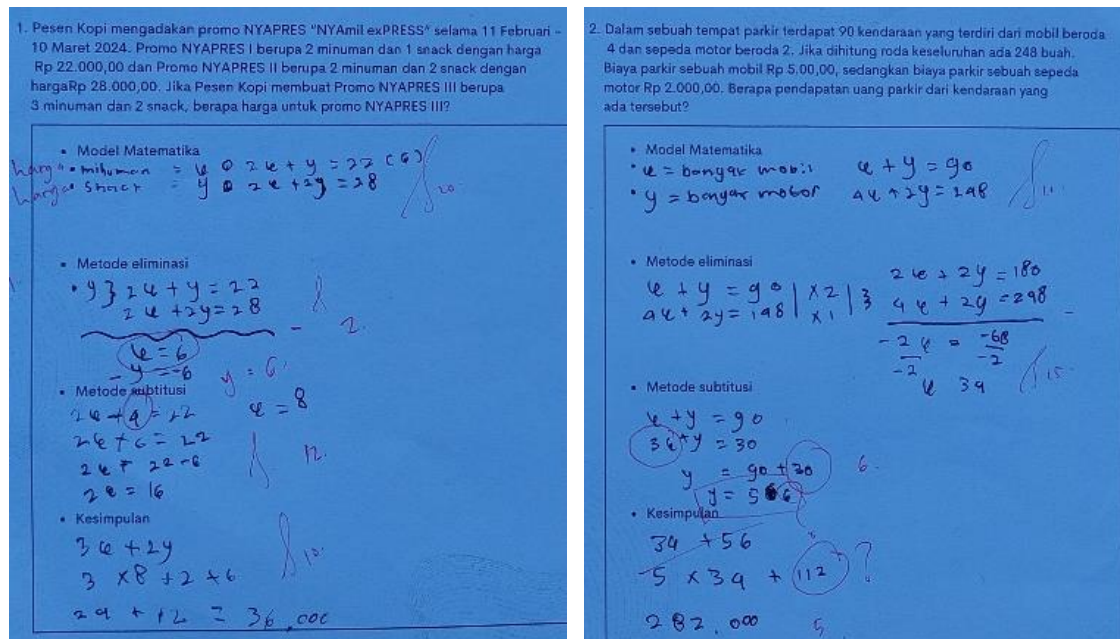

Figure 2. Answers of Male Students Who Got the Lowest Grades

Male students scored the lowest, as shown in Figure 2, but could not solve contextual problems correctly. It was found that there were several errors in the writing or calculations needed to get the final answer. Based on the problem-solving indicators, the answers of male students who get the lowest scores can be described as follows: (1) explore the problem; in this section, students can explore the problem well. This is monitored from students can write examples to make mathematical models then. Still, in writing the description, the examples are not appropriate because they are not clear about the price or a lot, (2) plan, in this section, students can write mathematical models correctly and completely following the contextual problems given, (3) Implement plans, in this section students can write the solving steps incorrectly in the process of elimination and substitution It can be seen from how in determining the value of or (4) Looking back, in this section students write conclusions in the form of answers that match the questions given to the questions. Although students can determine the correct answer, they write down calculations that are not quite right. xy,
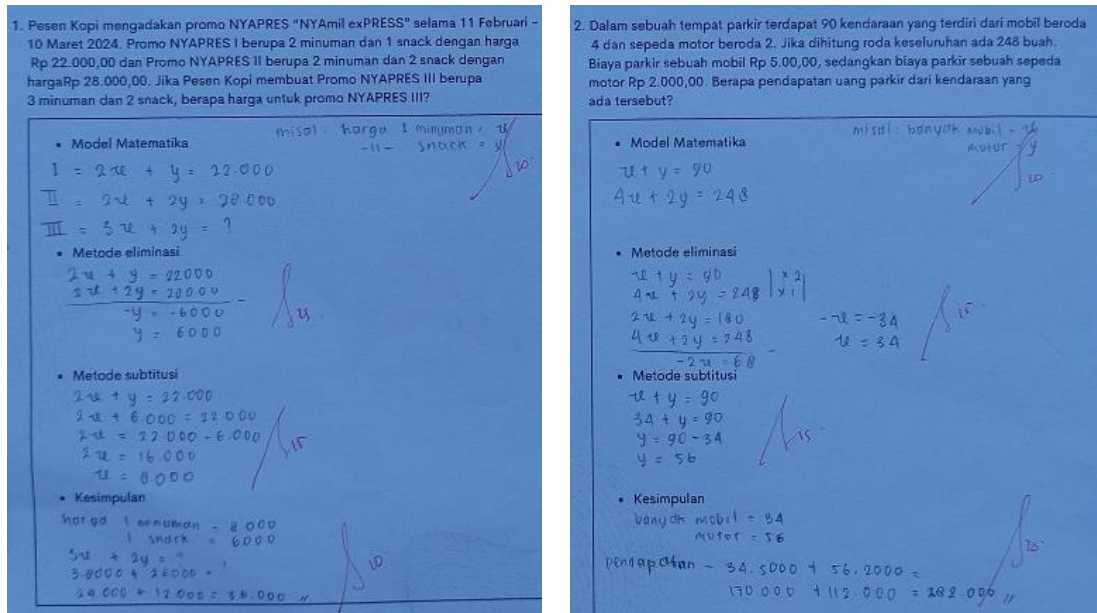
Figure 3. Answers of Female Students Who Got the Highest Marks

The female student with the highest score is the same as the male student who gets the highest score, as shown in Figure 3. Overall, the answers written are precise and correct sequentially, do not make calculation mistakes, and are easy to understand.
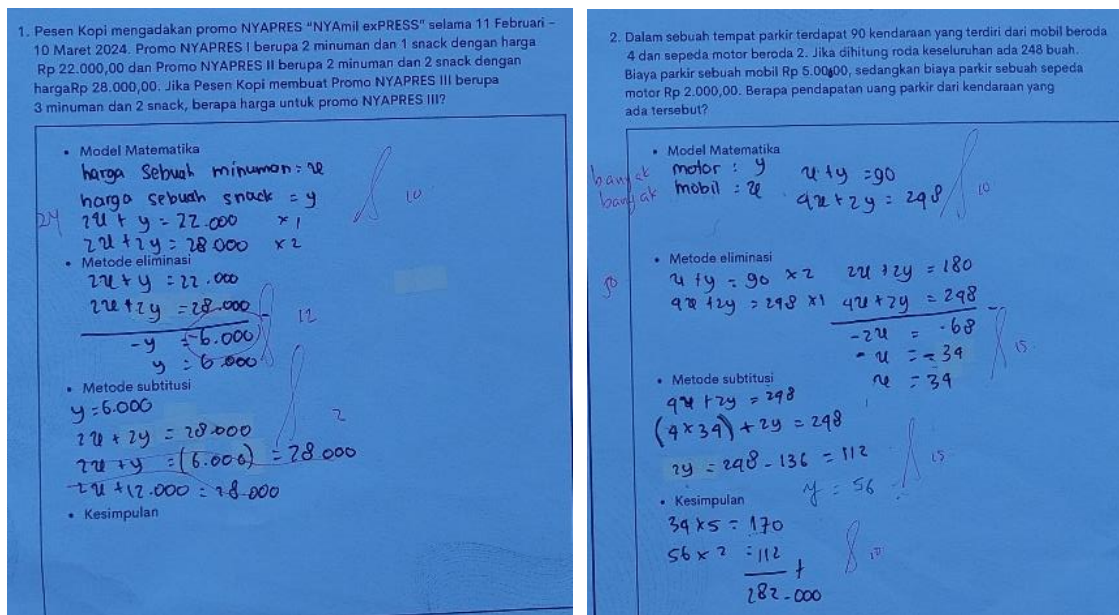

Figure 4. Answers of Female Students Who Got the Lowest Scores

The female student with the lowest score, as shown in Figure 4, is not much different from the male student who gets the lowest score. When exploring the problem, it is appropriate to be able to write down the separation and also the mathematical model according to the problem given. In making plans, there are still errors in making substitutions, so students cannot solve the problem correctly.

The average score of male and female students based on problem-solving factors can be seen in Table 3.

Table 3. Average Student Ability Scores by Mathematical Problem-Solving Indicator

Indicator	Average Score	
	Male	Female
Understand the problem	86,36	86,54
Make a plan	97,73	100,00
Implement the plan	90,91	95,19
Review the solution	82,95	96,15

On average, the cognitive aspects of problem-solving skills in female students are better than in male students, especially in the material of 2-variable linear equation systems. If categorized as shown in Table 4.

**Table 4. Students' math problem-solving skills
by gender for each indicator**

Indicator	Average Score	
	Male	Female
Understand the problem	Average	Average
Make a plan	High	High
Implement the plan	Average	Average
Review the solution	Average	Average

In problem deepening, planning, implementation, and evaluation, male and female students showed comparable scores in the high and medium categories. Although both have the same category, the average score of female students is higher than that of male students.

In line with the research (Akhyar &; Senjawati, 2023) which shows that female students have better problem-solving skills compared to male students. Research findings (Nurcholis et al., 2021) the difference in problem-solving skills between male and female students is insignificant, but from the analysis, female students show a slight advantage over male students. This was revealed based on findings from research (Sitohang, 2020) Revealing factually, female students show advantages over male students. This is based on a theory that shows women have advantages in terms of accuracy, accuracy, and accuracy of thinking. Research shows that female students' math problem-solving skills are higher overall than male students.

The explanation above shows that female students have better skills in completing mathematical problems compared to male students. However, there is no significant difference in the mathematical problem-solving abilities between male and female students.

In summary, while female students demonstrate stronger performance in mathematical problem-solving, the gap in abilities between genders is not substantial.

4. Conclusion

Based on research findings, students' mathematical problem-solving skills in exploring problems, planning, making plans, and evaluating are in the high and medium categories. Female students showed superior abilities, with the highest average score of 94.47 compared to male students. These findings suggest that female students are better at solving math problems, which may be influenced by learning methods and motivation. This conclusion is important for designing teaching strategies that can improve the ability to solve mathematical problems in general, considering individual and gender differences.

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