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Characteristics of Students In Resolving Word Problems Based On Gender

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Abstract: *This study aims to analyze student errors in resolving word problems, which are then formulated into characteristics of student errors according to gender. The subject selection was done randomly from male and female students of grade VII who made mistakes in solving the questions. Research data from the test results of 2 items word problem type. The form of student error is based on misconceptions, procedures, and techniques. The results showed the students' misconceptions, don't understand question commands, do not write information correctly, misinterpret question information, do not simplify fractions correctly, do not understand the value of fractions, misunderstand number signs/symbols and do not understand number signs/symbols, incorrectly determine signs/symbols of operations. Procedural error, incorrectly determining the settlement operation Technical errors, incorrectly using calculation operation marks, incorrectly performing calculation operations, incomplete settlement steps, incomplete simplification, incorrect simplification. Technical errors, namely calculations are not in accordance with the command, less careful (careless) writing answers, errors in writing answers and it do not match the command questions (conclusion). The reason is not understanding the reading and not being familiar with the questions. Students' understanding and knowledge of reading have an important role in identifying, interpreting, and even selecting or determining completion strategies.*

Keyword: *Form of Student Error, Problem Solving, Word Problems*

INTRODUCTION

Mathematics is a integrated from various disciplines (Nurhikmayati, 2019). For example is in the field of science and technology where its developmalet uses number theory, probability theory, or algebra. Therefore, one of the goals of learning mathematics in school is to build skills in problem solving (Fatqurhohman., et al, 2020), and students are required to increase their understanding of the concepts being studied and use the ideas in their completion (Fatqurhohman., et al, 2017).

In the classroom learning process, male and female students have different abilities in absorbing their knowledge (Yazidah, 2017). In addition, students are also required to master a number of learning materials through related problems. To explore further, the author made observations in several schools, one of which was in junior high school by giving problems related to word problem fractions, because these problems were assumed to provide an overview of students' understanding and mastery of the problems given. The results obtained showed that the students' mastery of the concept of fractions was still low, this can be seen from the results of the students' answers that students unconsciously still had difficulties and also made many mistakes from operations, completion steps and final answers that did not match the instructions for the questions. Therefore, a teacher must often conduct self-evaluation, both from teaching methods / strategies and giving questions according to the ability level of students so that there are no recurring mistakes.

An error is a deviation from something that has been determined (Aryani & Maulida, 2019). Analyzing the mistakes is done by observing, identifying, and classifying them with certain rules (Astuty & Wijayanti, 2013).

According to Lusiana (2017) that the decline in student scores is due to errors when understanding lessons, where student scores are one of the components of the evaluation of classroom learning which is applied through the completion of related questions (Fatqurhohman, et al, 2020), and the characteristics of difficulties. Students learn mathematics related to the process of grouping, operating, and calculating (Jamaris, 2014: 186). Furthermore, it was revealed from some of the findings of previous research about students' mistakes in solving the questions including, Farida (2015) states that students' mistakes in understanding information about questions, procedures or inconsistencies in interpreting the results of answers through their mathematical models, (Ramlah et al, 2016; Suciati & Wahyuni, 2018; Pradini, 2019) regarding misconceptions, facts, principles, and procedures, (Saputro, 2016) regarding misuse of operations and carelessness / negligence, (Abdullah et al, 2015; Magfirah et al, 2019, Mulyani & Muhtadi, 2019) regarding errors in transforming problems, process skills, and writing the results (coding).

Based on previous research, no one has focused on the characteristics of errors in solving questions based on gender. The researcher assumes that if the teacher knows the characteristics of student errors seen from gender, it will be very helpful in designing methods / strategies and providing problems that can train and accustom students to using their skills. Gender differences in solving math problems from the cognitive aspect show that female students have a cautious, hesitant, structured attitude and male students make decisions hastily, are less systematic, and less tidy (Indrawati & Tasni, 2016). This is what can have an influence on solving the problems given later. Based on the educational curriculum, the cognitive aspect is one of the benchmarks for assessment in child development because it relates to a person's level of thinking through rational abilities in the form of the ability to recognize or remember, understand, apply, analyze, or evaluate the concepts, processes, methods studied. Therefore, the ability of students to solve problems is one of the main components in learning mathematics, because its application in everyday life can develop cognitive aspects such as analytical, critical, careful and creative thinking.

Berk (2013) states that gender characteristics are formed from perceptions and expectations of environmental pressures and cognitive work in the form of types, stereotypes, identities, and gender roles. The gender roles relate to male and female, in which female are more likely to participate in literature or economics, and male in the exact / applied fields. So that gender differences (male and female) in problem solving are assumed to have an impact on the results both from the selection of the concept and the use of the procedure for solving it.

The results of the research by Meilani and Pujiastuti (2020), Dorisno (2019), Siswandi, et al (2016) show that the percentage of male students' errors is greater than that of female in solving steps and the results in solving math problems. According to Smetackova (2015) that male students tend to use strategies for spatial and mathematical abilities (abstraction), and (Hidayat & Dwiningrum, 2016; Mulyani & Muhtadi, 2019) female students tend to use verbal strategies, (Indrawati & Tasni, 2016) because most female students have more memory and memory, are diligent / diligent, can divide their time (between playing and studying). This is what gives rise to differences in skills in solving math problems seen from differences in emotional, behavioral, thought patterns and intelligence (Ambarwati et al, 2014; Zhu, 2007).

Based on previous research, this study aims to analyze and describe students' mistakes when solving problems, which are then formulated into the characteristics of the

form of student errors and their causes. The error characteristic in question is a written description of the form of student error in solving the problems.

METHOD

This research is a descriptive study using a Mixed Methods Research. The subjects in this study were 100 grade VII students and 2 randomly selected subjects who were considered to be representative of the male and female groups. The research data were obtained from the results of the test answers which consisted of 2 question items. The test questions given are in the word problems of fraction which are used to analyze the form of student errors.

Table 1. Test Questions

No	Test Questions
1	Maria has 24 oranges. $\frac{3}{8}$ part is kept in the refrigerator, $\frac{1}{3}$ is given to her sister and how many oranges can be eaten of Maria?
2	Dina, Dewi, and Ratih are in one line. Dina stands at the very front, Dewi stands $\frac{3}{4}$ meters behind Dina, and Ratih stands $\frac{2}{3}$ meters behind Dina. What is the distance between Dewi and Ratih?

From the student answer data, the researcher analyzed and calculated the number of students who answered correctly, wrongly, or did not answer each question item. Meanwhile, the data chosen by the researcher were students' answers that were wrong and were grouped into categories of student error forms. The categories determined by the researcher include namely: (1) misconceptions: related to students' understanding of mathematical concepts, (2) procedural errors: related to the use of procedures or steps to solve, (3) technical errors (calculations): related to accuracy in calculations (operation) and writing the final answer. Indicators of student error forms are shown in table 2 below.

Table 2. Indicator of Student Error

No	Form of Error	Indicator
1.	Concept	<ul style="list-style-type: none"> ○ Doesn't understand both the numerators and denominators ○ Incorrect fractional operation
2.	Procedural (process)	<ul style="list-style-type: none"> ○ The completion step is not according to the question command
3.	Technique (calculation)	<ul style="list-style-type: none"> ○ Error writing down answers

RESULT AND DISCUSSION

The results of this research in quantitative and qualitative analysis. The process of quantitative analysis is carried out by showing the number and percentage of correct answers, wrong answers, or non-response. The main focus is on student errors based on gender (male's and female's students). The process of qualitative analysis is carried out by showing the error in the results of the students' answers which refer to the error category and describing the components of the error.

The percentage of student answers to each question item is shown in Table 3 below.

Table 3. Percentage of Student Answers

Item Test	Student Answers (%)					
	Right (n=100)		Wrong (n=100)		Didn't (n=100)	
	M	F	M	F	M	F
1	40	34	9	14	1	2
2	42	38	8	12	0	0

Male (M) = 50 students, Female (F) = 50 students

Based on Table 2 that in the question item 1. The percentage of students who answered correctly 74%, namely male as much as 40% greater than female as much as 34%, the percentage of students who answered incorrectly 23%, namely male's as much as 9% smaller than female's as much as 14%, and the percentage of students who did not answer 3%, namely male as much as 1% smaller than female as much as 2%. In question item 2, the percentage of students who answered correctly was 80%, namely male's as much as 42% greater than female's as much as 38%, the percentage of students who answered incorrectly 20%, namely male's as much as 8% less than female's by 12%, and students who did not answer none or 0%. The percentage of item 1 and 2 shows that male's students who answered correctly were greater than female's students, male's students answered incorrectly less than female's, and male's students who did not answer were also smaller than female's students. From the percentage of the results of the answers to item 1 and 2, it can be said that the understanding, skills, and accuracy of male's students towards questions are better than that of female's. This is in contrast to the results of the research by Meilanawati and Pujiastuti (2020) that the ability of female's students is better than that of male's in solving math problems.

The percentage of each male's and female's student's error form based on the question items is shown in Table 4 below:

Table 4. Percentage of Student Error Forms

Item Test	Student Error Forms (%)					
	Concept		Procedural (process)		Technique (calculations)	
	M	F	M	F	M	F
1	2	7	3	3	4	4
2	3	5	2	3	3	4

Male (M) =, Female (F)

Based on Table 3, the biggest student error in question items 1 and 2 lies in concept errors of 9% and 8%, followed by technique (calculation) as much as 8% and 7%, then procedural (process) as much as 6% and 5%. According to Magfirah., et al (2019) that most students make misconceptions incorrectly using the formula or inverse and misinterpreting the problems. Errors in interpreting the questions cause students to have the opportunity to make carelessness in their calculations (Amalia & Hadi, 2020), due to the limited understanding of students in identifying problem information and choosing the solution strategy (Pradini, 2019).

The following is an example of the answers of male's students (M) and female's students' answers (F).

$24 - \frac{3}{8} - \frac{1}{3} = 24 - \frac{9}{24} - \frac{8}{24} = \frac{7}{24}$	$24 - \frac{3}{4} - \frac{1}{3} = 4\frac{4}{5} - \frac{3}{4} - \frac{1}{3} = 3\frac{10}{5}$
Male	Female

Picture 1. Item Test 1

<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> $\frac{3}{4} - \frac{2}{3} = \text{①}$ </td> <td style="width: 50%; padding: 5px;"> $\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ②}$ </td> </tr> <tr> <td style="padding: 5px;"> $\frac{8-9}{12} = \frac{-1}{12}$ </td> <td></td> </tr> </table>	$\frac{3}{4} - \frac{2}{3} = \text{①}$	$\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ②}$	$\frac{8-9}{12} = \frac{-1}{12}$		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> $\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ①}$ </td> <td style="width: 50%; padding: 5px;"> $\frac{3}{4} + \frac{2}{3} = \frac{5}{7} \text{ METER} \text{ ②}$ </td> </tr> </table>	$\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ①}$	$\frac{3}{4} + \frac{2}{3} = \frac{5}{7} \text{ METER} \text{ ②}$
$\frac{3}{4} - \frac{2}{3} = \text{①}$	$\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ②}$						
$\frac{8-9}{12} = \frac{-1}{12}$							
$\frac{3}{4} - \frac{2}{3} = \frac{1}{4} \text{ meter} \text{ ①}$	$\frac{3}{4} + \frac{2}{3} = \frac{5}{7} \text{ METER} \text{ ②}$						
Male	Female						

Picture 2. Item Test 2

Based on the results of the answers it is shown for each item of the question that the forms of student error are, namely: misconceptions, procedural errors (process), and technique errors (calculations).

Misconceptions

Concept errors relate to students' understanding of mathematical concepts. In item 1, male's and female's do not understand the question questions and misinterpret or translate question information that is converted into a simpler form. In addition, they did not write down what should be done to determine the completion step, but instead immediately took the completion step and made mistakes. In this case, students do not understand the meaning of the question, which means that the question is to determine the part to be stored in the refrigerator as much as $\frac{3}{8}$ of 24, look for the part then determine the $\frac{1}{3}$ part given to Maria's sister. However, male's and female's directly determine the completion step using the subtraction operation for the part without writing the correct information on the problems.

In item 2, male's and female's also did not understand the question questions and did not write them down correctly. Students here do not understand the order of the value of the fraction, for which they directly determine operations and perform calculations. This means that students' understanding of the concept of numbers is still low, which means that male has not been able to distinguish signs or symbols in the value of a number against the value of a distance or position between Dewi and Ratih (questions informations) which is written with a negative value (-), female's made mistakes in interpreting the question using the addition operation and subtraction operations to determine Dewi's with Ratih (questions informations) of position. It's can be said that students in understanding the question information are still lacking. According to Lestiana., et al (2016) that the ability or skill in understanding information or reading is very important, because it is used as material for interpreting or translating or even identifying question information correctly and accurately. *So that the limitations of understanding a reading can result in students ignoring the keyword questions that can affect the completion process.*

Procedural Errors (process)

Procedural (process) errors relate to the steps to solve or a person's inability to manipulate information when solving problems. In problem item 1, male's and female's incorrectly determine the operation that causes the error to change or simplify fractions and the steps for solving that are carried out are not sequential or regular. Male's and female's are supposed to use the multiplication operation to determine the portion stored in the file using $\frac{3}{8}$ of the 24 and then determine the portion given to Maria's sister (questions informations) using $\frac{1}{3}$ of the 24. In fact they use the $\frac{3}{8} - \frac{1}{3}$ subtraction operation (male's) and $\frac{3}{4} - \frac{1}{3}$ (female's), then the results are to reduce the number of fruit purchased.

In question item 2, male's and female's also incorrectly determined the operation which caused Dewi's position with Ratih (questions informations) to not match the question information. Male's incorrectly determines the order of the size of the fraction value in operation, namely $\frac{3}{4} + \frac{2}{3}$ which should be $\frac{2}{3} - \frac{3}{4}$. Where as female's uses the addition operation $\frac{3}{4} + \frac{2}{3}$ and and the subtraction operation $\frac{3}{4} - \frac{2}{3}$. In subtraction operation, male's directly subtracts the numerator by the numerator and denominator by denominator without equating the denominator. It's said that students do not understand the concept of fractions correctly, either from the term fraction, the order of fraction values or using operations. According to Ratna, et al (2015) and Pradini (2019) that the error that often arises in solving problems is changing to a simple form and compiling systematic steps which are caused by the skill to understand the questions.

Technical Errors (calculations)

Technical errors (calculations) relate to accuracy in calculations (operations) and writing the final answer. In question item 1, male's did the calculation by $\frac{3}{8} - \frac{1}{3}$ which then reduced the number of pieces purchased $24 - \frac{3}{8} - \frac{1}{3}$ which resulted in $\frac{7}{24}$, while female's wrote the wrong part of the first fraction which should have been $\frac{3}{8}$ written $\frac{3}{4}$ by doing the calculation $24 - \frac{3}{4} - \frac{1}{3}$ which results $3\frac{10}{5}$. So that the results of the male's dan female's answers do not match the questions, besides that they also do not provide final conclusions from the answers obtained according to the question orders, where the purpose of the question is to determine the part to be stored in the refrigerator, the part that will be given to Maria's sister (questions informations), and the remainder of the division.

In item 2, there are two different male's answer results from determining the value of the fraction and using the fraction operations. In the first male's does not understand the value of a fraction which causes the result to be negative (-), the second male's when performing the operation does not understand the terms of the numerator and denominator which in carrying out the operation does not equalize the denominator and immediately performs the subtraction operation on the numerator and the denominator uses the largest denominator against the two fractions. In the female's answer there are also 2 different ones, the first female's uses a $\frac{3}{4} - \frac{2}{3}$ subtraction operation where the subtraction operation uses a numerator with a numerator and a denominator with a denominator. The second female's uses the addition operation $\frac{3}{4} + \frac{2}{3}$ which is the process of the operation by adding the numerator by the numerator and the denominator with a denominator. So that the results of the male's and female's answers do not match the questions either. In addition, they also did not provide the final conclusion from the answers obtained according to the order, namely determining the distance between Dewi and Ratih (questions informations).

Based on the results of these answers, students do not understand the concept of fractions, either from determining the value of a fraction, the term of a fraction, or being careless (careless) in using fraction operations which cause the results of the answers obtained are not in accordance with the order or the question asked. This is in line with the statemalet (Verzosa & Mulligan, 2014; Malihatuddarojah & Prahmana, 2019) that technical errors are mostly caused by inaccuracy in using operations and settlemalet steps, which have an impact on the results (Dasmarwan, 2020). The description of the form of student error for each item is shown in Table 5 below.

Table 5. The Description Of The Form Of Student Error

Form Of Error	Indicator	Descriptions	
		Male's Student (M)	Female's Student (F)
Conceptions	Doesn't understand both the numerators and denominators	<ul style="list-style-type: none"> ○ Don't understand the question command ○ Not writing down the information correctly ○ Does not simplify fractions properly ○ Don't understand the question command 	<ul style="list-style-type: none"> ○ Misinterpreted question information ○ Does not understand fractional values ○ Don't understand the question command
	Incorrect fractional operation	<ul style="list-style-type: none"> ○ Misunderstand number signs / symbols ○ Don't understand fractional values 	<ul style="list-style-type: none"> ○ Don't understand the signs / symbols of numbers ○ Incorrect operation mark / symbol
Procedural (process)	The completion step was not as ordered	<ul style="list-style-type: none"> ○ Incorrect calculation operation ○ Incomplete settlement steps ○ Not simplifying completely 	<ul style="list-style-type: none"> ○ Incorrect use of calculation operation mark ○ Misleading
Technique (calculations)	Error writing down answers	<ul style="list-style-type: none"> ○ The calculation was not as ordered ○ Error writing answers ○ Answers not as ordered 	<ul style="list-style-type: none"> ○ Not careful in writing answers ○ The answer does not match the question command

CONCLUSION

In this study, the characteristics of the forms of student error when solving word problems are based on three errors, namely concept errors, procedural errors (process), and technical errors (calculations). In concept errors, The mistakes that students often make include not understanding the question command, not writing the information correctly, misinterpreting the question information, not simplifying the fraction correctly, not understanding the value of fractions, misunderstanding number signs/symbols and not understanding number signs/symbols, incorrectly determining signs/operation symbol (negative/positive). In procedural errors (processes), Incorrectly using calculation

operation marks, incorrectly performing calculation operations, incomplete settlement steps, incomplete simplification, incorrect simplification. In technical errors (calculations), the calculation does not match the command, is not careful (careless) writes the answer, the error in writing the answer and the answer is not in accordance with the question command (conclusion).

Based on the mistakes made by students, the main cause is the lack of or even not understanding the reading and being unfamiliar with the questions, not understanding the concept of operations properly which results in incorrectly determining and carrying out operations in calculations, not being careful (careless) in calculations, and can not manage the times properly resulting in insufficient time given to provide / write a summary answer according to the question command. In other words, an error and difficulty are something that cannot be separated, because if someone experiences a difficulty, it is likely that they will make an error which results in the results obtained not as expected. In addition, understanding the reading or problem is the main key in the completion process.

As an educator, at least know the mistakes that students often make, so that it can help in providing self-evaluation, both in terms of learning and students' understanding of the questions given. The use of word problem form questions is a question that is classified as difficult for students who have never been introduced / solved, because these questions require more understanding than ordinary questions, so that these questions can find out or even measure the level of student understanding in interpreting, compiling or determining the steps for solving, as well as making various solutions of ideas developed through understanding.

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