

## **SLOW LEARNER ERRORS ANALYSIS IN SOLVING INTEGER PROBLEMS IN ELEMENTARY SCHOOL**

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### **Abstract**

The indication of mathematics difficulties of slow learners can be identified by mathematics errors analysis. This study was aimed at analysing the errors of slow learners in solving arithmetic (integer operation). The study was set as a descriptive case study that employed a qualitative approach and was conducted in two elementary schools in Indonesia. Two of fourth graders who are considered as slow learners in two elementary schools were chosen as participants of the study. The data were collected by giving five numbers of integer operation problems to the slow learners. The data gained were analysed using Newman's Error Analysis (NEA) theory. The results of the study showed that four types of errors were made by the slow learners in answering integer operation that cover comprehension errors (50%), transformation errors (8%), process skill errors (17%), and encoding errors (25%). The finding indicates that slow learners tended to face problems in interpreting mathematical problems, developing problem solving strategy, using appropriate operation, and also in making conclusion. The result of the analysis was expected to give input to mathematics teachers to prepare appropriate teaching practice for slow learners in studying mathematics, especially in integer operation problems.

Keywords: Error, Newman's Error Analysis (NEA).

## 1. Introduction

Slow learners belong to children who have both special needs with below normal rate intellectual capacity and difficulties in understanding a lesson. But, they are not categorised into intellectual disabilities [1]. Dasaradhi et al. [2] stated that slow learners are students whose cognitive capacity is under average of normal students. Their IQ scores are classified in several ranges. Most of them are under average, and some of them are not less than 70 [3], 70-90 [4], 71-89 [5], 76-89 [6], and 70-90 [7]. From the opinion above, it can be concluded that slow learners have intelligence level between 70 and 90. Because of this cognitive limitation of slow learners, they have weaknesses in understanding mathematics [8].

The results of some studies in Mathematics field investigating slow learners in junior high school showed that students have difficulties in identifying keywords in mathematics problem's, especially in fraction [9]. It was also found by the previous studies that errors were also made by slow learners in solving mathematical problem in number operation [10]. The results indicated that slow learners are undeniably having problems in arithmetic. In elementary schools, students learn arithmetic more. Thus, if the students have problems in arithmetic, they will find it difficult to learn mathematics at school. In fact, arithmetic is the basic lesson to learn the higher level of mathematics. This was explained by previous studies [11]. They stated that arithmetic was one of the branches of the discipline of mathematics. None of the new branches, whether pure or applied, operates without the basic mathematical rules skills established in arithmetic. Having the same sound, Booker also declares that children, generally, tend to make some errors when having problem studying mathematics, including arithmetic in their parallel thinking to gain answer as well as generalizing concept and process [12].

Some studies on mathematics error analysis have been conducted using Newman's Error Analysis (NEA). Analysis of students' mathematics error in assignment in England showed that students have problems in content knowledge when solving mathematics problem [13]. Another study that analysed slow learners' errors in junior high school in fraction problem revealed some errors made students that cover with comprehension, transformation, process skill, and encoding errors [14]. Abdullah et al. [15] analysed students' error in solving high order thinking (HOTS) Problem in fraction and the results showed that the frequency of error on encoding was 27.58%. The other factors are process skill (27.33%), transformation (24.17%), and comprehension (20.92%).

Teachers need to be aware of students' difficulties and errors of the student. Teachers also have to take an appropriate approach to improve their teaching practice. Teachers are responsible to identify the difficulty in studying mathematics and understand the main errors before teaching other mathematics topic. The indication of mathematics difficulties of slow learner can be identified by mathematics error analysis. Departing from this point of view, the study was intended to analyse errors made by slow learners in solving mathematics problem in elementary school level, focusing on arithmetic integer operation. The types of errors analysed in this study were reading, comprehension, transformation, process skill, and encoding.

## 2. Method

This study was set as a descriptive study using a qualitative approach as it was aimed to examine few individuals or few cases and display the complexity of a place or information provided by an individual [16]. Meanwhile, a case study design was employed since the study was focused on exploring in depth and in detail the subjects to be studied. The process in the case study design could be illustrated in Fig. 1 [17].



**Fig. 1. Case study design.**

The initial orientation was the first step in a case study where we explored and searched for information on schools. Exploration was done in depth to collect data through observation of the subject through tests. Conformability or validation step was carried out by re-checking the works of students with different time intervals.

The participants were two slow learners of fourth grade students from two different elementary schools in Indonesia. The participants were chosen since they have a weakness in communication shown by their difficulties in writing and speaking. However, students' writing can still be read and confirmed orally; Thus, the errors can be analysed properly. The selected participants were recommended by mathematics teacher in those schools to be the participant of the study. Later, the students were interviewed to confirm their answer. Meanwhile, the data were obtained by giving written test to the slow learners which consists of five integer problems as can be seen in Table 1.

Table 1 showed integer operations problems that are used to collect data. Problem number one was about integer addition operations, number two was about addition and subtraction operations, number three was the addition and the multiplication operations, number four was about dividing problem, and number five was a combination of addition and division. NEA was used to analyse students' errors. Newman explains that NEA was a design as a simple diagnostics procedure in solving mathematical word problems [18]. NEA categorized error types in hierarchy based on the level of students' problem solving namely: reading error, comprehension error, transformation error, process skill error, and encoding error. Oktaviana [19] elaborated the indicator used to identify students' errors in solving problem as follow.

- Reading Error: The student makes error in reading term, symbol, words, or important information in the problem.
- Comprehension Error: The student doesn't know what was asked by the problem or made error in understanding information in the problem. So, they cannot process the truth even though they read the problem correctly.

- Transformation Error: The student can read and understand the problem correctly, but is failed in changing it into correct mathematics model or is failed in using calculation operation symbol to finish the problem.
- Process Skills Error: The student can read, understand, transform the problem in to mathematics models, but student fails in calculating or in making computation.
- Encoding Error: The student can read, understand, transform the problem in to mathematics models, and perform skill process, but he fails in giving a final appropriate answer. Student cannot conclude the correct answer in mathematical sentence or errors due to the carelessness.

**Table 1. Test model specifications and test conditions.**

Item	Question
1	Yuli has a piggybank with Rp. 10.500,00. Later her grandfather gave her some money to save in piggybank which was Rp. 31.000,00. How much money that Yuli has in piggybank now?
2	Andi bought the shoes, the price was Rp. 47.000,00. Andi paid with two Rp. 10.000 bills and one Rp. 20.000 bills. How much change did Andi received?
3	A satay seller sold fifty portions a day. One portion consists of four skewer of satay. How many skewers of sate are sold?
4	A farmer harvested rice of 1,001 kg. He put it in to eleven sacks, so each sack contain...
5	Palm oil plantations produce 324 liters cooking oil on Friday, on Saturday 216 liters, on Sunday 400 liters. All the cooking oil was packed equally in to twenty containers that are distributed to supermarket. How many liters of cooking oil were in each container?

### 3. Results and Discussion

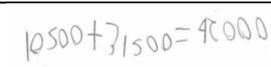
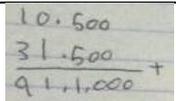
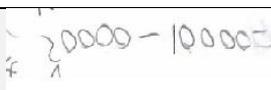
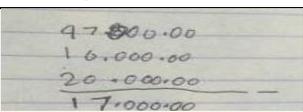
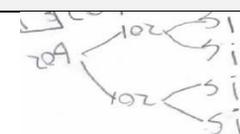
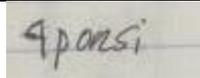
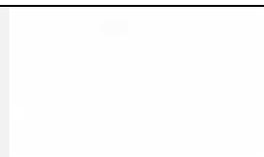
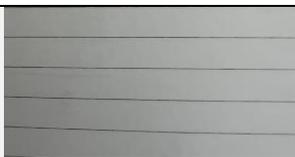
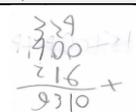
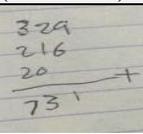
They were four types of errors that the slow learners made in solving integer operation problem (see Table 2). The following table is some examples of students' errors in solving arithmetic integer problem.

Comprehension error showed that students did not know what were asked by the problems and errors in understanding information in the problem. No answer was also a part of comprehension errors as seen in item four where no students could answer the problem. The transformation error is shown in Table 2 (see Item 2, S2). Student missed the (x) calculation operation symbol, where the answer should be  $47000 - (2 \times 10000) - 20000 = 7000$ . Process skill errors happened when students failed in calculating. Thus, they could not proceed to complete procedure. Encoding error relates to error due to students' carelessness (see Item 1, S2 and Item 3, S1). Reading error was not found in this study since the slow learners could still read the problem well, although it was not fluent. Correct answer was found in Item 1 of Student 1 (S1) when the students made no error.

A total of 12 errors were found made by slow learner students using NEA. Table 3 above summarizes the types of error committed, its frequency, and its percentage distribution. It can be seen from the table that most errors were on comprehension (50%). This indicates that students face difficulties in understanding the problems

well. Meanwhile, the least errors were on reading error (0%; but not fluently). It means that students could read all problems. Other studies with normal student participants showed that the most errors occurred not in comprehension level; in the Trance [20] study, the biggest error was in transformation (47.69%) and the least errors were on reading (3.85%); Abdullah's study showed the highest percentage of errors was 27.58% for encoding and the lowest was also reading (0% of error) [15], and Santoso et al. [21] found the biggest was transformation (20%) and the least error was on reading 2%.

**Table 2. Type of slow learner errors.**

Question	Answer (S1)	Answer (S2)
<b>Item 1</b>	 Type of error: (not identify error)	 Type of error: Encoding Error
<b>Item 2</b>	 Type of error: Comprehension error	 Type of error: Comprehension error Transformation error
<b>Item 3</b>	 Type of error: Process skills error encoding error	 Type of error: Comprehension error
<b>Item 4</b>	 Type of error: Comprehension error (no answer)	 Type of error: Comprehension error (no answer)
<b>Item 5</b>	 Type of error: Process skills error: Encoding error	 Type of error: Comprehension error

**Table 3. Percentage of errors.**

Type of errors	Number of errors (S1 and S2)	Percentage
Reading error	0	0%
Comprehension error	6	50%
Transformation error	1	8%
Process skill error	2	17%
Encoding error	3	25%
<b>Total</b>	12	100%

The finding of this study showed that the biggest error percentage made by slow learners in solving integer problems was comprehension errors and there was only one problem that could be correctly answered by the participants in the study. Different from normal students, slow learners face difficulties in the following multistep directions as stated in website [www.foundationosa.org/slow.htm](http://www.foundationosa.org/slow.htm). It is hard for them to focus on the given assignment [22]. Therefore, slow learner students are lack in understanding long mathematical sentence problem. Shaw [3] mentioned that slow learner students perform low intelligent and academic achievement. They have difficulty in learning the concept of abstract lessons and in organizing new materials as well as in assimilating new information in to prior information. But, they can show higher achievement when the information is given in concrete form. The results of the study showing that slow learner students have a high percentage of comprehension errors (50%) but low reading errors percentage that is almost the same as normal students (0%). This may happen due to this reason.

The findings of the study indicate that in designing learning process, it is necessary for teachers to pay attention to the effective learning media [23, 24]. Slow learner students need to be given learning media that can help them in solving abstract problems. One alternative is to use game-based learning media that is able to attract slow learner students' attention and make them focused on the learning [23, 24]. Further, Shaw [3] suggested several ways to support the slow learners' learning process that cover using concrete instructions, providing opportunities for repetition and often, applying discrete skill practices to different challenges, helping students to develop time management and basic skills, breaking lessons and assignments into short discrete elements, and using various activities and computers. The instructions need to be designed to strengthen learning, enable students' success by appreciating their sincere effort for learning. The learning process also needs to be carried out to demonstrate students' competence through various ways, such as by pairing students with their peer as a mentor, linking academic learning with real-world experience, and by encouraging students' involvement into the activities they enjoy that may lead to their success [3].

#### 4. Conclusions

After analysing the data, it can be concluded that that there were four types of errors made by slow learners in answering integer operation problems. The errors include comprehension error, transformation error, process skill error, and encoding error. This finding indicates that slow learners tended to face problems interpreting mathematical problems, in designing and developing problem solving strategy, in using appropriate operation, and also they tended to face

problems in making conclusion. The results of this study can be used as a reference for mathematics teachers to find alternative solutions for slow learners in solving integer operation problems.

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