Slow Learner Errors Analysis in Solving Fractions Problems in Inclusive Junior High School Class

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Abstract. A slow learner whose IQ is between 71 and 89 will have difficulties in solving mathematics problems that often lead to errors. The errors could be analyzed to where the errors may occur and its type. This research is qualitative descriptive which aims to describe the locations, types, and causes of slow learner errors in the inclusive junior high school class in solving the fraction problem. The subject of this research is one slow learner of seventh-grade student which was selected through direct observation by the researcher and through discussion with mathematics teacher and special tutor which handles the slow learner students. Data collection methods used in this study are written tasks and semistructured interviews. The collected data was analyzed by Newman’s Error Analysis (NEA). Results show that there are four locations of errors, namely comprehension, transformation, process skills, and encoding errors. There are four types of errors, such as concept, principle, algorithm, and counting errors. The results of this error analysis will help teachers to identify the causes of the errors made by the slow learner.

1. Introduction
Education is the right of every citizen, no exception for children who has learning difficulties, including slow learner. A Slow learner has thinking skill below the average than other normal students in his/her age. This is a big challenge for teachers to help slow learners build their understanding of learning in inclusion classes, especially in learning mathematics. Because even average students generally find it difficult and make errors in solving mathematics problems, especially for the slow learner may takes longer time to understand the problem. One of the mathematical topics considered a problem for students is the fractions. Fractions is one of the concepts that is considered difficult to master by some students [5].

A number of researchers have analyzed students’ errors in solving fraction problems. One of them is the research of Abdullah et al. [1] indicated that students often make errors in encoding (27.58%), followed by process skills (27.33%), transformation (24.17%) and comprehension (20.92%). However, no field research has analyzed the slow learner error in solving the fraction problem. In fact, the slow learner who is a student with a slow learning ability need more help with various approaches to overcome the difficulty of them and make them easy to understand the topics taught by teachers, especially fractions.

Slow learners are student who has the ability to think below average of their age peers. It does not mean they can not develop the potential that exists within them. It is just slow learner needs more efforts to understand a concept that had been mastered by the majority of class. That is accordance with Ruhela’s opinion [10] which reveals that the slow learner has below average cognitive abilities of their age mates.
and who struggle to cope with the traditional academic demands of the regular classroom. The slow learner intelligence level is between 71 and 89 [3]. However, Chauhan [4] argues that the slow learner has an IQ of between 76 and 89, while Malik [7] describes slow learner IQ being between 70 and 90. From some of the above expert opinions it can be concluded that the slow learner has a level of intelligence between 71 and 89. Their level of intelligence is too high to be considered a child with mental retardation and is too low to be considered a their age mates. In general, a slow learner is a child who has intellectual potential below average but not included as mental retardation. Therefore, a slow learner is a child labeled as borderline mentally retarded, and they are slower to grasp whatever is being taught if it involves abstract or conceptual symbols in the subject matter that should be within easy reach of most children their age [7]. Thus, these slow learning characteristics are the unique characteristics of the slow learner, so they take longer to learn than their peers.

However, Chauhan [4] expresses another characteristic of the slow learner, the first being limited cognitive capacity: the slow learner fails to overcome the learning situation and to give an abstract reason. The second characteristic is the slow learner has a poor memory. The next character is a distraction and lack of concentration: the slow learner can not concentrate too long on the teacher's instructions orally. The last characteristic is an inability to express ideas: slow learner has difficulty finding and combining words, so they are not able to express ideas.

Slow learners are also considered as children with any identifiable combination of dysfunctionalities such as attention deficit disorders (ADD), dyscalculia, dyslexia, dysgraphia, dyspraxia, dysnomia, hyperactivity or other related problems [13]. One of the dysfunctionalities associated with mathematics is dyscalculia. Briefly, dyscalculia is a disturbance in the difficulty of learning mathematics [2]. The slow learner’s inability to understand mathematics is shown by his/her weakness in the manipulation of algorithmic computation [6]. This affects the way they solve mathematics problems. In solving mathematics problems, a slow learner has difficulty about following multi-step instructions [9], so they need more specific work instructions. Problems given are also more likely on simple questions. Their weak recall ability makes the slow learner work slowly and sometimes inconsistently. These obstacles often lead to errors in solving mathematics problems, especially on fractions.

The slow learner’s errors in solving fraction problem needs to be analyzed further. So that, we can get a clear and detailed explanation about the slow learner’s weakness in solving fractions problems, especially regarding the locations, types, and causes of errors. In this research, those errors will be analyzed by Newman's Error Analysis (NEA). Newman identified five errors types in solving written mathematical tasks. They are reading, comprehension, transformation, process skills, and encoding errors [11]. While, regarding the types of errors, Soedjadi [12] associated errors with mathematical object and classified them as fact, concept, principle, and operation errors. However, Mercer and Mercer [8] divide the types of errors into four categories, namely wrong operation, obvious computational error, defective algorithm, and random response. From the two opinions above, the types of errors used in this research are concept, principle, algorithm, counting, and random response errors. The findings of this research can be used as reference for mathematics teachers, especially who teach in inclusion classes to find alternative solutions to improve teaching and learning activities adjusted to the ability and characteristics of a slow learner, especially in solving fractions problems. Thus, the increase in teaching and learning activities is expected to improve learning outcomes or slow learner learning achievement.

The purpose of this research was to analyze the slow learner error in solving the fractions problems that focused on the operation of fractions. This research was conducted to describe the locations, types, and causes of the slow learner error in solving fractions problems.

2. Method
This research is qualitative descriptive. The purpose of this research is to describe the locations, types, and causes of slow learner errors in the inclusive junior high school class in solving the fraction problem. The subject of this research is one slow learner of a seventh-grade student. Due to differences in characteristics and abilities between slow learners and the others. The subject selection was decided by considering the mathematical abilities and communication skills both verbally and in writing. The
mathematical ability was viewed based on basic mathematics skill (such as addition, subtraction, multiplication, and division), interest in math, and grade in math. Meanwhile, the slow learner was considered to have good communication skills, if the slow learner was able to communicate with new people, does not avoid eye contact, has good pronunciation (pronunciation can be understood by others), and has handwriting that can be understood or read by others. The subjects was also based on the consideration of mathematics teacher and special tutor. So that we got one slow learner with good mathematics abilities and good communication skills better than the others. Methods of data collection are written tasks and semistructured interviews. The written tasks aim to show and describe the slow learner errors in solving a fraction problem consisting fourteen items. Interviews aimed to clarify written tasks data as well as to determine the causes of the errors made by slow learner. The interviews were conducted after the research subjects conducted a written tasks. The credibility test approach used in this study is the triangulation of time. The data obtained from the test is then analyzed using Newman's Error Analysis (NEA).

3. Results
Based on the results of data analysis including data reduction, data display and conclusion drawing, it was found that the subject made an error as in the location and type of error presented in Table 1.

Table 1. Locations and types of slow learner errors.

| Items | Problem | Example of Errors | Locations of Errors | Types of Errors |
|-------|---------|-------------------|---------------------|----------------|
| 3     | Add it! | $2 + \frac{1}{9}$ | Comprehension error | Concept error  |
|       |         |                   | Process skills error| Principle error|
|       |         |                   | Encoding error      | Algorithm error|
|       |         |                   |                     | Counting error |
| 4     | Determine the results! | $2 \frac{2}{3} - \frac{3}{6}$ | Comprehension error | Concept error  |
|       |         |                   | Process skills error| Principle error|
|       |         |                   | Encoding error      | Algorithm error|
|       |         |                   |                     | Counting error |
| 11    | Mr. Dana bought 1 liter of milk. When you want to drink, the milk is spilled, the remaining $\frac{1}{5}$ liter of milk. How many liters of milk spilled? | | Comprehension error | Concept error  |
|       |         |                   | Process skills error| Principle error|
|       |         |                   | Encoding error      | Algorithm error|
|       |         |                   |                     | Counting error |
| 12    | Mrs. Rizka bought $\frac{3}{4}$ liter of cooking oil. On the half way the cooking oil was spilled as much as $\frac{2}{3}$ liter. Then, Mrs. Rizka bought another $\frac{5}{12}$ liter. How many liters of cooking oil owned by Mrs. Rizka now? | | Process skills error | Concept error  |
|       |         |                   | Encoding error      | Principle error|
|       |         |                   |                     | Counting error |
Mrs. Novi is a tailor. Mrs. Novi received $\frac{2}{3}$ meter of cloth to be handkerchief. For each handkerchief it takes $\frac{1}{6}$ meter. How many handkerchiefs can be made Mrs Novi?

**Figure 5.** Answer of item 14.

Thus, it can be concluded that the results of this research identify four locations of errors and four types of errors made by the slow learner in solving fractions problems. The four locations of errors are the comprehension, transformation, process skill, and encoding errors. While, The four types of errors are the concept, principle, algorithm, and counting errors.

Based on the results of interviews with the subject can be concluded the causes of errors made by the subject when solving the problem of fractions, as presented in Table 2.

| Items | Problem | Example of Errors | Locations of Errors | Types of Errors |
|-------|---------|-------------------|---------------------|-----------------|
| 14    | Mrs. Novi is a tailor. Mrs. Novi received $\frac{2}{3}$ meter of cloth to be handkerchief. For each handkerchief it takes $\frac{1}{6}$ meter. How many handkerchiefs can be made Mrs Novi? | | | Comprehension error
Transformation error
Process skill error
Encoding error |

Table 2. Causes of slow learner errors in solving fractional problems.

| Items | Causes of Errors |
|-------|------------------|
| 3     | Did not understand the concept of addition between integers and fractions. Incorrect in carrying out the procedure of solving problem. Did not fully understand the concept of simplifying fractions. Incorrect in writing the final answer. |
| 4     | Incomplete or incorrect in carrying out the procedure of solving problem. Incorrect in doing calculations or computation. Incorrect in writing the final answer. |
| 11    | Did not understanding the concept of subtraction between integers and fractions. Incomplete or incorrect in carrying out the procedure of solving problem. Incorrect in doing calculations or computation. Incorrect in writing the final answer. |
| 12    | Did not fully understand the concept of simplifying fractions. Incorrect in writing the final answer. |
| 14    | Incapable to understand and explain the meaning of keywords or information contained in the problem. Incorrect in identifying or determining the operation used. Incorrect in carrying out the procedure of solving problem. Did not fully understand the concept of simplifying fractions. Incorrect in writing the final answer. |

Beside to the causes of error in Table 2, there are another cause that affect the slow learner to make errors in solving the fractions problems that is the poor concentration level.

4. Discussion
Based on the locations and types of errors subject made in this research, it could be seen that subject did not have difficulties in reading. It was shown by how fluent the subject read the problem. The subject could read the keywords or symbols correctly. While in the comprehension part, the subject had difficulties to recognize the keywords in the problem, especially the word problem that require division with fractions. During interview, the subject could answer question regarding what information given in the problem and what was asked to find or to show; but the subject couldn’t explain the meaning of the keywords in the problem. As stated by Chauhan [4] that due to limited cognitive capacity, slow learners failed to cope with learning situations and to reason abstractly. Their inability to deal with abstract material resulted in wrong choice of operation to solve the problem. Their poor memory [4], limited comprehension of mathematical language [13], and weak algorithmic manipulation [6] resulted in difficulty to understand abstract mathematical concept. Those caused them to carry out the wrong procedure in solving problem and to make wrong calculation. In the end, they didn’t write the answer correctly (encoding).

Furthermore, the subject had difficulty focusing on given tasks [9]. The poor concentration levels also caused errors in solving fractions problems that actually could have solved by them correctly. When the subject poor concentration [4], the fractions problems that should be able to do the subject correctly then the subject more often make errors in solving the problem of the fractions. Due to their poor concentration skills, the subject had difficulty connecting and transferring information given to solve the problems[10].

5. Conclusion
The results showed that on the location of errors the slow learner made comprehension, transformation, process skills, and encoding errors. Based on the type of errors the slow learner made concept, principle, algorithm, and counting errors. Based on the location and type of error can be concluded the cause of slow learner error in solving the problem of fractions. What caused the error made by the slow learner was they didn’t understand and couldn’t explain the meaning of the keywords or information in given problem. Then, the subject didn’t understand the concept of addition and subtraction in integers and fractions. The subject also didn’t understand how to simplify the fractions. The next cause was the subject made mistakes by choosing the wrong operation to solve the problem, carrying out the wrong procedure to solve the problem, and making wrong calculation. In the end they didn’t write the answer correctly. Another causes was their poor concentration skills. The results of this research can be used as a reference for mathematics teachers, especially who teach in inclusion classes to find a alternative solution for the slow learner in solving fractions problem.

References
[1] Abdullah A M, Zainal N L, and Ali M 2015 Analysis of Students’ Errors in Solving Higher Order Thinking Skills (HOTS) Problems for the Topic of Fraction vol. 11 pp 133-142
[2] Abdurrahman M 2012 Anak Berkesulitan Belajar: Teori, Diagnosis, dan Remidisinya (Jakarta: Rineka Cipta) p 210
[3] Atik F, Kartini, Supardi, Lusli M M, Damanik T, Rivai and Dipa W 2013 Panduan Teknis Pelaksanaan Pelatihan Bagi Pelaksana Prosedur Operasional Standar dan Modul Pelatihan: Pendidikan Inklusif Berbasis Sekolah (Hellen Keller International Indonesia & Direktorat Pembinaan Pendidikan Khusus dan Layanan Khusus Pendidikan Dasar) p 21
[4] Chauhan S 2011 Slow Learners: Their psychology and Educational Programmes vol. 1 pp 279-289
[5] Erlinda N and Surya E 2017 Mathematical Learning Strategy of Fractional form by Using Learning Model of Gagne and Human Figure Line Media vol. 34 pp 13-22
[6] Herriot S T 1967 The Slow Learner Project:The Secondary School "Slow Learner" In Mathematics vol. 5 p 2
[7] Malik S 2009 *Effect of Intervention Training on Mental Abilities of Slow Learners* vol. 1 pp 61-64
[8] Mercer C and D Mercer A R 1981 *Teaching Student with Learning Problems* (Colombus: Charless Merril) p 145
[9] Paul P B 2016 *Coping With Slow Learners* vol. 2 pp 56-58
[10] Ruhela R 2014 *The Pain of the Slow Learner* vol. 4 pp 193-200
[11] Singh P, Rahman A A and Hoon T S 2010 *The Newman Procedure for Analyzing Primary Four Pupils Errors on Written Mathematical Tasks: A Malaysian Perspective* vol. 8 pp 264-271
[12] Soedjadi R 2000 *Hakikat Pendidikan Matematika Di Indonesia* (Jakarta: Direktorat Jendral Pendidikan Tinggi Departemen Pendidikan Nasional) p 13
[13] Yusha'u M A 2012 *Teaching Slow Learners in Mathematics: YUGAL Remediation Model As Alternative Method* vol. 13 pp 108-123