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Analysis of mathematical problem-solving skills viewed from initial ability and gender differences in an elementary school

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Abstract: This study aims to describe the mathematical problem solving skills of students based on gender. This research is a descriptive qualitative study. Sampling was done by purposive sampling. The subjects of this study were fifth grade students of SDN Sinduadi 1 Sleman Yogyakarta in the academic year 2018/2019. The technique of collecting data used are testing and interview methods to get data about the process of making information done by students in solving mathematical problems. The instruments used to collect data are solving test and interview guidelines. The results of this study indicate male and female students who have low initial mathematical ability have not been able to apply mathematical problem solving with Polya steps. Those students are include in very poor category. Where Polya steps are 1) understanding the problem, 2) plan problem solving, 3) solve the problem according to the plan, and 4) re-checking. Therefore, special learning strategies and habituation are needed for students to solve the problem completely. In conclusion there are differences between male and female in problem solving but not so significantly.

Keywords: Gender, mathematics, problem solving, skills

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INTRODUCTION

Mathematics is one of the subjects that exists at all levels of education, including at the level of elementary school education. This encourages to equip students with logical, analytical, systematic, critical and creative thinking with the ability to work together (Permendiknas Number 22, 2006: p. 345). According to the National Council of Teachers of Mathematics (1989) the objectives of mathematics learning are: (1) learning for conversation, (2) learning to reason (3) learning to solve problems, (4) learning to link ideas, (5) forming positive attitudes for mathematics. One of the goals of mathematics learning according to Wardhani (2008: 8) is problem solving which includes the ability understand problems, arranging mathematical models, completing models, and interpreting the model obtained.

Problem solving skills are basic skills that must be possessed by a person and can be used in various fields of daily life (Kaya, et al., 2014). The art of problem solving is the heart of mathematics. Mathematical problem solving is a complex cognitive activity involving a number of processes and strategies (Daneshamooz et al., 2012). Gagne (Bell, 1978) says that problem solving is a stage of thinking that is at the highest level among 8 types of learning. The eight types of learning are learning signals, learning stimulus responses, learning series, learning verbal associations, learning discrimination, learning concepts, learning rules, and learning problem solving. According to Goldberg (Hines: 2008) "Mathematical problem solving has been defined as the ability to read, process, and solve mathematical situations." According to Polya (Alacaci and Dogruel: 2012)"Solving problems is a fundamental human activity. In fact, the greater part of our conscious thinking is concerned with problems". The four stages of problem solving according to Polya (Zevenbergen et al., 2004: 108) are: (1) understanding the problem, (2) drawing up a resolution plan, (3) implementing a resolution plan, and (4) reexamining, reflecting solutions.

In general, mathematical skills of students in Indonesia are still not as expected. According to the research results of the Center for Upgrading Teacher Mathematics

Development Team in several Elementary Schools in Indonesia revealed that the most prominent students' difficulties in learning mathematics were 51% numeracy skills, 50% basic concept mastery, and 49% problem solving (Duskri et al., 2014). From the results of interviews with the fifth grade teacher at SDN Sinduadi 1 Sleman Yogyakarta, most students do not like mathematics, there are still mistakes made by students in problem solving in both story problems when understanding problems and in calculating. There are also differences character and cognitive learning mathematics between girls and boys even though the difference is not significant. For example male are more confident and simple in answering questions while female are more detailed and careful.

According to Permendiknas Number 22 of 2006 the higher level thinking ability emphasized on skills that require reasoning, critical thinking, and creativity. These three components will be able to be taught to students through problem solving activities. The result of the PISA Indonesia test in 2015 shows the average score of mathematics ability students is 386, the score is still at level two of math ability (OECD, 2016). In other words, Indonesia is the sixth lowest in all PISA participating countries surveyed. The capability of students viewed from the PISA test survey results shows that students have not yet reached the ability to get into and solve the problems from diverse information, and the use of diverse algorithms in problem solving. The TIMSS 2015 (Trends in International Mathematics and Science Study) research data also concludes that Indonesian students' mathematical thinking ability is at the bottom level, which is 45th out of 50 survey participants with 397 points. One of the factors causing the low performance of Indonesian students in PISA and TIMSS is the weak non-routine problem solving skills. PISA and TIMSS provide problems or problems that are not routine or require simple reasoning that causes conflict in students. The questions developed in TIMSS cover four cognitive domains, namely knowledge of facts and procedures, application of concepts, routine problem solving, and reasoning (Mullis et al., 2013). These problems cannot be worked out by students well. This is due to the problems presented in the form of story problems that are rarely studied by students. Students usually solve mathematical problems in the form of routine problems, which only require answers in the form of algorithmic calculations.

In general, problem-solving questions are presented in the form of contextual story problems, where the questions are based on students' real lives. One of the subjects that is difficult for students to understand is fractions. The results of the study conducted by Suhita (2013) explained that the part of students' mistakes in working on fraction story problems lies in the form of modeling, computing, and making conclusions. Other research also conducted by Ardiyanti et al. (2014), explained that the mistakes made by students in solving math fraction story problems were (1) understanding the questions (81.03%), (2) making mathematical models (56.03%), (3) computing (56.90%), and (4) drawing conclusions (57.76%).

One of the factors that influence student learning achievement is initial ability. This ability is one of the determining factors in the success of mathematics learning. The initial ability of students is important for teachers before starting the learning proces, so that the teacher can find out whether students already have the prerequisite knowledge to participate in learning and the extent to which students already know what material will be presented (Lestari, 2017). By knowing these two things, the teacher can design the learning proces well. This is in accordance with Ausubel's theory which states that the learning process will run well if the subject matter or new information can adapt to the cognitive structure that someone has (Lestari and Yudhanegara, 2015).

In solving mathematical problem solving problems, surely the ability of each child or individual is different, especially when viewed from gender differences. A study conducted by Fennema et al. (1998, p.4) found that in problem-solving skills in which girls tended to employ "concrete solution strategies such as modeling and counting, while boys tended to use more abstract solutions strategies that reflected conceptual understanding". In other words, the basic characteristics of the male's ability in solving problems is in reasoning and the female's ability is in precision and accuracy. This is in accordance with Krutetski's research (Sugiyanti, 2006: p. 3) which states that men are superior in terms of reasoning and have better mathematical and mechanical abilities even though this difference is only evident at a higher level. While women are superior in accuracy, thorough, careful and equality of thinking.

According to Susento (2006) gender differences not only result in differences in abilities in mathematics, but ways of gaining mathematical knowledge. Keitel (1998) states "Gender, social, and cultural dimensions are very powerfully interacting in the conceptualization of mathematics education, ...". This shows that gender, social, and culture influence mathematics learning. Gender differences have consequences not only in mathematics' abilities but also in a way of gaining mathematical knowledge itself. Male and female have differences in learning attitudes, for example female usually use more learning strategies compared to male. There is no essential difference between the ability of male and female, but the differences in attitudes that men and women have that make a difference in implementing learning strategies (Nurmaliah, 2013). Students who have high, medium and low abilities use different strategies to find solutions to problems. Students who have high abilities usually use strategies unexpectedly while students who have moderate and low initial abilities usually use long strategies and the results are sometimes less accurate (Nazariah and Abidin, 2017). Brandon (1985) states that influential gender differences in mathematics learning occur during elementary school age. Yoenanto (2002) explains that male students are more interested in mathematics compared to female students, so that female students are more anxious in dealing with mathematics compared to male students. These results may differ from the results of other people's studies because they really depends on the sample used. Therefore the gender aspect needs to be of particular concern in learning mathematics. In other words, a pleasant change in the mathematics learning process pays attention to aspects of gender differences so that male and female students are no longer afraid of mathematics. Gender differences in education in schools can influence achievement (the result of the learning process) of the students where based on some of the opinions above, male are more interested in mathematics and reasoning, while female are superior in accuracy and thinking precision.

Unger (Kusumawati, 2007) states that: (1) male prefer exact knowledge and abstract things than female, (2) male think more logically than female, (3) male are better able to overcome problems faced than female, (4) male are more aggressive than female, (5) male are more confident than women, (6) male are more objective than female, (7) male are less emotional than women, (8) male are more independent than female, (10) male are easier to distinguish between tastes and ratios than female. Brunner et al. (2007) found that girls slightly outperformed boys on reasoning abilities, but on specific mathematics abilities, boys had a significant advantage over girls. Student Assessment (PISA), Marks (2008), found that in most countries, "girls on average, have ... lower scores in mathematics than boys" and the average "across-country gender gap was 11 score points" in favor of boys (p. 96).

According to the National Center for Education Statistics (1997), based on data from the late 1980s to the early 1990s, women and men both liked math and science. According to Santrock (2003), although the average mathematical performance of men is higher than that of women, not all men have better mathematical performance than women. The issue of gender equality recognizes that women experience rapid development, making them equal to men in various life activities, supported by modern education policies that no longer contain gender discrimination. Based on the explanation above, the purpose of this research is to describe students' mathematical problem solving skills based on initial abilities and gender differences.

METHODS

Type of research

The type of this research is qualitative research. Type of qualitative research used is the descriptive qualitative research used case study. Cresswel (2015) Qualitative research is a research procedure that produces data in the form of written or oral words of people and behavior that can be observed. This search is an attempt to describe, record, analyze and interpret the conditions that occur. The problem described in this research is students' math problems solving skill. To describe the problem solving skill by giving the test that is by analyzing the results of math problem solving tests with indicator 1) understanding the problem, 2) plan problem solving, 3) solve the problem according to plan, and 4) re-checking. Qualitative research was chosen with the aim of analyzing students' mathematical problem solving skills based on gender differences in SD Negeri Sinduadi 1 Sleman Yogyakarta. In addition, by using qualitative research the researchers can communicate directly with respondents to find out mathematical problem solving in solving fraction problems so that the information obtained will be more accurate and in-depth.

Sample

The research subjects are the fifth grade students of SDN Sinduadi 1 Sleman Yogyakarta. The researcher determines the research subjects by using a purposive sample. From 27 students, 6 students were taken as samples containing 3 male and 3 female who had high, medium and low initial abilities. Moleong (2013: p. 224) states,"the purpose of the sample was chosen not to focus on the existence of differences which would later be developed into generalizations but to elaborate on the specificities that exist in the concotion of unique contexts". In addition, to explore information that will be the basis of the design and theories that emerge. Students' mathematical problem solving skills are grouped into three categories based on the pre-test result, namely high, moderate, and low. Pre-test results are grouped into high, moderate, and low categories according to Sudijono (2018).

Table 1. *Criteria for grouping students*

Criteria for grouping	Category
Score ≥ mean + 1 SD (Standard Deviation)	High
Mean – 1 SD < Score < Mean + 1 SD	Moderate
Score ≤ mean – 1 SD	Low

Data and data sources

The data used in this study are oral, written, and activity. Data in the form of oral information related to the results of interviews with students and teachers. Data in written form is related to the results of students' work in solving math problem solving about fractions. The question given is a matter of story about fractions as follows Mr. Togar is an employee at a company. Every month he receives the salary Rp.840,000.00. From his salary, 1/3 part is used for household needs, 1/5 part is used for tax payment, 1/4 part is used for children's education expenses, and the rest of the salary is saved. How much is Mr. Togar's money saved?. Activity data is data obtained from observations. The source of the data are taken based on test, interviews, observations, and results from literature studies.

The main data source of this research is the results of students' mathematical problem solving skills tests in solving problems of stories about fractions and the results of interviews with students. The results of this test are used to find out the problem solving skills of students in solving problem question. The question are about fractions in the form of stories. Interview guidelines are prepared to find out things that cannot be seen during the study. In addition, interview guidelines can make it easier for researchers to conduct question and answer between teachers and students. Problem solving ability assessment guidelines are used to obtain data about students' skills in solving the problems in the form of stories about fractions.

Data collection techniques

Data collection in this study was conducted by test and interview to get data about the information processing that is done by students in solving mathematical problems. The main instrument in this study is the researcher himself. Assistive instruments used in this study are: (1) problem solving test; (2) guidelines for assessing problem solving skills; (3) interview guidelines. The problem solving test is used to know mathematical problem solving in accordance with Polya's steps. This problem solving test consists of solving material problems about fractions. Students 'problem solving skills assessment guidelines are used to obtain data about students' mathematical problem solving skills in solving problem stories about fractions.

Interview guidelines are used to guide researchers in interview activities about students' problem solving skills.

Data validity

The validity of the data used in this study is technique triangulation. Technique triangulation is the researchers use different data collection techniques to get data from the same source (sugiyono, 2013). The technique used is the test and interview. The first researcher gave testing to students to find out mathematical problem solving skills. After completing the test, students are then interviewed to get more detailed and complete data. Student work are analyzed using guidelines for evaluating problem solving skills that refer to polya step indicators.

Procedure

First, the researcher do an observation of the learning proces and interview with the teacher. Second, researchers collect data using test instruments and interviews with students. Third, researchers conduct analysis by reducing and presenting data. Test results were analyzed using the Polya step problem solving skills assessment guidelines. The fourth researcher draws a conclusion. The following is an indicator of the problem solving Polya step (1973):

Table 2. *Polya step problem solving skills math indicators*

Stages	**Indicators**
Understanding the problem	Students are able to mention or write down information that is known and asked
Plan problem solving	Students can plan the steps to solve (strategy) the problem correctly
Solve problems according to plan	Students can complete problem solving according to the steps (strategy) that have been planned
Re-checking	Students can use the information available to recheck answers in different ways and make correct conclusions

The guidelines for assessing problem solving skills adapted from Harahap and Surya (2017) are as follows:

Table 3. *Guidelines for assessing problem solving skills*

No.	Stages	Score	Description
1.	Understanding the problem	1	Students mention things that are known and asked from the problem completely
		0.5	Students mention things that are known and asked from questions but are incomplete
		0	Students do not mention things that are known and asked questions
2.	Plan problem solving	1	Students use strategies appropriately
		0.5	Students use strategies that are less relevant and lead to wrong answers
		0	Students do not use strategy
3.	Solve problems according to plan	1	Students solve problems correctly
		0.5	Students solve problems but there are still errors or errors
		0	Students don't make problem solving
4.	Re-checking	1	Students make conclusions correctly
		0.5	Students make inaccurate conclusions
		0	Students don't make conclusions

Minimum score= 0, Maximum score = 4 on scale of 0 to 100

$$score = \frac{score\ obtained}{maximum\ score} x\ 100$$

The score obtained represents the score of problem solving skills. After obtaining the final score on the problem solving skills test, the researcher determines the category / score criteria obtained by the students. Giving criteria aims to find out the category of students' skills in solving problems. Criteria of test scores is according to Arikunto (2013) which have been modified as follows:

Table 4. *Criteria for problem solving skills*

Criteria Interval Score	Category
80-100	Very good
65-79,99	Good
55-64,99	Enough
40-54,99	Less
0-39,99	Very poor

RESULTS

Categorizing Initial Abilities

The results of the categorization of initial abilities are shown in table 5.

Tabel 5. *Initial ability category*

Category	**Number**
High	5
Moderate	9
Low	13
Total	27

Based on table 5, from the work of 27 subjects, there are 5 subjects who have high initial ability, 9 subjects who have moderate initial ability, and 13 subjects who have low initial ability. Most subjects did not solve the problem correctly and did not apply Polya's steps.

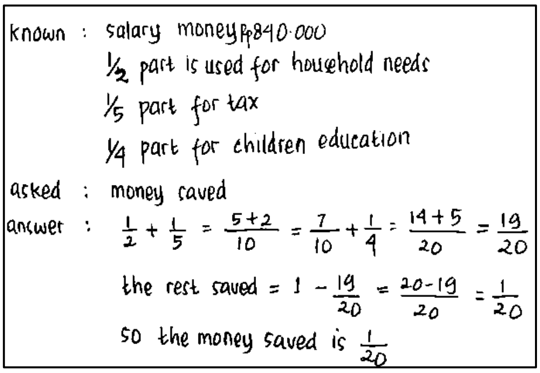
From the result above, 2 students from each ability were taken to become subjects of research that included male and female for data analysis on the use of Polya's problem solving steps. So the saubject of this study is 1 male student with high initial ability, 1 male student with moderate initial ability, 1 male student with low initial ability. Likewise with female subjects, 1 female student with high initial ability, 1 female student with moderate initial ability, 1 female student with low initial ability. Subjects were taken based on the results of the pre-test and assessment of the teacher who taught them.

Description of the test results of mathematical problem solving skills

The measurement indicators of mathematical problem solving skill consists of four stages: 1) understanding the problem, 2) plan problem solving, 3) solve the problem according to plan, and 4) re-checking. The results of the test and interview of problem solving skill of mathematics obtained the following :

Mathematical Problem Solving Skills Male students High Initial Ability

To see mathematical problem solving skills that have high initial ability conducted tests and interviews. The following are results of the work of male subjects high initial ability:



known : salary money Rp840.000
$\frac{1}{2}$ part is used for household needs
$\frac{1}{5}$ part for tax
$\frac{1}{4}$ part for children education
asked : money saved
answer : $\frac{1}{2} + \frac{1}{5} = \frac{5+2}{10} = \frac{7}{10} + \frac{1}{4} = \frac{14+5}{20} = \frac{19}{20}$
the rest saved $= 1 - \frac{19}{20} = \frac{20-19}{20} = \frac{1}{20}$
so the money saved is $\frac{1}{20}$

FIGURE 1. *The results of the work of male subjects high initial ability*

From Figure 1 it can be seen that the subject understand the problem which is by mentioning all of the information from the question. The subject write what is known from the question which is the amount of the salary, Rp.840,000, ½ part is used for household needs, 1/5 part is for tax, ¼ part is for children's education and the question is about the rest of the money to be saved. Then the subject solves the problem by calculating all the needs and the whole salary was changed into 1 whole part. Furthermore the subject solves the existing problem by subtracting one whole part (salary) by the sum of all needs. The subject also explaines the results of his conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following excerpts of interviews with subjects female high initial

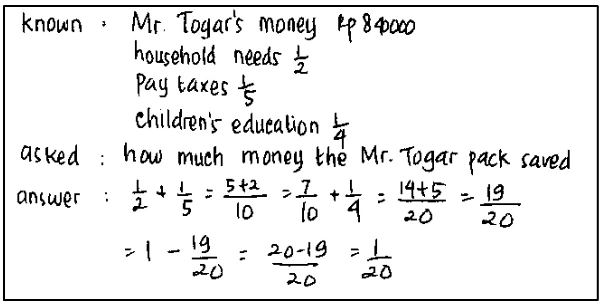
Researcher: How do you solve the problem?

Subject: I look for the total amount of money used by Mr. Togar, then to find the remaining savings which is one minus the total sum of the money

Based on the results of tests of mathematical problem solving skills (figure 1) and interviews shows that subjects are able to understand the problem. Subjects can determine what is known and what is asked from the given problem, subjects are able to select their knowledge that is used to understand problems able to plan problem solving, able to solve problem solving in accordance with the planned steps and the results are also right, able to check answers that has been obtained.

Mathematical Problem Solving Skills Male students Moderate Initial Ability

To see mathematical problem solving skills that have moderate initial ability conducted tests and interviews. The following are results of the work of male subjects moderate initial ability:



known : Mr. Togar's money Rp 840000
household needs $\frac{1}{2}$
Pay taxes $\frac{1}{5}$
children's education $\frac{1}{4}$
asked : how much money the Mr. Togar pack saved
answer : $\frac{1}{2} + \frac{1}{5} = \frac{5+2}{10} = \frac{7}{10} + \frac{1}{4} = \frac{14+5}{20} = \frac{19}{20}$
$= 1 - \frac{19}{20} = \frac{20-19}{20} = \frac{1}{20}$

FIGURE 2. *The results of the work of male subjects moderate initial ability*

From Figure 2 it can be seen that the subject understands the problem by mentioning all the information contained in the problem. The subject writes down what is known, namely a salary of Rp.840,000, for household needs ½ part, for tax 1/5 part, for children's education ¼ part and the question is about the rest of the money to be saved by Mr. Togar. Then the subject plan problem solving by calculating all needs and the whole salary is changed to 1 whole part. Furthermore the subject solves the existing problem by subtracting one whole part by the sum of all needs. The subject does not make conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following are excerpts of interviews with moderately capable subjects:
Researcher: Are you sure about your answer? how do you check your answer is correct?
Subject: Yes, i am sure. Do not know ma'am

Based on the results of tests of mathematical problem solving skills (figure 2) and interviews, subjects were able to understand the problem. Subjects can determine what is known and what is asked from the given problem, able to plan problem solving, able to solve problems appropriately, have not been able to check the answers already obtained.

Mathematical Problem Solving Skills Male students Low Initial ability

To see mathematical problem solving skills that have low initial ability conducted tests and interviews. The following are results of the work of male subjects low initial ability:

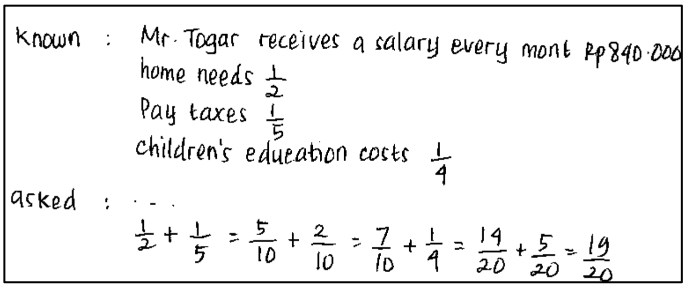

known : Mr. Togar receives a salary every mont Rp840.000
home needs $\frac{1}{2}$
Pay taxes $\frac{1}{5}$
children's education costs $\frac{1}{4}$
asked : . . .
$\frac{1}{2}+\frac{1}{5}=\frac{5}{10}+\frac{2}{10}=\frac{7}{10}+\frac{1}{4}=\frac{14}{20}+\frac{5}{20}=\frac{19}{20}$

FIGURE 3. *The results of the work of male subjects low initial ability*

From Figure 3, it can be seen that the subject does not understand the problem correctly, namely he does not mention all the information contained in the problem. The subject only writes down what is known, namely the salary of Rp.840,000, - for household needs is ½ part, for tax 1/5 part, for children's education ¼ part. The subject does not write what is asked. The subject immediately resolves the problem and does not make conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following excerpts of interviews with subjects low initial ability:
Researcher: What is asked of the problem, why is it not written?
Subject: I don't know ma'am

Based on the results of tests of mathematical problem solving skills (figure 3) and interviews, subjects were able to understand the problem. The subject can determine what is known and can't mention the thing asked from the given problem, unable to plan problem solving, unable to solve problems correctly, not yet able to check the answers already obtained.

Mathematical Problem Solving Skills Female students High Initial ability

To see mathematical problem solving skills that have high initial ability conducted tests and interviews. The following are results of the work of female subjects high initial ability:

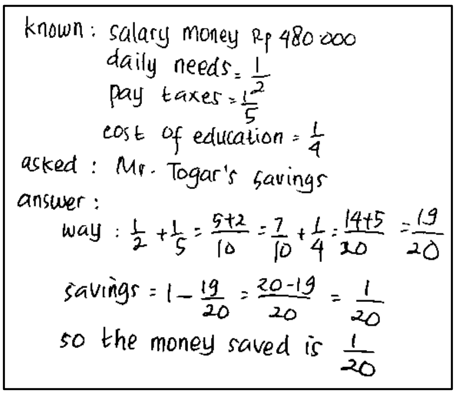

known : salary money Rp 480.000
daily needs = $\frac{1}{2}$
pay taxes = $\frac{1}{5}$
cost of education = $\frac{1}{4}$
asked : Mr. Togar's savings
answer :
way : $\frac{1}{2}+\frac{1}{5}=\frac{5+2}{10}=\frac{7}{10}+\frac{1}{4}=\frac{14+5}{20}=\frac{19}{20}$
savings $= 1-\frac{19}{20}=\frac{20-19}{20}=\frac{1}{20}$
so the money saved is $\frac{1}{20}$

FIGURE 4. *The results of the work of female high initial ability*

From Figure 4 it can be seen that the subject understands the problem by mentioning all the information contained in the problem. The subject writes what is known, namely the salary of Rp.840,000, - for household needs is ½ part, for tax 1/5 part, for children's education ¼ part and the question is about the rest of the money to be saved by Mr. Togar. Then the subjects calculating all needs and the whole salary is changed to 1 whole part. Furthermore the subject solves the existing problem by subtracting one whole part by the sum of all needs. The subject does not make conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following excerpts of interviews with subjects high initial ability:
Researcher: How do you check that your answer is correct?
Subject: I examined the answers from the beginning by calculating them again

Based on the results of tests of mathematical problem solving skills (figure 4) and interviews that subjects are able to understand the problem. The subject can determine what is known and what is asked from the given problem, able to plan problem solving, able to solve the problem according to the planned steps and the results are also right, able to check the answers already obtained. Subjects check by examining step by step the answers to each answer.

Mathematical Problem Solving Skills Female students Moderate Initial ability

To see mathematical problem solving skills that have moderate initial ability conducted tests and interviews. The following are results of the work of female subjects moderate initial ability:

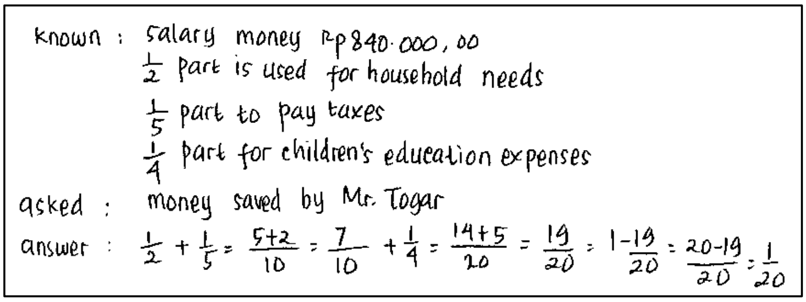

known : salary money Rp840.000,00
$\frac{1}{2}$ part is used for household needs
$\frac{1}{5}$ part to pay taxes
$\frac{1}{4}$ part for children's education expenses
asked : money saved by Mr. Togar
answer : $\frac{1}{2} + \frac{1}{5} = \frac{5+2}{10} = \frac{7}{10} + \frac{1}{4} = \frac{14+5}{20} = \frac{19}{20} : 1 - \frac{19}{20} = \frac{20-19}{20} = \frac{1}{20}$

FIGURE 5. *The results of the work of female moderate initial ability*

From Figure 5 it can be seen that the subject understands the problem by mentioning all the information contained in the problem. The subject writes what is known, namely the salary of Rp.840,000, - for household needs, which is ½ part, for tax 1/5 part, for children's education ¼ part and the question is about the rest of the money to be saved by Mr. Togar. Then the subject calculates all needs. Furthermore the subject solves the existing problem by subtracting one whole part by the sum of all needs. The subject does not make conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following are excerpts of interviews with subject female high initial ability:
Researcher: what is known and asked of the problem?
Subjects: known that is ½ part for household needs, 1/5 part to pay taxes, ¼ part for education costs. What was asked was the remaining money saved by Pak Togar

Based on the results of tests of mathematical problem solving skills (figure 5) and interviews that subjects are able to understand the problem. The subject can determine what is known and what is asked from the given problem, has not been able to plan problem solving, is able to solve the problem appropriately, is able to check the answers already obtained.

Mathematical Problem Solving Skills Female students Low Initial ability

To see mathematical problem solving skills that have low initial ability conducted tests and interviews. The following are results of the work of female subjects moderate initial ability:

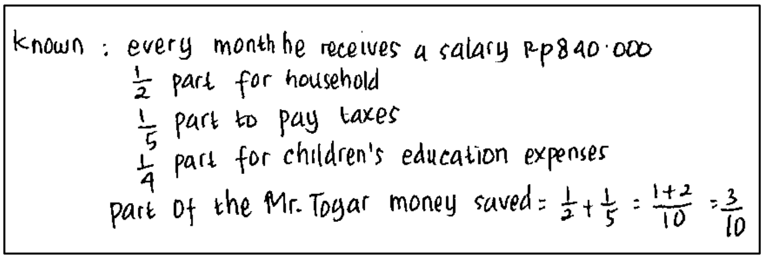


FIGURE 6. *The results of the work of female low initial ability*

From Figure 6 it can be seen that the subject understands the problem by mentioning all the information contained in the problem. The subject writes what is known, namely the salary of Rp.840,000, for household needs ½ part, for tax 1/5 part, for children's education ¼ part and does not write what is asked from problem. The subject does not plan to solve the problem. The subject immediately completes the answer by adding up several parts of the needs. But the subject does not write down what is asked. The subject does not make conclusions.

To clarify the results of students' answers, interviews were conducted between researchers and students. The following excerpts of interviews with subjects female high initial ability:
Researcher: What are your plans for solving this problem?
Subject: don't know ma'am

Based on the results of tests of mathematical problem solving skills (figure 6) and interviews that subjects are able to understand the problem. The subject can determine what is known and can't mention the thing asked from the given problem, unable to plan problem solving, unable to solve problems correctly, not yet able to check the answers already obtained.

From the six subject answers above, students' mathematical problem solving skills can be presented in the following problem solving skills assessment table:

Table 5. *Assessment of students' mathematical problem solving skills*

Skills	Subject assessment																	
	Male									Female								
	High initial ability (S1)			Moderate initial ability (S2)			Low initial ability (S3)			High initial ability (S4)			Moderate initial ability (S5)			Low initial ability (S6)		
	1	0.5	0	1	0.5	0	1	0.5	0	1	0.5	0	1	0.5	0	1	0.5	0
Understanding the problem	√			√				√		√			√				√	
Plan problem solving	√			√					√	√					√			√
Solve problems according to plan	√			√				√		√			√				√	
Re-checking	√					√			√	√			√					√

Based on table 5, it can be seen that subjects S1, S2, S4, and S5 have the skills to understand the problem well. Subjects S1, S2, S4, and S5 understand what concepts are used to solve existing problems. While S3 and S6 do not understand the problem well. Subjects, S1, S2, and S4 plan well the problem solving of related material. Whereas S3, S5, and S6 do not plan for problem solving. Subjects S1, S2, S4, and S5 solve problems well. S3 and S6 have not been able to solve the problem. S1, S4, and S5 are able to check the answers already obtained. Whereas S2, S3, and S6 have not been able to check answers again. From the above table it can be concluded that only S1 and S4 meet all four criteria of good and correct problem solving skills. S3 and S6 have not been able to apply Polya's problem solving steps properly. The following are recapitulation of student problem solving skills

Table 6. *Recapitulation of student problem solving skills in solving story problems*

Subject	Category
S1	Very good
S2	Good
S3	Very poor
S4	Very good
S5	Good
S6	Very poor

Based on table 6 it can be concluded that subjects S1 and S4 have very good solving skills. Subjects S2 and S5 have good solving skills. Whereas S3 and S6 have very poor of problem solving skills. So, students who have low initial mathematical ability have not been able to apply mathematical problem solving with Polya steps

Polya problem solving (1973) there are four steps, namely understanding the problem where students can determine the things that are known and asked of the problem, (2) making a plan of resolution; (3) implement the solution according to plan; (4) rechecking. The results of the above study indicate, mathematical solving skills between men and women there are differences but not significant. The results of this study indicate that there are mathematical problem solving skills differences between male and female but they are not significant. The initial ability influence students in solving mathematical problems. Students who have high initial mathematical abilities are able to apply Polya's steps better than students who have moderate and low initial abilities. Based on the results of tests of mathematical problem solving skills in solving word problems about fractions, female subjects from each category answered the test questions in sufficient detail in understanding problems and problem solving compared to male subjects. This is in accordance with Zubaidah (2013) which explains that female have a higher level of learning scores than male. Female are more motivated and work more diligently than male. This is also supported by a research conducted by Shalihah (2015) which says that there are differences between male and female students in solving problems, namely in planning problem solving. Male students are less thorough and get incorrect calculation results, while female students are more careful in doing calculations and get the right results.

The research conducted by Gallagher & De Lisi (1994) shows that male and female students of high mathematical abilities use different solution strategies on math problems. Female students outperform male students on conventional problems and male students outperform female students on unconventional problems (Gallagher & De Lisi, 1994). Research of Brown & Kanyongo (2010) indicated that while male and female did not differ with regard to the perception of the school environment, educational values and goals, and general academic self-concept, they differ significantly on the persistence and mathematics self-concept factors. Female tend to persist more, but hold lower mathematics self-concept than boys. On the other hand, study Preckel, et.al (2008) showed that gender differences in self-concept, interest, and motivation in mathematics are more prevalent in gifted than in average-ability students. On the other hand, male tend to have better performance than female (Orton, 1992: 124). Benbov and Stanley (Orton, 1992: 123) state that gender on mathematics learning outcomes is due to male mathematical abilities are superior, which in turn is related to greater ability of male in spatial tasks so that in mathematical topics certain male can get higher scores than female' scores, such as fractions, geometry, and geometry problems, whereas female are better at verbal skills. Other research results, the findings indicated that while female performed a higher general academic achievement in school courses than male (Bursal, 2017).

On the other hand, there is a much larger consensus on the interaction of gender and academic achievement variables. There have been an increasing number of studies in recent years that report differences in the academic success levels in favor of girls (Bursal, 2013; Martin et al., 2012; Mullis et al., 2012; Yıldırım et al., 2013). The reports of the most comprehensive academic achievement studies around the world, such as Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA), also repeatedly cite girls as having higher academic achievements than boys in their latest reports (Martin et al., 2012; Mullis et al., 2012; OECD, 2010; 2013).

In addition there are some notes about mathematical problem solving skills based on students' works with the results of the interview. The first skills is understanding problems. Here the initial ability of students influence the completion of mathematical problem solving. If students have low initial conceptual ability, they will have difficulty understanding the problem, especially changing the information in the story problem into the form of a mathematical model. Tuohimaa, et al. (2008) states that reading skills influence the skills in understanding the problems. Students are unsure how to translate problems according to mathematical models, excessive cognitive burdens arise for a variety of reasons, at least related to general weaknesses in working memory in low-achieving students (De Jong, 2010)

The second skill is to plan problem solving. In this step, the skills to plan the problem solving are still low. Most students immediately solve problems without writing problem planning. From the results of the interview, students do not know what strategies to use. This study proves that it is important for teachers to introduce various strategies to them for teaching problem solving such as Polya's steps. Students cannot solve problems well if they do not have various problem solving skills. This is in line with research by Hattikudur et al. (2016) that the benefits of learning various procedures are very good when students compare these procedures. They have alternatives when they plan and find solutions. Cabanilla-Pedro et al. (2004) emphasize that the use of statistical problem solving strategies can improve students' analytical skills. With different strategies maintaining meaningful ways of learning mathematics (Intaros et al., 2013).

The next skill is to solve problems, students who have high initial ability and are able to solve the given problem. However, students who have low initial ability have difficulty in calculating fraction results. This result is in line with the theory put forward by Gagne et al (2005) which states that "in solving the problem requires complex rules or high-level rules and high-level rules can be achieved after mastering the rules and concepts previously defined". Turmudi (2008) states that to look for problem solving students must utilize their prior knowledge, and through this process they will often develop new mathematical understanding. In addition, viewed from the results of student work, female students are more thorough and complete in writing problem-solving steps than men. However, research conducted by Jamiah (2016) shows that male students have better problem-solving abilities compared to women, male students are more thorough and more complete in writing problem-solving steps compared to female students. While the research conducted by Sugiyanti (2006) obtained the results that the difference in mathematical problem solving abilities lies in subjects with high mathematical abilities, namely female subjects still make arithmetic errors while male subjects do not do arithmetic operations. In other words, the difference depends on the subject.

The fourth skill is rechecking. Students who have high initial ability can conclude or rewrite the answers they get. While students who have moderate and low initial ability cannot conclude or rewrite the answers they have obtained. In line with Thevenot & Barroillet's opinion, in reviewing the answer, an individual must understand the contextual situation described in the problem, track the information, examine numerical values in the relational structure of the storyline, and finally do the calculation again. These stages certainly require complex thinking.

Students find difficulty in solving problems because: 1) the difficulty of turning words into mathematical solutions makes them do not understand the purpose of the problem; 2) Lack of mastery of various strategies in solving problems; 3) Lack of mastery of the concept of a low fraction count so that they cannot solve the problem: 4) Lack of practice in reviewing the results of calculations.

Suggestion for the results of the research that have been presented can be used as input for educators and educational activists to find learning strategies to improve the quality of problem solving skills based on Polya's steps. The results of this study may differ from other studies because it depends on the sample and area of research.

DISCUSSION and CONCLUSIONS

The conclusions of this study are: (1) Mathematical problem solving skills of male student with high initial ability (S1): student is able to understand problems. Student can determine what is known and asked by the given problems. Student is able to select knowledge that is used to understand the problem. Student is able to plan problem solving. He is able to solve the problem in accordance with the planned steps and the results are also right. He is able to recheck the answers already obtained. Therefore S1 include in very good category; (2) Mathematical problem solving skills of male students with moderate initial ability (S2): Student is able to understand the problem. He can determine what is known and what is asked of the problem given. He is able to plan problem solving. He is able to solve problems correctly. He has not been able to recheck the answers already obtained. Therefore S2 include in enough category. (3) Mathematical problem solving skills of male students with low initial ability (S3): student is able to understand problems. He is can determine what is known and what is asked of the problems given. He is unable to plan problem solving. They are unable to solve problems correctly. He has not been able to check again answers already obtained. Therefore S3 include in very poor category; (4) Mathematical problem solving skills of female students with high Initial ability (S4): student is able to understand problems. She cans determine what is known and asked of the given problems. They are able to plan problem solving. She is able to solve problem in accordance with the planned steps and the results are also right. She is able to recheck the answers already obtained. Student check by examining the step by step answers to each answer. Therefore S4 include in very good category; (5) Mathematical problem solving skills of female students with moderate initial ability (S5): student is able to understand problems. She is determine what is known and what is asked of the problems given. She has not been able to plan problem solving. She is able to solve problems appropriately. She is able to recheck the answers already obtained. Therefore S5 include in good category; (6) Mathematical problem solving skills of female students with low initial ability (S6): student is able to understand problems. Student can determine what is known and asked of the problems given. She is unable to plan problem solving. She is unable to solve problems correctly. She have not been able to check the answers already obtained. Therefore S6 include in very poor category. From these results it can be said there are differences between male and female in mathematical solving skills but are not significant. Mathematical problem solving skills of high ability students are better than moderate and low ability.

Students show difficulty in solving problems because: 1) students' difficulty in converting words problems into mathematical sentences makes them not understand the pupose of the problem; 2) students show lack of mastery of various strategies in solving problems; 3) students show lack of mastery of the concept of a low fraction count so that they cannot solve the problem: 4) students show lack of practice in reviewing the results of calculations.

It is suggested that the results of the research that have been presented be used as input for educators and educational activists to find learning strategies to improve the quality of problem solving skills based on Polya's steps. The results of this study may differ from other studies because it depends on the sample and the place where the research was conducted.

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