JMPM: Jurnal Matematika dan Pendidikan Matematika
10 (1), 1-16
https://www.journal.unipdu.ac.id/index.php/jmpm

Analysis of Student Misconceptions using the *Four-Tier Diagnostic Test* on One-Variable Linear Equations and Inequalities

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Received: 12 August 2023 | Revised: 26 January 2025
Accepted: 6 February 2025 | Published: 20 February 2025

Abstract

This study investigates students' misconceptions about linear equations and inequalities of one variable. Using a descriptive quantitative approach, data were collected from 160 seventh-grade students in Gowa Regency, South Sulawesi, through a four-tier diagnostic test. Analysis revealed that 28% of students had misconceptions, categorized into six types. Additionally, 11% showed false positives, 12% false negatives, 44% lacked knowledge, and only 5% had a correct scientific understanding. The identified six types of misconceptions included fundamental algebraic concepts such as variable degree, variable concepts, coefficients, constants, and inequality notation. Students struggled with algorithm use, function generalization, and properties of inequalities, indicating a lack of algebraic thinking. These findings highlight the need for targeted instructional strategies to address students' conceptual misunderstandings and improve their mathematical reasoning.

Keywords: *algebra; diagnostic test; math misconceptions*

How to cite: Yansa, H., Parera, A., Retnawati, H., Nasharuddin, Janna, M., Mulyati, & Syarif, S. R. (2025). Analysis of student misconceptions using the four-tier diagnostic test on one-variable linear equations and inequalities. *JMPM: Jurnal Matematika dan Pendidikan Matematika*, *10*(1), 1-16. https://dx.doi.org/10.26594/jmpm.v10i1.3985.

INTRODUCTION

Students often experience an understanding that is different from the concepts of experts, both those with below-average abilities and those who excel (Yang & Sianturi, 2019). This condition is called misconception miskonsepsi (Barke et al., 2019). In educational practice, misconceptions are a very fatal problem (Raharjo et al., 2019) because these understandings are obstacles to the acceptance of new concepts (Yang & Sianturi, 2019; Ojose, 2015). Even if there are repeated errors in students in solving problems, it indicates the occurrence of misconceptions, which makes the basic competencies of the subject difficult to achieve (Wartono et al., 2016). Therefore, the discussion of misconceptions is still important to study.

In recent decades, many national and international studies have analyzed misconceptions related to mathematical concepts (Patricia & Zamzam, 2019; Arroisi & Fachrudin, 2017; Herutomo, 2017; Gradini, 2016; Byrd et al., 2015). Findings from Mehmetlioglu (2014) study showed that students in grades 7 and 8 experienced more misconceptions related to fractions than grade 6. There is a tendency that the addition of new knowledge does not guarantee the displacement of initial misconceptions. Because every time they get information from textbooks, movies, the internet, material from teacher delivery or direct interaction in the environment but without in-depth reasoning (Fadllan et al., 2019). So Ojose (2015) concluded, students will always experience misconceptions because of the nature of mathematics.

Students' inability to connect new knowledge with prior knowledge in the cognitive brain network, one of the forerunners of misconceptions. They experience confusion in converting one form of representation to another (Mania et al., 2018) or the use of incorrect rules and excessive application inference (Ojose, 2015) and lack of basic knowledge and misinterpretation of symbols (Radatz, 1979; Zaini & Retnawati, 2019). For example, in Rohimah (2017) findings, students experienced confusion in the use of signs (symbols). Students are more focused on the value obtained without paying attention to the symbols used, they think $x = 2$ and $x < 2$ are the same. Some of them understand the equal sign (=) and inequality has no effect in determining the solution set.

The material of linear equations and inequalities, the concept often experiences misconceptions. 53.5% of students experience misconceptions in algebraic material which begins with misconceptions in solving equations (Djam'an et al., 2019) and misconceptions in simplifying linear equations of one variable (Kurniati et al., 2018). Of course, these findings are only a small part of the misconceptions that occur, but no matter how simple math misconceptions will mushroom affecting the concepts of other related subjects. Teachers must immediately identify the location of the misconception so that it does not carry over to the next class. Furthermore, remediation is carried out before the concept becomes more firmly entrenched in long-term memory (Treagust, 1988).

Some teachers have difficulty identifying the problems faced by students, making it difficult to find and reveal the location of misconceptions (Zuya, 2015). Basically, misconceptions cannot be observed directly (Jubaedah et al., 2017). According to Griffard & Wandersee (2010), it is very difficult to identify the location of misconceptions if only assisted by traditional instruments without revealing the reasons for choosing answers. After that, a two-level diagnostic test was developed to overcome the weaknesses of traditional tests (Adadan & Savasci, 2012). Diagnostic tests are used to review, describe the location and causes of learning difficulties or misconceptions (Alyusfitri & Wahyuni, 2017).

Two-tier diagnostic tests identify the location of misconceptions experienced by students before, during and after learning takes place (Bunawan et al., 2015). Furthermore, it shifted to three levels with the advantage of revealing the level of student confidence in the answer (Arslan et al., 2012). The limitation of the three-level test is that it only presents one level of student confidence in answering, even though they could have a different response at the second level. So Caleon & Subramaniam (2010) and Kaltakci (2012) developed a four-tier diagnostic test by adding a confidence rating at the fourth level and considered to describe students' conceptions and misconceptions. The test proved to be effective in identifying the location of misconceptions compared to two and three tiers, and was able to measure lack of knowledge more accurately (Kaltakci-Gurel et al., 2017).

The four tier diagnostic test will identify misconceptions with false positive and false negative. It is called false positive when the student answers correctly but the reason is wrong or the student's understanding is mixed with misconceptions that show the

https://dx.doi.org/10.26594/jmpm.v10i1.3985

illogicality of the information from the actual concept (Rizki & Setyarsih, 2022), or vice versa with false negative when answering incorrectly but not giving the correct scientific reason (Kaltakci-Gurel et al., 2017). Several studies in Indonesia have used four-level tests to measure misconceptions, but focused on science education such as physics, biology and chemistry subjects (Diani et al., 2019; Jubaedah et al., 2017; Ismail et al., 2015). For mathematics itself, especially the discussion of linear equations and inequalities of one variable has not been found.

The purpose of this study is to focus on applying the four tier diagnostic test to analyze student misconceptions in solving equations and linear inequalities of one variable so that it can fill the literature on the variety of student misconceptions related to the material of equations and linear inequalities of one variable. This study not only aims to analyze students' misconceptions in linear equations and inequalities of one variable, but also to provide practical recommendations to teachers in identifying and overcoming these misconceptions. The results of this study are expected to serve as a foundation in the development of misconception-based learning strategies and contribute to improving the quality of mathematics learning in Indonesia.

RESEARCH METHODOLOGY

The type of research used in this study is descriptive quantitative. The sample selection used saturation sampling by involving the entire population (Muhammad, 2015) namely junior high school students in grade VII in Gowa Regency, South Sulawesi, totaling 160. The data collection method used was the test method with a four tier diagnostic test instrument in the form of multiple choice and analysis of student work operations on problems solved in a procedural way. In the four tier diagnostic test instrument at the first level of the test, presenting the concept of linear equations and inequalities of one variable; at the second level, confidence in the responses given at the first level; at the third level, the reasons for the answers at the first level, and at the fourth level, confidence in the reasons at the third level. Below are presented the 10 question items used in data collection.

Items 1:

1st tier: The degree variable of the equation $x - 4 = 3x - 1$ is....

A. 0 C. 2

B. 1 D. 3

2nd tier: Are you sure about your answer?

A. Sure

B. Not sure

3rd tier: Reason:

A. The equation if operated then obtained the degree

B. The variable in the equation is only x

C. The variable in the equation has no degree

D. The highest degree of the variable is not written because it is 1.

4th tier: Are you sure about your answer?

A. Sure

B. Not sure

Items 2:

1st tier: If $6x - 4 = 5$ then the variable, coefficient, and constant are ... respectively.

A. $6x;\ 5;\ 4$ C. $x;\ 6;\ 9$

B. $x;\ 6;\ -4$ and 5 D. $x;\ 6x;\ 4$ and 5

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2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. Equation form $ax + b = c$ where a, b, and c are real numbers with x as variable, a is coefficient (number that contains variable), b and c are constants (number that does not contain variable).
B. Equation form $ax + b = 0$ dwhere a and b are real numbers and x is the variable, a is the coefficient (the number that contains the variable), b is the constant (the number that does not contain the variable)
C. Contains every element of the equation
D. If the equation is operated then the variable, coefficient and constant are obtained.

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 3:

1st tier: If $2x - y = 5$ then determine the variable, coefficient and constant respectively! And is the equation a linear equation with one variable?
A. x and y ; 2 and -1; 5; Yes C. x and y ; 2 and -1; 5; No
B. $2x$ and y ;5 dan -1; No D. $2x;\ y;\ 5$; Yes

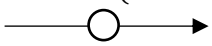
2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

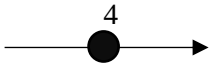
3rd tier: Reason:
A. The equation contains x and y which are variables (variables), 2 and -1 are coefficients (numbers that contain variables), 5 is a constant (numbers that do not contain variables), so it is a linear equation with one variable.
B. The equation contains x and y which are variables, 2 and -1 are coefficients (numbers that contain variables), 5 is a constant (numbers that do not contain variables), so it is not a linear equation with one variable.
C. The equation contains $2x$ which is a variable, y is a coefficient (a number that contains a variable) and a constant (a number that does not contain a variable), so it is a linear equation with one variable.
D. The equation contains $2x$ and y which are variables, 5 is a coefficient (a number that contains a variable) and -1 is a constant (a number that does not contain a variable), so it is not a linear equation with one variable.

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 4:

1st tier: The interval of the solution set drawn on the number line that satisfies the inequality $6x - 8 < 2(2x - 8)$ is

A. 

B. 

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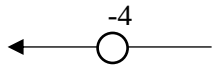
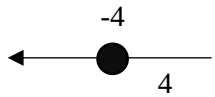
C. 

D. 

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason;
A. The interval of the solution set of the inequality is to the right because it is positive
B. The interval of the solution set of the inequality points to the left because it is negative
C. The value that is a member of the solution set is subsumed and a true value statement is obtained
D. The value that is a member of the solution set is subsumed then the same value is obtained in both segments

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 5:

1st tier: If $\frac{(2x-3)}{3} = \frac{(3x+1)}{2}$ then the value of x that satisfies is ...

A. 11
B. $\frac{-9}{5}$
C. $\frac{4}{5}$
D. 2

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. If the values are subsumed in the equation, the same value is produced in both segments.
B. If the values are substituted into the equation, the value of x is produced
C. Substituting values into the equation produces a true statement
D. If a value is substituted into the equation, a value that satisfies

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 6

1st tier: The solution to the inequality $\frac{4q+3}{5} > q - 2$ where q is a member of the set of integers is ...
A. q < 13 or q € {0,1,2,3,4,5,6,7,8,9,10,11,12}
B. q < 13 or q € {1,2,3,4,5,6,7,8,9,10,11,12}
C. q >13 or q € {14,15,16, ...}
D. q = 5 or q € {5}

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. If the values are subsumed, the statement is true and the integers start

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from 0.
B. If the values are substituted, the statement is true and the integers do not contain 0.
C. If the value to be substituted is the same value in both segments and the integers are equal to the natural numbers
D. If the value is substituted, it will produce the same value in both segments and the number starts from 0.

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 7:

1st tier: Novi's money is 5 times Heri's money. Novi's money is Rp. 25,000 more than Heri's money. If Heri's money is denoted by Rp. x then the mathematical model that fits the situation is ...
A. $5x = 25.000$
B. $5x + x = 25.000$
C. $x = 5x + 25.000$
D. $5x = x + 26.000$

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. Novi and Heri's money multiplied by 5
B. Novi's money is bigger than Heri's money.
C. Novi's money is 5 times Heri's money, so Heri's money is added to Novi's money.
D. $5x$ represents that Novi's money is 5 times Heri's money while $x + 25.000$ represents that Novi's money is 25,000 more than Heri's money.

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 8:

1st tier: A rectangle is 4 cm longer than its width and its perimeter is not more than 35 cm. If the width of the rectangle is denoted by y then the mathematical model that fits the situation is ...
A. $8 + 4y \leq 35$
B. $8 + 4y < 35$
C. $4y < 35$
D. $4 + y \leq 35$

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. Using the circumference formula and the word “no more” means excluding the number 35.
B. Using the circumference formula and the word “no more” means that it can contain the number 35.
C. Length and width are multiplied and the word “no more” means excluding the number 35.
D. Length and width are summed and the word “no more” means that it can contain numbers

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4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 9:

1st tier: Wiwin wants to build a fish pond whose base is a rectangle with a width 4 meters less than the length. If Wiwin wants the circumference of the base of the pond to be 56 meters so that the fish in the pond will move more freely. The length of the base of the pond is ...
A. 14 cm
B. 16 cm
C. 56 cm
D. 224 cm

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. The product of width and perimeter
B. The length of the pond = its perimeter
C. Using the formula for the perimeter of a rectangle
D. Using the rectangle area formula

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

Items 10

1st tier: A rectangle is $(3x - 2)$ cm wide by 9 cm long. The area of the rectangle is not more than 63 cm^2. The solution set of the equation formed if the value of x is a member of the set of integers is ...
A. $x = \{1,2,3,4,5,6,7,8\}$
B. $x = \{1,2,3\}$
C. $x = \{1,2,3,4,5,6,7\}$
D. $x = \{0,1,2,3\}$

2nd tier: Are you sure about your answer?
A. Sure
B. Not sure

3rd tier: Reason:
A. Using the area formula and integers including the number 0
B. Uses the area formula and the integers do not include the number 0
C. Uses the area formula and does not include 0 because the area is negative
D. Uses the area formula and does not include 0 because the area is negative

4th tier: Are you sure about your answer?
A. Sure
B. Not sure

The instrument was adapted from 10 questions of the three tier diagnostic test (Firman, 2016) on equations and linear inequalities of one variable. Furthermore, a level of confidence was added to the answer level so that it became a four tier diagnostic test, this addition refers to the development of a four tier diagnostic test by Jubaedah et al. (2017) and Ismail et al. (2015) which uses CRI: sure and not sure.

This addition is to distinguish conceptions, lack of knowledge, misconceptions, and misconceptions with false positives and false negatives that are more comprehensive (Kaltakci-Gurel et al., 2017). The grouping criteria in Table 1 follow the classification of the four-tier diagnostic test results, as outlined by Kaltakci (2012), as well as the scoring

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using dichotomous data (0,1). Score 0 for wrong and unsure answers while score 1 for correct and sure answers.

Table 1. Decisions Making on the Four-Tier Diagnostic Test

1st tier	2nd tier	3rd tier	4th tier	Decision for four-tier test
Correct	Sure	Correct	Sure	SC
Correct	Sure	Correct	Not Sure	LK
Correct	Not Sure	Correct	Sure	LK
Correct	Not Sure	Correct	Not Sure	LK
Correct	Sure	Wrong	Sure	FP Rarely MSC
Correct	Sure	Wrong	Not Sure	LK
Correct	Not Sure	Wrong	Sure	LK
Correct	Not Sure	Wrong	Not Sure	LK
Wrong	Sure	Correct	Sure	FN
Wrong	Sure	Correct	Not Sure	LK
Wrong	Not Sure	Correct	Sure	LK
Wrong	Not Sure	Correct	Not Sure	LK
Wrong	Sure	Wrong	Sure	MSC
Wrong	Sure	Wrong	Not Sure	LK
Wrong	Not Sure	Wrong	Sure	LK
Wrong	Not Sure	Wrong	Not Sure	LK

Description: SC: Scientific Conception; LK: Lack of Knowledge; FP: False positive; MSC FN: False negative; MSC: Misconception.

The scoring is done to analyze students' misconceptions. Data analysis used descriptive techniques that describe or describe student misconceptions on the subject of linear equations and inequalities of one variable.

RESULTS AND DISCUSSION

In the four tier diagnostic test, there are 6 indicators of questions to review students' concept understanding of linear equations and inequalities of one variable. The question indicators are presented in Table 2. Based on Table 2, all indicators that make up the understanding of the concept of linear equations and inequalities of one variable at the junior high school level have high misconceptions. The value is in the range of 8-50%.

After analyzing, students are mapped into five categories, namely the average student who has scientific conception, lack of knowledge, misconceptions, false positive and false negative. False negative is considered less fatal than false positive because it is associated with carelessness or lack of attention, students choose the wrong answer but accompanied by correct scientific reasons. In false positives, students choose the correct answer but with incorrect reasoning (Kaltakci-Gurel et al., 2017). And lack of knowledge is shown when students are not sure of the answer (Hestenes & Halloun, 1995).

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Table 2. Misconceptions on Each Indicator

Indicator	Number	Misconception (%)
Identifying variables, coefficients, constants and degrees of linear equations/inequalities of one variable	1,2	38
Knowing examples and non-examples of linear equations of one variable	3	48
Determining the value of a linear equation of one variable	4	50
Determine the value of a linear inequality of one variable	5,6	8
Transforming everyday problems related to linear equations of one variable into mathematical models	7,8	32
Solving everyday problems related to linear equations of one variable into mathematical models	9,10	33

The following Figure 1 presents the average understanding of student concepts based on responses to the four tier diagnostic test.

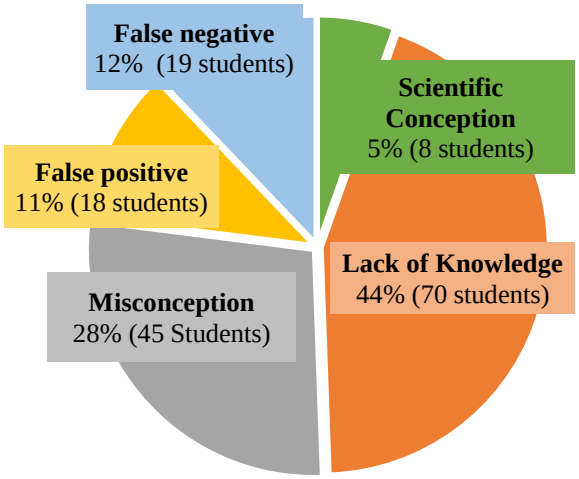

Figure 1. Categorization of Students' Responses

From the pie chart in Figure 1, it can be seen that the misconceptions experienced by students are much greater than those who understand and do not understand the concept of linear equations and inequalities of one variable. A total of 44% or 70 students have low understanding, 45 students (28%) have misconceptions, 19 (12%) have false negatives, 18 (11%) have false positives, and 8 (5%) students understand the concept. Then to examine the response of students' answers to each item, it is presented in the form of a graph in Figure 2, as done by Kaltakci-Gurel et al. (2017).

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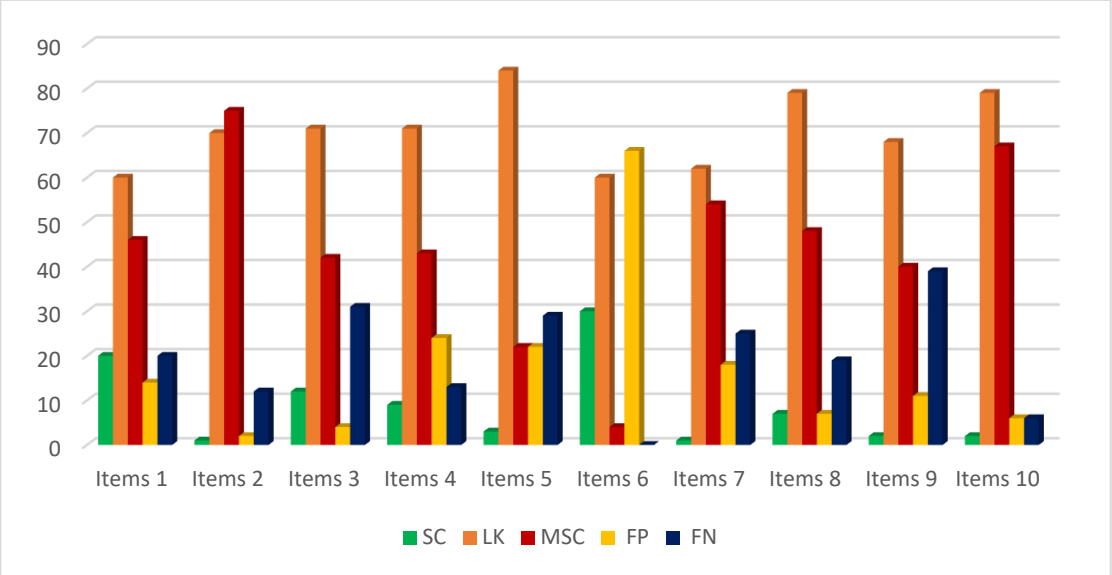

Notes: SC: Scientific Conception; LK: Lack of Knowledge; FP: False positive; MSC FN: False negative; MSC: Misconception.

Figure 2. Student Responses to the Four-Tier Diagnostic Test Items

Figure 2 shows a graph of the number of answers on each item of the four tier diagnostic test. Based on the graph, students' wrong answers tend to be caused by lack of knowledge and misconceptions. Of all the items, item 2 has the highest misconception of 47% students, followed by item 10 with 42% students. In Item 6, 19% of students answered correctly. So it implies that the item is better understood but there is a high false positive misconception in 41% of students. while the least understood item is item 7, only one student understands the concept.

Based on the analysis, there are six misconceptions experienced by students, namely:

1. Misconception of the concept of variable degree, variable, coefficient and constant
2. Misconception of the general form of the function of linear equations of one variable
3. Misconception of algorithm usage
4. Misconception of special properties of inequality
5. Misconception that the two segments of the inequality are equal
6. Horizontal Mathematization Misconceptions

It has been pointed out before that no matter how simple math misconceptions are, they can affect understanding at the next level and in other subjects. The quantitative analysis showed that half of the respondents had misconceptions and most of them did not understand the concept. The following describes the misconceptions experienced by students. Misconceptions that occur:

Misconceptions of the Concept of Variable Degree, Variable, Coefficient and Constant

In the indicator of identifying the degree of variables, variables, constant coefficients and degrees of the first one-variable linear equation/inequality is represented by items 1 and 2. Students have misconceptions in identifying the degree of the equation.

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The degree variable of the equation $x - 4 = 3x - 1$ is.... [items 1]

Only 28.7% of students answered correctly, while 88.8% believed the answer. Students who have misconceptions and do not understand the concept choose various reasons such as they believe the degree of the variable is obtained when operated or the variable in the equation does not have a degree.

Misconceptions on the concepts of variables, coefficients, and constants were found in item 2. In this item only one of the students who had an understanding of the concept, the rest were dominated by not understanding and misconceptions. The question for item two is as follows:

If $6x - 4 = 5$ then the variable, coefficient, and constant are … respectively [items 2]

Most of them believed that the answer was 6x;5;4 They were wrong in distinguishing between the three. The same error was also found in the study (Pramesti & Retnawati, 2019).These algebraic symbols are interchangeable with each other. Numbers that go together with letters are also called variables and numbers that stand alone or do not contain letters are also called coefficients. therefore 6x is considered a variable. this case also applies to item 3; presented with the equation 2x-y=5 students are again asked to determine variables, coefficients and constants. This misconception is quite fatal because the concept of variables is the most basic concept in algebra (Beeh et al., 2018).

Misconception of the General Form of Function of Linear Equation of One Variable

A problem is presented [items 3]:

If $2x - y = 5$ then determine the variable, coefficient, and constant, respectively! And is the equation a linear equation of one variable?

This misconception is the result of the misconception on variables, so they are confused in determining the number of variables in an equation. Some of them answered that the equation is a one-variable linear equation. This is what Usiskin (1999) refers to as difficulty in understanding the algebraic form of a function due to confusion in identifying the number of letters in the equation.

Misconception of Algorithm Use

The misconception of using algorithms is reviewed in the trial and error method used by students. this was found in problem solving (item 4) $\frac{(2x-3)}{3} = \frac{(3x+1)}{2}$, there were students replacing the variable x with all the values in the answer choices in order to produce a satisfying equation. This method is an alternative step if students are confused about where to start the operation. However, it is actually not very effective to use, especially if looking for two or more variables because it takes a long time.

Even though they got a satisfactory result, Brown & Quinn, (2006) classified it as an error of misusing the algorithm, they guessed instead of using the equation solving algorithm. According to him, this step does not show competence in proportional reasoning to solve problems. Dewi et al., (2023), Fauziyah (2023), dan Jusniani et al., (2024) in their study found that most students experienced confusion working on algebraic problems involving fractions. Basically they also still experience errors in the arithmetic thinking process

According to Filloy et al. (2004) this method may be used but shows students'

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procedural skills in solving systems of linear equations are low or fail in computational fluency (Brown & Quinn, 2006). Identifying students are not yet at the algebraic thinking stage. Based on the two levels of thinking in mathematics proposed by Herutomo (2017), namely arithmetic and algebra.

This condition also shows that students have difficulty in mathematical process skills. It has been mentioned in the study of Hadi et al. (2018) that in general this difficulty occurs when students perform operations and manipulate algebraic forms. Also called weakness in modifying algebraic forms (Sutiarso, 2019). Therefore, this finding can be the basis for teachers to re-maximize teaching, especially in understanding the solution of fraction-shaped algebraic problems.

Misconception of the Special Properties of Inequalities

The misconception of the special properties of inequalities was mentioned in Taqiyuddin et al. (2017) study when students continued to use the inequality sign when multiplying negative numbers in both inequality segments without changing it at all. This case was found in item 6 with the item question "The solution of the inequality $\frac{4q+3}{5} > q - 2$ where q is a member of the set of integers. Some of them answered $q > 13$ after seeing the student's solution paper, it turned out that they did not change the inequality sign (>) to (<) when multiplying both segments by -1. Though the sign of inequality changes, when multiplying or dividing both segments with negative numbers (As'ari et al., 2017).

Misconception that the Two Segments in the Inequality Are Equal.

Item 6 is the item that has the most false positive means the answer is correct, but at the level of wrong reasoning and confidence. 41% of students found the solution set of the equation $\frac{4q+3}{5} > q - 2$ is $q < 13$, motivated by the wrong reasoning that if the value is subsumed, it will produce the same value in both segments and the number starts from 0. They focus on q as the variable to be replaced. According to Rohimah (2017), this condition shows that students' thinking process has reached algebraic thinking. However, they experienced misconceptions because they interpreted that in an inequality between the right and left segments were of the same value or there was equality of values in the inequality. Teachers should explain more deeply about the meaning of inequality symbols $<, >, \leq, \geq$.

Horizontal Mathematization Misconceptions

Horizontal mathematization is a condition where students are wrong in converting sentences into mathematical models (notation) (Jupri et al., 2014). The misconception of changing story problems in the equation model is a problem that is quite a lot experienced by students, 33% have misconceptions, 11% false positives and 15.6% false negatives. This misconception was experienced in the story problem of linear equations and inequalities of one variable, especially in items 7, 8, 9 and 10. students were asked to model equations.

There was only 1 student who really understood converting everyday problems related to linear equations and inequalities of one variable into mathematical models. horizontal mathematization, also resulted in students experiencing errors in solving everyday problems related to linear equations of one variable into mathematical models. To improve teaching in the future, teachers must identify students' concept understanding more deeply. After that, the teacher conducts remediation and presents more applicative problems that are adapted to students' real life.

https://dx.doi.org/10.26594/jmpm.v10i1.3985

CONCLUSION AND SUGGESTIONS

Based on the results of research using the four tier diagnostic test instrument, it can be concluded that 28% of students experience misconceptions, including 11% experiencing false positive, namely answering correctly with the wrong reason, 12% experiencing false negative, namely answering wrong but at the level of reasoning answering correctly. 44% students have a lack of knowledge and 5% students have scientific conception. The variety of misconceptions experienced by students related to the concept of linear equations and inequalities of one variable are misconceptions of variable degree, the concept of variables, coefficients and constants, the general form of the function of linear equations of one variable, the use of algorithms, special properties of inequalities, assume both segments in inequalities are equal and horizontal mathematization.

Based on the misconceptions experienced by students, it is recommended that teachers explain and ensure students understand the basic concepts of algebra such as the concept of variable degree, variables, constants, coefficients, operations on fractions and mathematical representations. Of course, this misconception is quite high and there are probably many other misconceptions experienced by students in line with the many teaching methods used, diverse learning resources and others. It is very important to identify and analyze students' errors and misconceptions simultaneously. After that, the teacher conducts remediation and presents more applicative questions that are adapted to students' real lives. For further research, it is recommended to review various innovations or efforts to overcome students' misconceptions in learning mathematics.

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