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Analysis Of Student Errors On Algebraic Form Material Based On Kastolan Theory

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Abstract

Algebraic calculation operations are basic material that is the basis for studying other mathematical material, but there are still many students who still make mistakes in solving algebraic calculation operation questions. Therefore, it is necessary to analyze the errors made by students in working on algebraic calculation operations questions. This research aims to describe the errors made by students when completing algebraic operations according to Kastolan theory in solving algebraic arithmetic operation problems. This type of research is qualitative descriptive research. The data collection technique used was a test. The data analysis techniques used were: examining the results of students' answers by identifying and analyzing the types of errors made by students in answering questions related to the Kastolan error type; 1) Calculate the percentage of error for each type of error, 2) The results of the percentage level are classified based on the percentage of error, 3) The data that has been obtained is then calculated and will be carried out using descriptive analysis, 4) Make conclusions from the results of the analysis of students' errors in working on form operation questions algebra based on the Kastolan error type. Based on the research data and discussions obtained, 69% of conceptual errors were in the high category, 58% of procedural errors were in the sufficient category, and 59% of technical errors were in the sufficient category. It can be concluded that the mistakes that many students make when working on test questions are conceptual errors, namely errors in understanding the questions. Factors that cause students to make mistakes are not understanding the concept and not being able to apply the concept.
Keywords: *error analysis; kastolan theory; algebraic operations*

1. Introduction

Difficulty What to experience students in learn mathematics sourced from the fact that instead of building Knowledge About the concept mathematics, Students tend to memorize Mathematical concepts without knowing what meaning concept aforementioned (Supatmono, 2009). Three thing that cause Students have difficulty in learning mathematics, namely: (1) OConservation (calculation mathematics), (2) Intervention and (3) Extrapolation of implementation learn teach Determine How far success must be achieved in learning mathematics (Jamal, 2014). Kenedi et al., 2019 Stating that mathematics education is one of the learning subjects where it has a connection with concepts. One of the strategies that can be implemented in carrying out evaluations is distributing questions to students. After the evaluation is carried out, it can be found in the student answer section which is wrong related to the chapter discussed.

By learning mathematical material, the stages of learning implementation are important because at every level of education, students are accustomed to learning it (Novtiar & Aripin, 2017). By That's why, It is necessary to analyze the mistakes made by students in completing mathematical tasks.

Algebra is one of the mathematics materials taught explicitly at the junior high school level grade VII, which discusses structure, relationships and quantities. One of the algebra materials taught is

algebraic operations, and calculating operations are basic material and become the foundation for other mathematical materials (Dyson et al., 2015). The fact states that there are still many students who think that mathematics is a difficult subject because there are many formulas that must be memorized and understood. In line with this, students have difficulty in solving algebraic operation problems, resulting in low ability to solve algebraic operation problems, resulting in many errors (Yanto et al., 2014). In addition, students also have difficulty in doing algebra problems related to concepts and principles (Izmi et al., 2019).

Knowing the mistakes students make is one way educators understand students. Errors are a form of deviation from the correct answer, are systematic, and do not change, or in some areas are accidental (Meilanawati & Pujiastuti, 2020). Therefore, to describe students' difficulties in learning mathematics, it is necessary to analyze according to the type of student errors on facts, concepts, and procedures to find out students' difficulties and errors, so that the factors that cause errors can be identified. In this case, analysis is needed to diagnose student errors, which is a way to find out the insights of both teachers and students in mathematical knowledge (Setiawan, 2020). One of the methods used to analyze student errors is analysis based on Kastolan stages.

Types of errors based on Kastolan's theory are divided into three, namely errors konseptual, procedural errors, and errors Technical. While (Kastolan in Fitriyah et al., 2020) Says 3 types of errors are conceptual errors, strategy errors and technical errors. This kind of conceptual error occurs when students do not use and apply formulas correctly. Procedural errors occur if the method used is not right so that it is still in a structure that is not easy. Technical errors occur when there is no accuracy in estimating or solving problems. Errors in the theory of kastolan can make it easier to check for errors in answering questions given to the material Algebraic forms (Ilmiyah et al., 2018). Kastolan's theory was chosen because it can clarify students' mistakes in detail (Khanifah & Nusantara, 2013). By using castoral theory, it can make it easier for writers to log errors so that it is easier to recognize mistakes made by students when solving mathematical problems.

Fujirahayu et al (2022) Saying the cause of error in every error based on the Kastolan theory is an error in making a model mathematics, student does not show a system of completion and lacks the ability of students to perform Calculate operation. While, in research conducted by Mauliandri & Kartini (2020) state that the causal elements cause student errors in answering questions mathematics can be caused by two kinds factorthat is factor from within the student and factors from outside the student. In research Sugiarti (2018) said the low grades obtained by students due to UTS (Test Midterm), where students have difficulty in mathematics material, namely Algebra, in algebra material students have difficulty in capturing ideas and subsequently have difficulty in calculating operations.

Pujilestari (2018) dan Lelboy et al (2021) Saying error is a form of deviation from the actual answer that is systematic. The mistakes discussed in this study are mistakes made by students in doing algebraic form operation problems. Mistakes made by students need to be analyzed further, in order to get an idea of weaknesses - weaknesses in students. Based on the information above, in this study, the error analysis carried out is: a) Collecting error data, b) Identifying and classifying errors, and c) Correcting errors.

Based on the picture above, researchers are interested in discussing students' problems in answering mathematical problems, especially in algebra material by conducting research with the title of analyzing student errors in algebraic form material based on castoral theory. In this study, researchers will analyze and describe the types of mistakes made by students according to Kastolan Theory in solving mathematical problems in algebra material. In Kastolan theory there are three types of errors analyzed, namely the type of procedural error, the type of conceptual error, and the type of technical error. With this error analysis research, it is expected to provide an overview of student error categories based on castolan theory.

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2. Method

This type of research is qualitative descriptive, which intends to describe, expose or tell students' mistakes in the process of solving math problems. While qualitative research is used to analyze student errors on algebraic form material. The subjects of this study were 30 grade VII students of SMP 26 Pekanbaru. The instrument used is a test sheet consisting of five validated description test questions.

Data analysis techniques carried out, namely: examination of student answer results by identifying and analyzing the types of errors made by students in answering questions related to the type of Kastolan error; 1) Calculate the percentage of error for each type of error, 2) The percentage level results are classified based on the percentage of error (Kurniasari et al., 2021) shown in Table 1, 3) The data that has been obtained, then calculated and will be analyzed descriptively, 4) Make conclusions from the results of student error analysis in doing algebraic form operation problems based on Kastolan error types

Table 1. Error Percentage Category

Category	Percentage (%)
Very Low	0% – 20%
Low	21% – 40%
Enough	41% – 60%
Tall	61% – 80%
Very High	81% – 100%

Source: Kurniasari et al (2021)

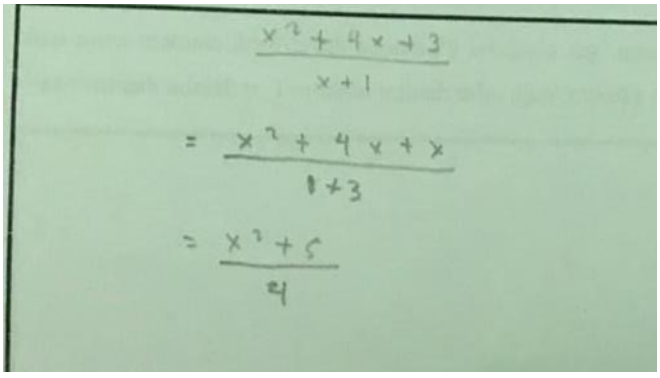
3. Results and Discussion

Based on the results of research that has been done, the percentage of student errors in solving algebraic calculation operations problems is obtained, based on Kastolan's theory as contained in Table 2

Table 2. Percentage of Error Types

Error Type	Percentage	Category
Conceptual error	69%	Tall
Procedural Errors	58%	Enough
Engineering Errors	59%	Enough

Berdasarkan data pada tabel 2 dapat diketahui bahwa secara umum jenis kesalahan terbesar yang dilakukan siswa dalam menyelesaikan soal operasi aljabar adalah kesalahan konseptual 69% dengan kategori tinggi. Berdasarkan hasil analisis, diperoleh contoh kesalahan konseptual yang dilakukan siswa seperti yang dimuat pada Gambar 1 .



Gambar 1. Types of Conceptual Errors

Figure 1 shows the types of mistakes students make when solving problems. The picture above shows that students made conceptual mistakes, students should have done the problem using division operations. But judging by the answers, students convert into and sum the same variables. So that students are wrong in doing the questions given.$x^2 + 4x + 3x^2 + 4x + x$

From conceptual errors that Shown at Picture 1, there are several Causative factors i.e. students less Understand the concept of division in algebra.This is in line with research conducted by Najwa (2021) Factors that cause mistakes made by students include not understanding concepts, not being able to apply concepts, and determining formulas incorrectly. In addition, there are external factors that come from outside the individual such as health and environmental conditions when working (Drs.slameto, 2013). Lenterawati et al., 2018 said that the factors causing students to make conceptual errors are students not understanding the prerequisite material and the lack of student knowledge

The type of procedural error with a percentage of 58% is included in the sufficient category. This type of procedural error is an error that occurs when trying to reverse a used step. An example of a procedural error made by a student is in Figure 2.

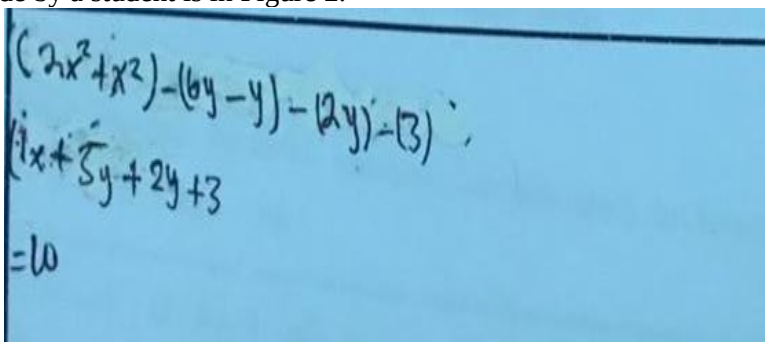


Figure 2. Types of Procedural Errors

Figure 2 shows the types of procedural errors students make when solving problems. Students make mistakes in carrying out the calculation process, so that the results of the calculations made by the students are wrong. As for the form of the question given where the student should multiply by , but judging from the student's answer, the student does not multiply and directly groups with similar tribes and performs addition and subtraction operations. Judging from the answer after knowing the grades and students add up all the constants. So that students make mistakes in procedural solving of problems.$(2x^2 + 6y - 3) - (x^2 - 2x + y) - (x^2 - 2x + y)xy$

The procedure for using surgical marks incorrectly and not writing down steps to answer the given problem. This is in line with research that has been conducted by Bauk et al (2022) A procedural error occurs due to improper completion steps performed by the subject and the subject cannot determine the sign of the operation. Procedural errors in performing algebraic calculation operations can become a vagueness that causes ambiguity in solving (Knill, 2014). (Syafira & Zulkarnaen, 2022) said that procedural errors occurred because students were wrong in choosing and arranging steps in solving the problem

Type of technical error with a percentage of 59%. This type of error belongs to the category of moderate. A technical error is an error in the understanding of the problem. An example of the type of technical error the student made is in Figure 3.

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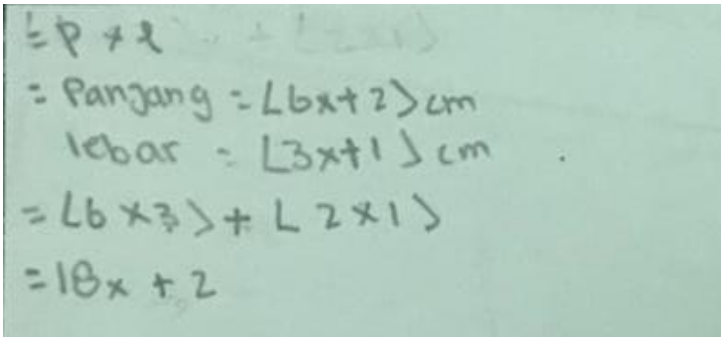

Figure 3. Types of Engineering Errors

Figure 3 shows the mistakes students make in applying the formula correctly, but incorrectly in operating the multiplication. This fact shows that the student made a technical error, whereby the student determined the formula correctly but the student was incorrect in operating multiplication using commutative properties. Judging from the students' answers, the students knew to solve the problem with a rectangular formula, but the students applied the multiplication operation incorrectly. Students should multiply length and width using the commutative multiplication property. But judging from the answers, students multiply by similar tribes, so there is an error in solving the problem.$(6x + 2)(3x + 1)$

The type of engineering error is that students can complete the final steps fixedly, but when in the final result students are less thorough in completing the calculation operations of the calculation which results in producing incorrect answers. The causative factor that becomes the student's fault is the student's lack of ability to perform counting operations. This is in accordance with research conducted by Lutfia et al (2019) which reveals that mistakes often occur when doing math problems, namely students are wrong in calculating.Strajhar et al., 2016 said that students often make technical mistakes because students are not careful in calculating multiplication and do not double-check the answers, causing students to answer the wrong questions.

4. Conclusion

In this study, types of errors in algebraic material with respect to hypotheses were obtained, in particular conceptual errors, procedural errors, and technical errors. From the results of the analysis of students' answers, calculation errors were obtained with a percentage of 69% in the high category, while conceptual errors made by students were in the form of errors in determining solving questions and not being careful in determining faktir and similar terms. For procedural errors of 58% with sufficient categories, the procedural errors made by students are not describing in advance how to solve the questions and immediately writing down the answers, so that errors occur during problem solving. The last type is technical errors which have almost the same percentage as procedural errors which are 59% with sufficient categories. The results of the study are for teachers and future teachers to use learning methods that are more appropriate for students and can make students easy in delivering the material to be given.

Based on these conclusions, the researcher wants to provide advice, namely in the learning process teachers should pay attention to the learning model used in order to make students more active in learning. In addition to using the right learning model, teachers should also deepen the concept of the material taught and its completion, so that students can do math problems, especially algebraic forms correctly. In this study, it only analyzes student errors using the castolan theory, so the researcher suggests that further researchers can conduct research by collaborating several theories in analyzing student errors.

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