

Error Analysis of Dyscalculia Children in Solving the Basic Arithmetic Word Problems Student of Inclusion Class in an Elementary School

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Abstract

Dyscalculia is a form of learning difficulty experienced by children in mathematics learning that involves counting skills, that is learning disabilities that affect the ability of children to acquire arithmetic skills. Many elementary students have difficulty in solving word problems, especially students with mathematics learning difficulties. Solving a word problem is a common difficulty for students with learning disabilities, so a teacher needs to have a clear understanding of the specific errors made by students with learning disabilities during problem-solving. Errors in solving mathematical problems need to be analyzed to determine the types of errors. In this research the types of student errors in solving basic arithmetic word problems related to the topic of integers. The difficulty in mathematics learning can be identified by using Newman's Error Analysis (NEA). The error analysis will include errors in reading, comprehension, transformation, process skills, and encoding. This research is a descriptive qualitative nature that aims to describe the types of errors that dyscalculia children make in solving the basic arithmetic word problems. The subjects of the research were students from the fifth grade of inclusion class in an elementary school. Data collection techniques used in this research are written tests and interviews.

Keywords: Dyscalculia Children; Arithmetic; Inclusion; Elementary School

Introduction

Education is one of the important factors in the development of society in Indonesia because a good education will give birth to the next generation of intelligent and competent nations in its field. One education in Indonesia is not only for children who have normal conditions but also for children who have special needs conditions that is inclusive education. As explained by Bendova et al. [1] in their research inclusive education aims to ensure equal access and equal opportunities in education for all individuals with SEN (Special Education Needs), regardless of the form of their specific needs. As quoted from Lindenskov [2] inclusion is a process of meshing general and special education reform initiatives and strategies to achieve a unified system of public education that incorporates all children and youths as active, fully participating members of the school community; who view diversity as the norm; and that maintains a high-quality education for each student by assuring meaningful curriculum, effective teaching, and necessary supports for each student. Meanwhile, according to Bergman [3] students with special needs often have problems with memory and therefore find it difficult to remember math facts and keep a sequence of steps in order. These students are sometimes referred to as having dyscalculia. They require specialized instruction and alternate or modified content to be successful in the general education classroom. One type of child with special needs is a dyscalculia child. Dyscalculia is a form of learning difficulties experienced by children in



learning mathematics, this difficulty arises when the child does the calculation. Counting skills need to be developed with the aim that children can solve real-life problems that require math or numeracy skills. However, the Tambychik & Meerah study [4] stated the deficiency of these mathematics skills and also of cognitive abilities in learning inhibits mathematics problem-solving. Therefore, math skills in counting still must be studied by every child to be a stock of his life in the future, because the skills of counting are needed in everyday life. Definition of dyscalculia According to Kaufmann & Aster [5] explains that dyscalculia is defined as difficulty acquiring basic arithmetic skills that are not explained by low intelligence or inadequate schooling. About 5% of children in primary schools are affected. As explained by Butterworth [6], a condition that affects the ability to acquire arithmetical skills. Dyscalculia learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence. Dyscalculia children are usually only seen clearly when they go to elementary school because at that time they begin to get basic mathematical concepts such as addition (+), subtraction (-), multiplication (\times), and division (\div). As explained by Butterworth [7] the development of mathematical skills has focused on counting or arithmetic, but even at early levels, many complex abilities are involved in these skills such as being able to carry out mental arithmetic using the four basic arithmetical operations - addition, subtraction, multiplication and division. Delphi [8] states that learners generally experience difficulties when solving math problems in the form of stories. The difficulty is related to teaching which requires learners to make mathematical sentences without giving instructions on the steps to be taken. In addition, according to Sutisna [9], to be able to solve math problems in the form of story problems, a child must have the skills to read comprehension. Students who can not read (understand) the problem, in addition to the students who have difficulty understanding what will be read, also have difficulty in doing the problem, because the story-shaped matter requires precision in solving it. As Kingsdorf & Krawec [10] explain solving word problems is a common area of struggle for students with learning disabilities (LD). For instruction to be effective, we first need to have a clear understanding of the specific errors exhibited by students with LD during problem-solving. Error analysis has proven to be an effective tool in other areas of math but has had little application to errors in word problems. In connection with this resulted in many students make mistakes in working on math problems, mistakes in working on math problems can be a benchmark of how students understand doing math problems. Therefore, it is necessary to analyze the difficulties that are the cause of the students' mistakes in the mathematical problem, so that they can find faults and fix them to avoid the same errors. Soedjadi [11] states that difficulty is the cause of errors. This shows that the difficulty in children with special needs in learning mathematics (dyscalculia) in solving basic arithmetic word problems is one of the indicators that the child is having errors in counting. As explained by Roy & Roth [12] arithmetic word problems are usually directed towards elementary school students and can be solved by combining the numbers mentioned in the text with basic operations (addition, subtraction, multiplication, division). The difficulty of learning mathematics is marked by errors in solving the given problem. One of the causes of the difficulty is that it lacks many mathematical skills, so students have difficulty understanding mathematical problems that affect the process of solving mathematical problems such as students having difficulty in reading. Students cannot know what information is needed to solve problems, and students have difficulty understanding the keyword in the problem, so they cannot interpret it into a mathematical symbol. Students' performance in solving math problems needs to be analyzed so that the student's errors can be known. One of the tools that can be used is error analysis with NEA (Newman's Error Analysis) procedure. Student difficulties can be identified by using the category of errors proposed by Newman based on the process of solving mathematical problems namely, reading error, comprehension error, transformation error, process skills error, and encoding error. (Wijaya et al., [13]). So the purpose of this study is to describe the types of errors made by dyscalculia

children in solving the basic arithmetic word problems by identified through the Newman's Error Analysis (NEA) procedure.

Method

This research includes descriptive qualitative research. The purpose of this research is to describe the types of errors made by dyscalculia children in solving the basic arithmetic word problems of students of inclusion class in an Elementary School. The selection of the subject of this study is based on the consideration that the fifth-grade students already know about basic arithmetic such as addition, subtraction, multiplication, and division, and also the fifth graders have obtained mathematics subject matter about integers. The selection of research subjects was chosen by the researchers by giving a dyscalculia test which then the results of the test were analyzed and the subjects that met the criteria as the subjects of the study. The number of research subjects which are selected is at least one student who meets the criteria that most students make errors in answering test questions given by the researchers or students who make errors with different types of errors such as the student performing consistent types of errors, student tendencies in reversal, transpositions, or lack of understanding about the many steps, the inability to replicate images accurately and students who have a smooth communicate orally, especially able to communicate with new people known. Having obtained at least one student who meets the criteria to be the subject of research, the researchers give a written assignment about the basic arithmetic word problems relating to the matter of integers on each subject of research and then do an interview based on the results of their work.

Data collection techniques in this research were written tests and interviews. Written tests were used to determine the types of errors made by children with special needs who have difficulty learning mathematics (dyscalculia) through dyscalculia tests and basic arithmetic word problems. Interviews were conducted after the subjects conducted a written test.

To check the validity of data from written tasks and interviews in this study, triangulation activities would be conducted to obtain valid data that can be analyzed as a conclusion or result of research. In this research, The used triangulation is time triangulation, i.e., checking the validity of written task data and 1st interview with the data of the written task and 2nd interview at different times that is done in approximately one week after the written task and 1st interview is implemented. The data obtained are then analyzed using Newman's Error Analysis (NEA) procedure.

Results And Discussion

Results

Based on the results of data analysis including data condensation, data presentation and data checking, it was found that the subject made an error as in the types of error presented in Table 1.

Thus, it can be concluded that the results of this research identified four types of errors that are often made by dyscalculia children in solving basic arithmetic word problems. The four types of errors are reading error, transformation error, process skill error, and encoding error.

Based on the results of interviews with the subject of research can be concluded the causes of errors made the subject of research when solving the basic arithmetic word problems, as presented in Table 2.

Table 1. The Types of errors in dyscalculia children

Items	Problem	Example of Errors	Types of Errors
1	Ramdhan and his friends will make the climb to the top of Mount Mahameru. The journey to the top of the mountain takes a long time. They travelled from Ranupani to the third post for 18 hours. Because the trip to the third post is very far away, eventually they often rest so they lose 3 hours. Meanwhile, the trip from the third post to Ranukumbolo takes about 9 hours. How many hours are Ramdhan and his friends travelling from Ranupani to Ranukumbolo?	➤ The subject does not write a final answer.	<i>encoding</i>
2	Nita buys 6 packs of candy, and each pack contains 75 candies. All the candies are distributed to 45 children equally. How many candies will each child receive?	➤ Purchase 6 packs of candy (+) Each pack contains 75 candies (+) The candy is distributed to 45 children (÷) ➤ $6 \times 75 - 45$ ➤ $6 \times 75 - 45 = 715$ ➤ The subject does not write a final answer.	<i>Reading</i> <i>Transformation Process Skills encoding</i>
3	Mrs. Afni has a supply of 210 books, then she buys 25 boxes of books. Each box contains 10 books. A total of 5 books were given to his nephew, then all the books of supplies and the rest given to his niece would be distributed to 7 foundations evenly. How many books will be accepted by each foundation?	➤ Mrs Afni has 210 supplies of books (+) A total of 25 books (×) Each box contains 10 books (×) A total of 5 books were given (-) Will be distributed to 7 foundations (÷) ➤ $210 + 25 \times 5 - 7$ ➤ $210 + 25 \times 5 - 7 = 210 + 25 = 235 \times 5 = 2350 - 7$ ➤ The subject does not write a final answer	<i>Reading</i> <i>Transformation Process Skills encoding</i>

Table 2. The causes of errors in dyscalculia children in solving basic arithmetic word problems

Items	The Causes of Errors
1	Not writing the final answer. ^e
2	Incorrect in writing the keywords or symbols used in the problem. ^a Incorrect in writing the right operation in solving the problem. ^c Does not use a way of completion, such as not writing down the completion steps used in solving the problem. ^d Incorrect in writing the sequence of steps in solving the problem. ^d Incorrect in doing the calculations. ^d Not writing the final answer. ^e
3	Incorrect in writing the keywords or symbols used in the problem. ^a Incorrect in writing the right operation in solving the problem. ^c Incorrect in writing the sequence of operations done first. ^c Incorrect in writing the sequence of steps in solving the problem. ^d Incorrect in doing the calculations. ^d Can not continue calculation. ^d Not writing the final answer. ^e

^a Reading Error.

^b Comprehension Error.

^c Transformation Error.

^d Process Skill Error.

^e Encoding Error.

Discussion

Based on the type of error in the results of the above research can be seen that the actual dyscalculia children have no difficulty in terms of reading. This is shown by the smoothness of the subject in reading the problem when interviewed. However, the subject cannot read the keywords nor write the symbols correctly. In terms of comprehension part, dyscalculia children on the subject of this research, understand the given word problems. Likewise, at the time of the interview, the subject was able to answer about what information is known and asked in the problem, but the subject was less able to explain what symbol or operation is used on the word problems. This causes them to incorrectly write the sequence of steps in completing the problem and incorrect in doing the calculations. In the end, they do not write the final answer.

Conclusion

The results showed that the types of errors that many dyscalculia children make are reading errors, transformation errors, process skill errors, and encoding errors. Based on these types of errors can be concluded the causes of errors dyscalculia in children in solving basic arithmetic word problems, such as the subject being less able to understand and explain what symbols are used in the word problems. Then, the subject does not understand the concepts of addition, subtraction, multiplication, and division of integers. The next cause, the subject is wrong in identifying or determining what calculating operation is used, incorrect in executing the procedure of working on the problem, and incorrect in doing the calculation or computation. The last cause is incorrect in writing the final answer. Thus, the results of this research can be used as a reference for math teachers, especially those teaching inclusion classes to find an effective alternative solution for dyscalculia children in solving word problems.

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