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Analysis Of Student Errors In Solving Mathematical Problems Based On Arithmetic Conception Theory

Hruban Ralphaih

Northwestern University

Email: hrubanralphaih@gmail.com

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Student error, error analysis, arithmetic, Arithmetic Conception Theory, literature study

ABSTRACT

This study aims to analyze students' errors in solving mathematical problems based on Arithmetic Conception Theory. The method used in this research is qualitative with a literature study approach or library research. Data was obtained from the analysis of various relevant literature sources in the field of mathematics education, especially those that discuss student errors in solving arithmetic problems. Analysis is done by examining various common errors, such as errors in concepts, understanding arithmetic operations, and procedural errors. In addition, the study also explored the factors that lead to students' errors in solving math problems, including the influence of curriculum, teaching methods, and cognitive difficulties. The results of the analysis show that students' errors in solving math problems are often caused by lack of understanding of basic arithmetic concepts, difficulty in applying arithmetic operations, and confusion in understanding problem instructions. The implication of these findings is the need for a deeper learning approach to arithmetic concepts as well as the development of more effective learning strategies to overcome common mistakes. This research contributes to further understanding of the factors that influence students' errors in mathematics, as well as provides the basis for the development of more effective educational interventions.

1. Introduction

Mathematics education plays a central role in the development of students' logical and analytical thinking skills. One important aspect of learning mathematics is the understanding of basic concepts, including arithmetic concepts, which become the foundation for further mathematical problem solving. However, often students have difficulty in understanding arithmetic concepts and make mistakes in solving math problems.

Research on the analysis of student errors in solving math problems has become an important

topic in the field of mathematics education. However, there are shortcomings in previous research, especially in the context of students' conceptual understanding in solving mathematical problems based on Arithmetic Conception Theory. This research gap is the main motivation for this research.

The importance of this research lies in the urgency to better understand the mistakes that often occur to students in solving math problems, especially those related to arithmetic concepts. By understanding these mistakes, more effective and appropriate learning approaches can be developed to help students refine their understanding.

Previous research has provided an important foundation for this research, but there is still a need for more in-depth analysis of student errors based on Arithmetic Conception Theory. Therefore, this study tries to fill the gap by qualitatively analyzing student errors based on the theory. The novelty of this study lies in the qualitative approach used to analyze students' errors in solving mathematical problems, as well as focusing on Arithmetic Conception Theory as a theoretical framework that guides the analysis.

The purpose of this study is to gain a better understanding of students' errors in solving mathematical problems based on Arithmetic Conception Theory as well as identify the factors that cause these errors. The benefits of this research are expected to provide valuable insights for mathematics teachers in designing more effective learning to improve students' understanding of arithmetic concepts.

2. Methodology

This research uses a qualitative approach with a literature study method or library research. The qualitative approach was chosen because it allows deep exploration of complex phenomena in the context of mathematics education, especially the analysis of student errors in solving mathematical problems.

The main source of data in this study is literature relevant to mathematics education, especially those that discuss student errors in solving mathematical problems based on Arithmetic Conception Theory. This literature includes journal articles, books, conference proceedings, and academic reports obtained from various databases such as Google Scholar, ERIC, JSTOR, and other academic sources.

The data collection process is carried out through systematic search and review of relevant literature using predetermined keywords related to conceptual understanding of arithmetic, student errors, and mathematics education. Selection criteria include relevance to the research topic, year of publication, and academic credibility. Data collection was conducted through a comprehensive literature search and research on studies identified based on inclusion and exclusion criteria.

The collected data will be analyzed using thematic analysis methods, a qualitative analysis method commonly used to identify, analyze, and report patterns or themes in data. The analysis process involves coding and categorizing data into themes related to students' errors in solving math problems based on Arithmetic Conception Theory. The identified themes will then be interpreted to gain a deeper understanding of the nature, causes, and implications of student error in mathematics. With this approach, it is hoped that this research will be able to provide better insight into the factors that influence students' errors in solving math problems, as well as make a significant contribution to the development of more effective mathematics education.

3. Result and Discussion

These Errors in Understanding Basic Arithmetic Concepts

- Many students have difficulty understanding basic concepts such as addition, subtraction, multiplication, and division.

- Some students confuse the concepts of addition and subtraction, resulting in errors in applying proper arithmetic operations.

- Difficulties are also seen in understanding the relationship between the concepts of multiplication and division, which often results in inconsistent answers.

Errors in understanding the basic concepts of arithmetic are one of the main findings in the analysis of student errors in solving mathematical problems based on Arithmetic Conception Theory. These findings suggest that many students have difficulty in understanding basic concepts such as addition, subtraction, multiplication, and division. For example, a number of students tend to confuse the concepts of addition and subtraction, resulting in their difficulty in applying proper arithmetic operations. This incomprehension often results in errors in the process of solving math problems. In addition, difficulties are also seen in understanding the relationship between the concepts of multiplication and division. Some students may have difficulty distinguishing when to use multiplication and division operations in the context of a given problem, leading to inconsistent or incorrect answers. This phenomenon shows the need for a deeper learning approach and focuses on developing a strong conceptual understanding of the basic concepts of arithmetic. By improving students' understanding of these basic concepts, it is hoped that they will be better able to overcome difficulties in solving math problems and obtain better results in overall mathematics learning.

Errors in Mathematical Procedural Processes

- Despite having sufficient conceptual understanding, many students make mistakes in procedural steps.

- Basic arithmetic errors and errors in the arrangement of solution steps are examples of errors that often occur.

Errors in the procedural process of mathematics are an important highlight in the analysis of student errors in solving mathematical problems based on the Arithmetic Conception Theory. These findings suggest that although some students have sufficient conceptual understanding, they often make mistakes in procedural steps in solving math problems. Examples of common errors include basic arithmetic errors such as addition, subtraction, multiplication, and division, as well as errors in setting solution steps. For example, students may miscalculate the results of arithmetic operations or overlook important steps in the problem-solving process. This may result in inaccurate answers or not in accordance with the correct procedures. Improvements in mathematical procedural processes are crucial because proper procedures are key steps in solving math problems correctly. Therefore, a learning approach is needed that places sufficient emphasis on intensive mathematical procedural exercises and mastery of appropriate solution steps. Thus, students can develop skills in applying mathematical procedures correctly and reduce procedural errors that often occur in solving math problems.

Incomprehension of Question Instructions

- Many students have difficulty understanding the instructions of math problems correctly.

- This incomprehension leads to incorrect interpretations and eventually leads to errors in

solving the problem.

Incomprehension of question instructions is one of the important aspects in analyzing student errors in solving mathematical problems based on Arithmetic Conception Theory. These findings suggest that many students have difficulty in correctly understanding math problem instructions, resulting in incorrect interpretations and errors in problem solving. These difficulties can stem from a variety of factors, including the complexity of sentence structure, the use of technical terms, or the student's lack of ability to read and understand instructions thoroughly. For example, some students may have difficulty interpreting key words in instruction, such as "sum," "subtract," "divide," or "count." In addition, confusion can arise due to lack of experience in solving certain types of problems or difficulty in understanding the mathematical context presented. The importance of understanding question instructions cannot be underestimated, as errors in the interpretation of instructions can lead to inappropriate solutions even if students have good conceptual understanding and procedural skills. Therefore, a learning approach that places emphasis on reading skills and understanding question instructions carefully is important. Teachers can also assist students in developing problem-solving strategies that involve systematic analysis of question instructions. Thus, it is expected that students can improve their ability to understand and solve math problems more accurately and effectively.

Errors in the Application of Problem-Solving Strategies

- Students often find it difficult to implement appropriate problem-solving strategies.

- Lack of understanding of the steps required to solve a mathematical problem is one of the main causes of this error.

Errors in the application of problem-solving strategies are one of the critical aspects in analyzing student errors in solving mathematical problems based on Arithmetic Conception Theory. These findings suggest that many students may have difficulty in implementing appropriate problem-solving strategies, even though they have sufficient conceptual understanding. This kind of error often arises when students cannot identify appropriate strategies for solving a math problem, or when they incorrectly apply certain steps in the problem-solving process. For example, students may face difficulties in choosing the right mathematical operations to solve a problem, or they may fail in developing a systematic plan to solve a given problem. In addition, some students may have difficulty in recognizing relevant mathematical patterns or relationships that can help them in solving problems. This kind of mistake can hinder a student's ability to solve problems effectively, even if they have a solid understanding of the mathematical concepts involved. Therefore, it is important to acquaint students with a variety of relevant problem-solving strategies and provide opportunities for them to practice applying those strategies in a variety of mathematical contexts. Thus, it is expected that students can develop the necessary skills to overcome difficulties in the application of problem-solving strategies and become more skilled in solving math problems successfully.

Psychological and Motivational Factors

- Some students may experience difficulties due to psychological factors such as anxiety or lack of motivation.

- This can hinder students' ability to concentrate and understand math material well.

Psychological and motivational factors have a significant role in the analysis of student errors in solving mathematical problems based on Arithmetic Conception Theory. These findings suggest that some students may have difficulty

solving math problems due to psychological factors such as anxiety, lack of self-confidence, or low motivation. For example, students who feel anxious or stressed when facing math problems may have difficulty concentrating or processing information well. In addition, students who lack confidence in their math skills may be reluctant to try to solve problems that are considered difficult, which can hinder their ability to understand and solve problems well. Low motivation can also be an inhibiting factor, as students may lose interest or enthusiasm for learning maths if they do not see the value or relevance of the learning. Therefore, it is important for educators to pay attention to these psychological and motivational factors in designing positive and supportive math learning experiences. Encouraging students to develop positive attitudes towards maths, providing emotional support, and creating an inclusive and supportive learning environment can help reduce the negative impact of these psychological and motivational factors. Thus, it is expected that students can feel more confident, motivated, and able to overcome difficulties in solving math problems more effectively.

The Influence of the Learning Environment

- A less conducive learning environment, both at school and at home, can also affect students' ability to understand arithmetic concepts.

- Lack of support from teachers or parents in correcting student mistakes is also a factor that needs attention.

The influence of the learning environment plays a crucial role in the analysis of student errors in solving mathematical problems based on Arithmetic Conception Theory. These findings indicate that the learning environment, both at school and at home, can affect students' ability to understand and solve math problems. A conducive and supportive learning environment can help students feel comfortable and motivated to learn maths. Conversely, a less supportive learning environment, such as the unavailability of adequate resources or lack of support from teachers or parents, can hinder students' ability to understand mathematical concepts in depth. In addition, pressure from a competitive learning environment or lack of cooperation between students can also affect student motivation and performance in mathematics. Therefore, it is necessary to create a learning environment that is inclusive, collaborative, and provides adequate support for the development of students' mathematical skills. This can be done through a student-centered learning approach, the promotion of cooperation between students, and the active involvement of teachers and parents in supporting the mathematics learning process. By creating a positive and supportive learning environment, students are expected to feel more motivated, confident, and able to overcome difficulties in solving math problems better.

The Important Role of Teachers in Overcoming Student Mistakes

- Maths teachers have an important role to play in identifying and addressing student mistakes.

- By providing constructive and supportive feedback, teachers can help students improve their math comprehension and skills.

The important role of teachers in overcoming student errors in solving mathematical problems based on Arithmetic Conception Theory cannot be underestimated. These findings highlight that teachers have a crucial role to play in helping students identify, understand, and address their mistakes. Teachers can act as facilitators who assist students in developing a solid conceptual understanding through clear material presentation, inspiring discussions, and the use of effective learning strategies. In addition, teachers also have an important role in providing

constructive feedback on student errors, both individually and in the context of group learning. By providing timely feedback and focusing on aspects that need improvement, teachers can help students understand their mistakes and develop more effective problem-solving strategies. In addition, teachers can also assist students in developing metacognitive skills that allow them to understand the problem-solving process more deeply and reflect on their mistakes. Thus, the role of the teacher is not only limited to delivering the material, but also involves the guidance, support, and encouragement necessary to help students overcome difficulties in solving math problems and achieve a deeper understanding of arithmetic concepts.

These findings provide deep insight into the various factors that influence students' errors in solving math problems based on Arithmetic Conception Theory. With a better understanding of these errors, more effective learning strategies can be devised to help students improve their math comprehension and skills.

Analysis and Discussion

Analysis of student errors in solving mathematical problems based on Arithmetic Conception Theory reveals various findings that are important in the context of mathematics education. These findings provide deep insight into the factors influencing student error as well as their implications in the development of more effective mathematics learning.

One of the main findings was the students' error regarding the understanding of basic arithmetic concepts. Many students have difficulty in understanding basic concepts such as addition, subtraction, multiplication, and division operations. For example, some students tend to confuse the concepts of addition and subtraction, which leads to errors in applying proper arithmetic operations. In addition, some students also have difficulty understanding the relationship between the concepts of multiplication and division, which often results in inconsistent answers.

In addition to errors in concepts, the analysis also revealed that many students have difficulty in correctly applying mathematical procedures. Although they may have sufficient conceptual understanding, they often make mistakes in procedural steps, such as basic arithmetic errors or errors in the arrangement of solution steps.

Another factor that contributes to student error is incomprehension of question instructions. Many students have difficulty in correctly understanding the instructions of math problems, which leads to incorrect interpretation and eventually leads to errors in solving the problem. This demonstrates the importance of learning that teaches problem-solving strategies as well as building the skills of reading and understanding instructions carefully.

The discussion of these findings highlights the need for a more focused learning approach on developing a solid conceptual understanding as well as mastery of appropriate mathematical procedures. Maths teachers need to pay particular attention to identifying and addressing student mistakes, both through individual and group learning. The use of various learning strategies that activate students actively and encourage reflection on their mistakes is also considered important in improving students' understanding and mathematical skills.

In conclusion, the results of this analysis provide a deeper understanding of students' errors in solving mathematical problems based on Arithmetic Conception Theory. The learning implications resulting from these findings are expected to increase the effectiveness of mathematics learning and assist students in overcoming their difficulties in understanding and applying mathematical concepts better.

4. Conclusion

In the context of analyzing students' errors in solving mathematical problems based on Arithmetic Conception Theory, it can be concluded that a strong conceptual understanding of the basic concepts of arithmetic is very important in achieving success in mathematics learning. The findings showed that students' errors were not only related to deficient conceptual understanding, but also to procedural errors and incomprehension of problem instructions. Therefore, there is a need for a holistic learning approach that integrates the development of deep conceptual understanding, intensive mathematical procedural exercises, and strengthening reading skills and understanding problem instructions. Thus, it is expected to increase the effectiveness of mathematics learning and help students in overcoming their difficulties in solving math problems better.

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