

Analysis of Student's Error in Solving Linear Inequality

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ABSTRACT: The purpose of this study is to describe the analyses of errors that students make in solving Linear Inequality. The method used in this study is a qualitative descriptive method. Questions were given to 3 students of Mathematic program of Pahlawan University. The data collection techniques in this study were the results of students' written tests and the results of interviews related to the results of students' written tests. Based on the results of the research conducted, it is known that the types of student mistakes math in solving the linear inequality problem are: a) Conceptual errors making graphic error solution, error in using the concept of a variable that will be used, identify what is asked and choosing error symbol, and b) Procedural errors include: error in choosing the strategy to be used in problem solving, error in apply strategy to solve the problem and error in viewing return what is the solution obtained is in accordance with what known and asked. Based on the result, the students should be given a meaningful learning to not only memorize the formula but also solve the linear inequality.

Keywords: *Error Analysis, Problem Solving, Linear Inequality*

Submitted:01-05-2022; Revised:10-05-2022; Accepted: 21-05-2022

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DOI prefik: 10.55927

ISSN-E: 2828-1519

<https://journal.formosapublisher.org/index.php/eajmr>

INTRODUCTION

The existence of mathematics in education and in life is very important. People use mathematics to solve problems in their daily life. Math helps someone solve problems more effectively and efficiently. According to the NCTM (2000) the process of mathematical thinking in mathematics includes five main standards of competences include the ability to problem-solving, reasoning ability, the ability of connection, communication skills and the ability representation.

Mathematics becomes a nightmare for many students; also, mathematical inequalities are considered an important mathematical topic as a prerequisite for many subjects such as algebra, trigonometry and analytic geometry. Therefore it falls to the responsibility of educators to identify learning difficulties among students about the topics that should be given to students in the light of these difficulties (Giltas and Tatar, 2011).

Mathematics is a very important subject. This is signaled by the government that mathematics is becoming a compulsory subject in schools. Mathematics is one of the subjects taught in school. School mathematics is given to help students prepare yourself to be able to face changing circumstances inside life and in an ever-evolving world, through the practice of acting based on logical, rational and critical thinking (MKPBM Team, 2001).

Sriyanto (2007) states that school mathematics is taught also aims to prepare students to be able to use mathematics and mathematical mindset in everyday life and in studying Science. The purpose of mathematics education in schools is more emphasized on the arrangement of reasoning, the basis for forming attitudes, and skills in the application of mathematics.

A person cannot study mathematics well if he dislikes, or at least have an interest in mathematics. And a person cannot possibly like mathematics, if he does not know well what exactly is math. Likewise for students in mathematics learning. Students can't study math well if he does not like or at least have an interest in mathematics. Students may not like mathematics if they are not familiar with well what exactly is math.

Interests submitted by the National Council of Teachers of Mathematics (NCTM) and a review of aspects of the curriculum mentioned that solving problems is one of the main pillars in the study of mathematics in the learning process.

One material that is considered difficult by students is the absolute value equation and inequality material, indicated by the number of students who make mistakes in solving the problem (Budi & Nusantara, 2020). This is supported by research conducted by Almog & Ilany (2012) which states that students have difficulty in interpreting the concept of absolute value. Stupel (2015) explains that absolute value is a mathematical material that focuses on positive and negative numbers. In his research found that many students experienced misunderstandings and misunderstandings in solving absolute value problems caused by various kinds of errors.

Based on the results of the researcher's interview with one of the mathematics lecturers at Pahlawan University, it is known that many students still have difficulty in solving absolute value inequalities. From the results of the interview, it was also known that the most common errors found were students did not know how to solve the questions given. In addition, there are still many students who are not careful in the calculation process and get the wrong final result.

The explanation above shows that research related to analyzing student errors on inequalities material is important and interesting to do as an evaluation material so that it can minimize the occurrence of the same mistakes and improve learning quality. to be done as an evaluation material so as to minimize the occurrence of the same mistakes and improve the quality of learning.

THEORETICAL REVIEW

A Linear Inequality

In mathematics a linear inequality is an inequality which involves a linear function. A linear inequality contains one of the symbols of inequality. It shows the data which is not equal in graph form. But the students fail to understand that solutions that they obtained have meanings or relevance to the equation or to understand the underlying property or the meaning of the equality (Kieran & Sfard, 1999). Lim (2006) stated that as a result of students being taught to treat inequalities as equations, they might not be required to grapple with the meaning of the solution set.

Furthermore, Tsamir and Bazzini (2004) found that students' intuitive beliefs when solving inequalities interferes with their mathematical decisions hence their performance. They further stated that the students mainly believed intuitively that "inequalities must result in inequalities and that solving inequalities and equations are the same process".

The Analyse of Student's Error

Analysis is an investigative to see, to observe, to know, discover, understand, study, classify, and explore as well as interpret existing phenomena (Atim, 2008:6). An error is a deviation from what true or deviation from what has been set previously (Kamarullah, 2005:25). Rosyidi (2005) define error as a form deviation from what is considered right or a predetermined procedure. Meanwhile, according to Kurniasari (2007), error is a form of deviation to the right thing, the established procedure previously, or deviations from something expected.

Based on the opinion of Kamarullah, Rosyidi and Kurniasari then it can be concluded that error is a form deviation from what is considered right or deviation from something that has been previously agreed upon. Errors experienced by students in working on story problems mechanically includes misunderstanding the question, errors make mathematical models, mistakes do computing, and misinterpreting answers to mathematical sentences.

Identification of students' specific errors is especially important for student with learning disabilities and low performing students (Fuchs, Fuchs, & Hamlett, 1994; Salvia & Ysseldyke, 2004). By pinpointing student errors, the teacher can provide instruction targeted to the student's area of need. In general, students who have difficulty learning math typically lack important conceptual knowledge for several reasons, including an inability to process information at the rate of the instructional pace, a lack of adequate opportunities to respond (i.e., practice), a lack of specific feedback from teachers regarding misunderstanding or non-understanding, anxiety about mathematics, and difficulties in visual and/or auditory processing.

As for this study, researchers divide the type of error into 2, namely conceptual errors and mistakes procedural.

1. Conceptual errors are mistakes what students do in interpret facts, concepts, and principles. As for the indicators of conceptual error is a) error in identify the known, b) error identifying data relevant c) identify what is asked d) error in using the concept of a variable that will be used e) error made mathematical model f) choosing error symbol g) graphics error solution h) determining error extreme point.

Conceptual errors may look like procedural errors, but they occur because the student does not fully understand a specific math concept, such as place value (Ginsburg, 1987, as cited in University of Kansas). As such, bugs are more serious errors. To determine if an error is conceptual, teachers should check by asking the student to represent the problem with concrete objects or show and explain the steps used to solve the problem (Hudson & Miller, 2006).

2. Procedural errors are mistakes in compiling the steps systematic hierarchical to answer a problem a) error in choosing the strategy to be used in problem solving b) error in applying strategy to solve the problem c) operation error calculation d) error in viewing return what is the solution obtained is in accordance with what known and asked e) error conclude. Operation errors are errors in perform operations or calculations. The indicator is that students cannot using operating rules or calculations correctly. The error's analyse of the students mechanically are misunderstanding the question, errors make mathematical models, mistakes do computing, and misinterpreting answers to mathematical sentences (Rahardjo and Astuti, 2011: 14).

METHODOLOGY

This research is a qualitative descriptive study with three students as research subjects. The selection of the three subjects was based on the results of the written test. The three subjects of this study were students who made the most mistakes, the most varied variations in location, types and causes of errors, and were communicative. The instruments in this study, namely test questions and interview guidelines. Test and interview methods are data collection methods used in this study. Furthermore, the data obtained, both the result data and the results of the interviews were analyzed. The technique of analyzing data is carried out through three stages, namely the data reduction

stage, the data presentation stage and the withdrawal and conclusion stage. Analysis of data from student errors in solving inequality system based on the results of student work carried out by analyzing student work for all test items.

RESULTS

Based on the written results and interviews with all three subjects obtained data analysis as follows:

1. Conceptual error

To determine if an error is conceptual, the lecturer should check by asking the student to represent the problem with concrete objects or show and explain the steps used to solve the problem.

a. Making graph error solution

Based on the answer that have been written by student, there is an error made by student. The first error is making graph error solution. Examples of student response error is shown in Figure 1.

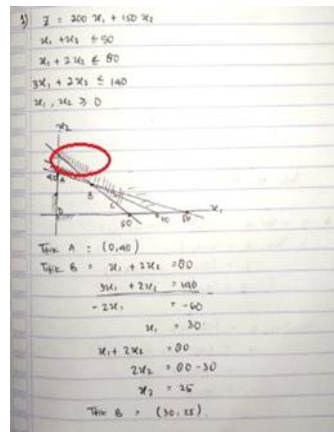


Figure 1

Based on the figure 1, the student makes an error in graphic. This error can be minimized by providing a variety of questions for students to practice. In this case, the student doesn't not understand, doesn't master the concept and careless.

b. Error in using the concept of a variable that will be used

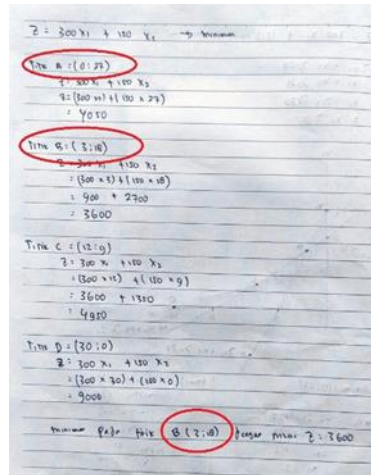


Figure 2

Based on the figure 2, the student makes an error in using the concept of a variable that will be used. The student cannot modify the sentence into a variable. After being asked about the written answers, the student could not give an appropriate reason. Then, the researcher asked about the concept of the variable, and it turned out that the student had not yet understood the concept of the variable.

c. Identify what is asked

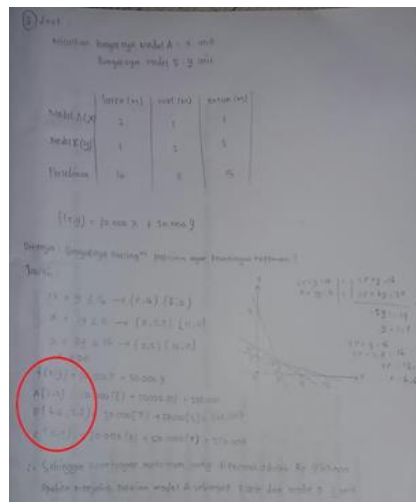


Figure 3

Based on the figure 3, the student makes an error in identify what is asked in the problem to determine the operation In problem solving, there are identify the given facts, the data steps that the student need to follow.

d. choosing error symbol

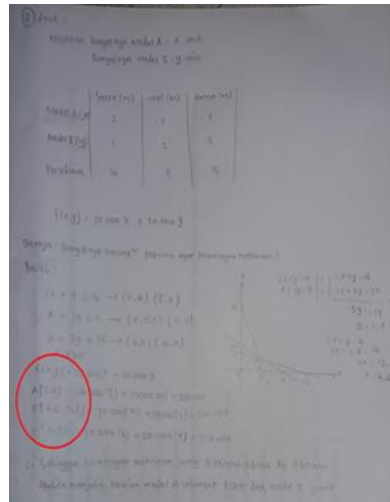


Figure 4

Based on the figure 4, the student make an error in symbol. Mathematical symbols manifest the representatives of mathematical ideas formulated through codes or symbols. Symbols that exist comprise numbers, operation counts, relational operators, and algebraic symbols. In addition, symbols represent the external dimensions of thoughts concerning on mathematical ideas.

This sort of error could be caused by some factors. First, the subject was unable to interpret the question related to the design of verbal representation requiring conversion to symbolic representation. Second, the subject did not acquire the basic concept of mathematics.

2. Procedural error

- a. Error in choosing the strategy to be used in problem solving

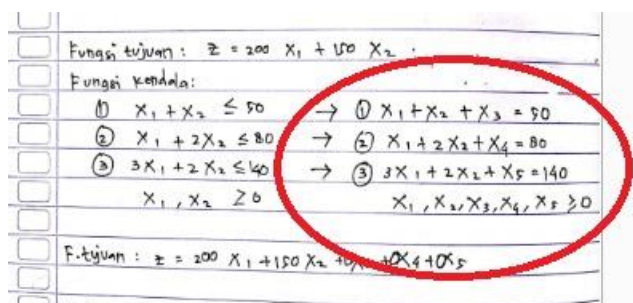


Figure 5

Based on the figure 5, the student has an error in choosing the strategy to be used in problem solving. By knowing the location and cause of errors students in problem solving, it will reduce errors made by the student. Thus the students' mathematical problem solving errors can be minimized.

This error can also occur because students do not understand the steps to solve linear inequality. The students do not get the meaning of the formula so that they cannot solve problems that are different from the one their teacher has taught or the completed problem as an example in a textbook. This error can be minimized by enabling students to understand the meaning of existing formulas, asking students to do all sorts of questions related to linear inequality, and reinforcing the understanding of prerequisite materials such as numbers.

- b. Error in apply strategy to solve the problem.

Title C = $x_1 + 2x_2 = 50$
 $3x_1 + 2x_2 = 140$

$$\begin{array}{r} 2x_2 + 2x_2 = 100 \\ 3x_1 + 2x_2 = 140 \\ -2x_2 = -40 \\ \hline x_2 = 40 \\ x_1 + 2x_2 = 50 \\ x_1 = 50 - 2(40) \\ x_1 = 50 - 80 \\ x_1 = -30 \end{array}$$

Title C = (10, 40)

Title D = (50, 0)

Title A = (0, 40)
 $Z = (700 \times 0) + (150 \times 40)$
 $Z = 6000$

Title B = (30, 25)
 $Z = (700 \times 30) + (150 \times 25)$
 $Z = 21000 + 3750$
 $Z = 24750$

Figure 6

Based on the figure 6, the student has an error in apply strategy to solve the problem. In addition to analyzing student errors in general, there are interesting things to note, namely misconception. Misconceptions are error about concept that students believe to be correct in problem solving. Error analysis is an instructional strategy that holds promise of helping students to retain their learning. Math strategies are basically how the students solve the problem. It's what's happening in their brain as they think through, and kind of the steps and procedures they are doing as they solve a problem.

- c. Error in viewing return what is the solution obtained is in accordance with what known and asked.

$Z = 300x_1 + 150x_2 \rightarrow \text{maksimum}$
 $3x_1 + x_2 \geq 27$
 $x_1 + x_2 \geq 21$
 $x_1 + 2x_2 \geq 30$
 $x_1, x_2 \geq 0$

• titik A (0 : 27)
 • titik B (3 : 18)
 $3x_1 + x_2 = 27$
 $x_1 + x_2 = 21$
 $2x_1 = 6$
 $x_1 = 3$
 $x_1 + x_2 = 21$
 $x_2 = 21 - 3 = 18$

Figure 7

Based on the figure 7, the student has an error in viewing return what is the solution obtained is in accordance with what known and asked. A solution is an assignment of values to the unknown variables that makes the equality in the equation true. In other words, a solution is a value or a collection of values (one for each unknown). Students' error is students' unintended incorrectness because they have no fully understood the subject. Most student errors are not due to unsureness, carelessness, or unique situational conditions.

DISCUSSION

The facts from the results of the study show that students experience misunderstanding of Linear Inequality and the definition of linear inequality. So that impressed that students only memorize procedural steps or do not understand strategy the solution. This is the same as the findings of previous researchers in the basic concept course mathematics that students are accustomed to memorizing formulas or fast methods at the previous level (Amir, 2015).

Students cannot answer the set of solutions correctly. The student experiencing misconceptions in understanding the concept of interval inequality in real numbers so they are wrong in writing the solution set as the final solution. in line with these findings, El-khateeb (2016) found students experiencing misconceptions and misunderstanding in solving inequality problems.

And it was found that students did not understand the use of linear inequalities in the procedural steps and there were students who did not do re-checking the set of solutions obtained. Because there are still many to be found the students' difficulties, then students should get more opportunities insdevelop their knowledge to solve mathematical problems (Widjajanti, 2009).

To minimize student's error, the lecturer can make improvements in the learning process, one of which is to emphasize the concept of students and guide and motivate students to practice answering questions. Identifying

students' consistent errors or misconceptions is the first step to providing remedial or corrective instruction. The lecturer can typically identify and describe specific errors, particularly in linear inequality and selecting appropriate instructional, is more challenging.

CONCLUSIONS AND RECOMMENDATIONS

Types of student mistakes math in solving the linear inequality problem are:

- a. Conceptual errors include: making graphic error solution, error in using the concept of a variable that will be used, identify what is asked and choosing error symbol.
- b. Procedural errors include: error in choosing the strategy to be used in problem solving, error in apply strategy to solve the problem and error in viewing return what is the solution obtained is in accordance with what known and asked.

Based on the result, the students should be given a meaningful learning to not only memorize the formula but also can understand the concept of linear inequality. The lecturer should give provision of materials for linear inequality that is easier understood by the students, involving students in learning, enabling students to understand the meaning of existing formulas, asking students to do all sorts of questions related to linear inequality, reinforcing the understanding of prerequisite materials, and providing a variety of questions for students to practice math.

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