ATLANTIS PRESS

Advances in Social Science, Education and Humanities Research, volume 262

4th International Conference on Teacher Training and Education (ICTTE 2018)

Students' Error Pattern and Its Cause in Mathematic Basic Ability Test of The 3rd Grade of Elementary School

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***Abstract*—Students should master three basic abilities: reading, writing, and counting (mathematics). Those three abilities are the basis to learn other subject and used in daily life in order to adapt to society. The objective of Basic Ability Test implementation is to find out the students' reading, writing and counting ability necessary to improve learning program (remedial program). This research aimed to describe: (1) mathematic basic ability of the 3rd graders of Elementary School, (2) students' error pattern in Mathematic Basic Ability test for the 3rd grade of Elementary School, and (3) the cause of students' error in Basic Ability test for the 3rd grade of Elementary School. This study was a qualitative research. The subject of research was 100 3rd graders of Elementary School in Kebumen Regency in 2018 who have taken Basic Ability Test. Data collection was conducted using test, interview, and observation technique. Data validation in this research was carried out using triangulation technique. Data analysis was conducted using qualitative analysis encompassing data reduction, data display, and conclusion drawing. The result of research showed that (1) mathematic basic ability of the 3rd graders of elementary school was 49.16%, (2) the error pattern included: (a) reading, writing, number order and place value, (b) procedure, basic fact, and counting operation technique, (c) mixed counting operation, (d) concept, order, and fraction counting operation, (e) length, time, weight, and angle measurement concepts, (f) plane concept, and (g) currency concept, and (3) the causes of error included: (a) inadequate mastery of reading, writing, number order and place value, (b) inadequate mastery of procedure, basic fact, and counting operation technique, (c) inadequate mastery of mixed counting operation, (d) inadequate mastery of concept, order, and fraction counting operation, (e) inadequate mastery of length, time, weight, and angle measurement concepts, (f) inadequate mastery of plane concept, and (g) inadequate mastery of currency conversion concept**

Keywords*— *Error Pattern, Basic Abilities Test, Mathematics

I. INTRODUCTION

Elementary school is one of education institutions attempting to achieve the national objective. In learning activity at school, every student unlikely evades the learning outcome assessment activity. Learning outcome assessment activity is conducted systematically and sustainably. "Assessment is an activity of finding out the students' development, progress, and/or learning achievement during Education Program" [1]. One of assessment activities conducted in Elementary School is Basic Abilities Test (BAT). BAT is implemented based on Republic of Indonesia National Education Minister's Decree Number: 012/U/002 about Assessment System in Elementary School, Elementary School for Exceptional Children, Basic Level of Elementary School for Exceptional Children, and *Madrasah Ibtidaiyah* (Islamic Elementary School), stating in article 3(2) that "In addition to the type of assessment as mentioned in clause (1), Basic Abilities Test and Education Quality Assessment can be conducted" [1].

This Basic Abilities test is given to the 3rd graders of Elementary School once a year, exactly in the end of school year. Students should master three basic abilities: reading, writing, and counting (mathematics). Those three abilities are the basis to learn other subject and used in daily life in order to adapt to society. Basic Abilities Test conducted in Elementary School aims to "find out the students' abilities of reading, writing, and counting, necessary to improve program at school, national and even international levels" [2]. After the test has been completed, the students should be followed up, among others by analyzing the question items of Basic Abilities Test and diagnosis of error in the students' work. Through analyzing the question items, it can be found whether or not the test questions have met the criteria of good test and the students' learning achievement. Through error diagnosis, types of error, error cause, and solution to the error can be found.

Mathematic Basic Abilities Test is a diagnostic test aiming to find out the students' counting ability necessary to improve the learning program. However, such the objective is neglected so far and

school holds the test only without following up the result of test. Meanwhile, to improve the learning, follow-up activity is required. This follow-up activity includes diagnosing the students' error, by means of finding types of error, causes of error, and solution to it. However, the fact shows that the Basic Abilities Test is only corrected and the result is reported to Education and Culture Service.

Basic Abilities test is an instrument of collecting information in the form of questions used to measure basic abilities of reading, writing, and counting conducted by individual or group. Basic Abilities Test "as the test given to students to measure basic abilities including reading, writing, and counting" [1]. The objective of Basic Abilities Test is to find out the students' ability of reading, writing, and counting necessary to improve learning program (remedial program). Basic Abilities test conducted functions as: (a) a means of ensuring, supervising, and controlling the quality of education, (b) feedback in the improvement of learning program at school, (c) a means of encouraging the improvement of students' ability, particularly reading, writing, and counting abilities. The benefits of Basic Abilities test are: (a) to provide information and to be early warning system all at once to everyone about students' ability level in the term of reading, writing, and counting, (b) to diagnose the students' weakness in reading, writing, and counting, (c) feedback to the teachers in improving the learning, (d) to be school mapping based on the students' reading, writing, and counting abilities.

The scope of Counting Material includes: (1) writing or ordering numbers, (2) working on counting operation (addition, subtraction, multiplication, division), and (3) conceiving shape and size. Meanwhile, Mathematic Standard Competency includes (1) writing the symbol of numbers up to 10,000, (2) ordering numbers, (3) reading the symbol of numbers, (4) writing the name of number, (5) identifying place value, thousands, hundreds, tens, and ones, (6) additing the result up to 10,000, (7) subtracting maximal number of 10,000, (8) working on mixed counting (additing, subtracting, multiplying, and dividing) the maximal number of 10,000, (9) multiplying two one-digit numbers with two digit and ten-fold number, (10) dividing three-digit number with one-digit number, (11) comparing, additing, subtracting fraction number with the same denominator, (12) comparing length, width, and weight, (13), identifying and determining time, (14) identifying plane (square and rectangle, right and non-right angle), (15) identifying money value and using it in daily life. The material of Counting Basic Abilities Test (BAT) used is based on the curriculum enacted nationally and relevant materials. Test material is taken from essential materials up to the 3rd grade of Elementary School, included into mathematics.

This Basic Abilities test held by Directorate General of Primary and Secondary Education and Research and Development Center of National Education, Education Service and Regional Office/Religion Department Office is implemented in the form of written and action test. For written test, the form of question includes multiple-choice, filling-in the blank, brief answer, and essay, adjusted with the competency measured. Meanwhile, action test can be conducted with practice test implemented by the school itself. Question study is intended to get valid test item that can actually measure the students' ability. Question study can be done in two ways: quantitative and empirical studies. Quantitative study has been conducted by validation practitioners, while empirical one is conducted by trying out the question to be tested. Usually the number of test items is larger than that tried out. Considering the result of tryout, the tryout test items are restudied and reviewed to find out their weakness, in order to get the actually good test items.

Basic Abilities Test (BAT) is conducted simultaneously in the end of school year in the 3rd grade. Test can be held for one or two days. Time allocated to Counting (Mathematic) basic ability test is 90-120 minutes. The result of Basic Abilities Test is examined or corrected and assessed by supervising team of the organizing school by prioritizing objectivity, made as a sample for national, province, and regency/city analysis. Each of abilities measured is scored at a 10-100 point scale. Counting Basic Abilities test is held in written test with multiple-choice, fill-in-the blank, and essay items. The test items consisted of 20 multiple-choice (maximum score of 40), 20 fill-in-the blank (maximum score of 40), and 4 essay items (maximum score of 20). Thus, the maximum end score in this Mathematic basic ability test is 100. To find out the ability the students have in Mathematic Basic Ability Test, the following criteria are indicated: (1) score ≥ 95 (Excellent), (2) score 80-94 (Very Good), (3) score 65-79 (Good), (4) score 50-64 (Fair), (5) score 35-49 (Poor), and (6) score < 34 (Very Poor).

Considering the elaboration above, this research aims to describe in-depth: (1) the mathematic basic ability of the 3rd graders of Elementary School, (2) error pattern the students make in Mathematic Basic Abilities Test in the 3rd grade of Elementary School, and (3) the cause of students' error in Mathematic Basic Abilities Test in the 3rd grade of Elementary School.

II. METHOD

This research strategy employed a descriptive qualitative research approach, by collecting as many as possible data concerning types and causes of error. The data of error pattern and cause were then analyzed to find solution to correct the students' error. The subject of research consisted of 100 3rd graders of Elementary School in Kebumen Regency in 2018 who have taken Basic Abilities Test.

Techniques of collecting data used were test, interview, and observation. Test technique was used to find out the Mathematic basic ability of the 3rd graders of Elementary School. Interview and observation were used to find type and cause of error the students make in Mathematic basic ability in the 3rd grade of Elementary School. Data validity in this research was obtained through source and technique triangulations. Source triangulation involved author, teacher, headmaster, and colleague. Meanwhile, technique triangulation involved test, interview, and observation [3], [5]. Data analysis used was qualitative analysis including three activity plots occurring simultaneously and continuously during and after data collection: data reduction, data display, and conclusion drawing or verification [4].

III. RESULT AND DISCUSSION

A. Result of Mathematic Basic Abilities Test in the 3rd graders of Elementary School

Considering the result of Mathematic Basic Abilities Test conducted, the following data is obtained.

TABLE I. SCORE OF MATHEMATIC BASIC ABILITIES TEST RESULT

Score	Frequency	Criteria	Percentage (%)
< 35	15	Very Poor	15
35 - 49	35	Poor	35
50 - 64	35	Fair	35
65 - 79	12	Good	12
80 - 94	3	Very Good	3
≥ 95	0	Excellent	0
Total	100		100

From table above, it can be seen that the lowest score = 22, highest score = 80, and mean mastery of mathematic basic competency test in the 3rd graders of Elementary school is 49.16%.

Meanwhile, the learning materials that have not been passed successfully are: (1) writing the symbol of numbers up to 10,000, (2) ordering numbers, (3) reading the symbol of numbers, (4) writing the name of number, (5) identifying place value, thousands, hundreds, tens, and ones, (6) additing the result up to 10,000, (7) subtracting maximal number of 10,000, (8) working on mixed counting (additing, subtracting, multiplying, and dividing) the maximal number of 10,000, (9) multiplying two one-digit numbers with two digit and ten-fold number, (10) dividing three-digit number with one-digit number, (11) comparing, additing, subtracting fraction number with the same denominator, (12) comparing length, width, and weight, (13), identifying and determining time, (14) identifying plane (square and rectangle, right and non-right angle), (15) identifying money value and using it in daily life [6], [7], [8].

B. Error Pattern and its cause in Mathematic Basic Abilities Test

Type and cause of students' error can be found by analyzing the students' answer and scribbling paper, observing, and interviewing the students regarding the result of Mathematic Basic Ability Test. This technique is also used to find out the cause of error likely deriving from outside students or external factor of students. Considering the result of analysis on students' work, observation, and interview with students, it can be found that the types and causes of error in Elementary School students in Mathematic Basic Abilities are as follows:

1. Error in Reading Number

For example, question: Symbol of number 4,627 is read…
Correct answer: "*Four thousand, six hundred and twenty seven"*
Some students answer: "*Six hundred ten two seven*"
Cause of error: Reading number and imprecision
Some students answer: "*Six hundred twenty ten thousand seven*"
Cause of error: Reading number and imprecision.

2. Error in the concept of number order

For example, question:
2,345; 2,369; 2,393;…....; .....…; 2,465. The appropriate number to fill in the blanks above is…. and …
Correct answer: 2,417 and 2,441
Some students answer: 2407 and 2431
Cause of error: Number order and skip counting
Some students answer: 2394 and 2395
Cause of error: Number order and skip counting.

3. Error in Additing Process

For example, question:
2,308
3,467
2,192 +
.....
Correct answer: 7,697
Some students answer: 7957
Cause of error: Forgetting to save and imprecision
Some students answer: 7927
Cause of error: Inadequate mastery of addition basic fact and imprecision

4. Error in Subtraction Process

For example, question:
7,863
3,456 -
.....
Correct answer: 4,407
Some students answer: 4418
Cause of error: Inadequate mastery of subtraction basic fact and imprecision
Some students answer: 4007

Cause of error: Inadequate mastery of subtraction basic fact and imprecision
.

5. Error in multiplication process
For example, question: 8 x 70 = ……
Correct answer: 560
Some students answer: 78 (summing or adding)
Cause of error: Inadequate mastery of multiplication concept and less focus
Some students answer: 56
Cause of error: imprecision and less focus.

6. Error in Division Process
For example, question: 612 : 9 = ……
Correct answer: 68
Some students answer: 38
Cause of error: Inadequate mastery of division technique and division basic fact.
Some students answer: 319
Cause of error: Inadequate mastery of division technique and division basic fact.

7. Error in Counting Process
For example, question: 4,367 + 978 = ……
Correct answer: 5,345
Some students answer: 4,543
Cause of error: Inadequate mastery of addition basic fact and imprecision.
Some students answer: 5,453
Cause of error: Inadequate mastery of addition basic fact and imprecision.

8. Error in using symbol
For example, question: 3/12 ….. 7/12
The symbol appropriate to complete the Mathematic sentence above is….
Correct answer: <
Some students answer: >
Cause of error: Inadequate mastery of inequality sign and of fraction concept
Some students answer: =
Cause of error: Inadequate mastery of inequality sign and of fraction concept.

9. Error in Fraction Additing Process
For example, question: 5/6 ….. 2/6
Correct answer: 7/6
Some students answer: 10/36 (Numerator and denominator are multiplied)
Cause of error: Inadequate mastery of Fraction Summing Process and imprecision in reading the question
Some students answer: 7/12 (Numerator and denominator are summed)
Cause of error: Inadequate mastery of Fraction Summing Process and imprecision in reading the question.

10. Error in Fraction Subtracting Process
For example, question: 7/9 - 4/9 = ……
Correct answer: 3/9
Some students answer: 3/18
Cause of error: Inadequate mastery of Fraction Subtracting Process
Some students answer: 2/9
Cause of error: Inadequate mastery of Fraction Subtracting Process.

11. Error in reading Time sign
For example, question:

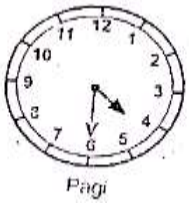
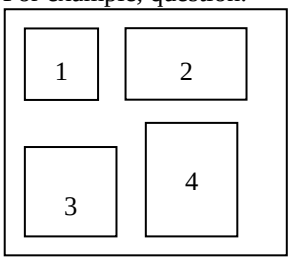


Figure above shows time….
Correct answer: 04.30
Some students answer: 400.30
Cause of error: Inadequate mastery of Time concept and imprecision
Some students answer: 05.30
Cause of error: Inadequate mastery of Time concept and imprecision.

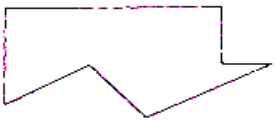
12. Error in time unit concept
For example, question: Harun helps mother from 15.30 to 17.15.
So, Harun helps mother for…. Minutes
Correct answer: 1 hour + 45 minutes = 105 minutes
Some students answer: 110
Cause of error: Inadequate mastery of time unit and imprecision
Some students answer: 115
Cause of error: Inadequate mastery of time unit and imprecision.

13. Error in plane concept
For example, question:



In figure above the structures constituting square are …. and….
Correct answer: 1 and 3
Some students answer: 4 and 2
Cause of error: Inadequate mastery of square concept and imprecision
Some students answer: 1, 2, and 4
Cause of error: Inadequate mastery of square concept and imprecision.

14. Error in Angle Concept
For example, question:



The number of right angles in figure above is …..
Correct answer: 3
Some students answer: 6 (six)
Cause of error: Inadequate mastery of right angle concept and imprecision
Some students answer: 7 (seven)
Cause of error: Inadequate mastery of right angle concept and imprecision.

15. Error in currency value concept
For example, question:

The value of all currencies above is…
Correct answer: IDR 5,700
Some students answer: IDR 6,600.00
Cause of error: Inadequate mastery of currency conversion and imprecision
Some students answer: IDR 5,520.00
Cause of error: Inadequate mastery of currency conversion and imprecision

Considering the result of analysis on error type and cause, the summary of error type and cause in Mathematic Basic Abilities Test in the 3rd graders of Elementary School can be presented below.

TABLE II. RESULT OF ANALYSIS ON ERROR PATTERN AND CAUSE

No	Error Pattern	Cause of Error
1	• Error in Reading Number	• Inadequate mastery of reading number • Imprecision
2	• Error in writing the symbol of number	• Inadequate mastery of number symbol • Inadequate mastery of place value • Imprecision
3	• Error in ordering number	• Inadequate mastery of ordering number • Imprecision
4	• Error in place value concept	• Inadequate mastery of place value. • Imprecision
5	• Error in additing procedure • Error in Basic Fact of addition • Error in the storing (saving) technique in addition	• Inadequate mastery of additing procedure, basic fact and technique • Imprecision
6	• Error in subtracting procedure • Error in Basic Fact of subtraction • Error in the borrowing technique in subtraction	• Inadequate mastery of subtraction procedure, basic fact and technique • Imprecision
7	• Error in multiplication procedure • Error in Basic Fact of multiplication • Error in multiplication technique	• Inadequate mastery of multiplication procedure, basic fact and technique • Imprecision
8	• Error in division procedure • Error in Basic Fact of division • Error in division technique	• Inadequate mastery of division procedure, basic fact and technique • Imprecision
9	• Error in mixed counting operation procedure • Error in Basic Fact of mixed counting operation • Error in mixed counting operation technique	• Inadequate mastery of procedure, basic fact and technique in mixed counting operation • Imprecision
10	• Error in ordering fraction • Error in comparing fraction • Error in additing two fractions • Error in subtracting two fractions	• Inadequate mastery of fraction concept and order. • Inadequate mastery of fraction additing and subtracting procedure • Imprecision
11	• Error in length unit	• Inadequate mastery of length concept and the relationship between length units • Imprecision
12	• Error in hour concept • Calculation with hour	• Inadequate mastery of concept and time unit relation. • No understanding on word problem • Imprecision
13	• Error in weight unit concept	• Inadequate mastery of weight unit concept • Imprecision
14	• Error in plane concept	• Inadequate mastery of plane introduction • Forgetting the name of plane
15	• Error in angle concept	• Inadequate mastery of angle concept and type. • Incapability of differentiating angle types.
16	• Error in currency value concept	• Inadequate mastery of currency introduction and writing. • Imprecision

Considering the table above, it can be concluded that students' error pattern in Mathematic Basic Abilities Test in the 3rd grade of Elementary School are as follows: (1) error pattern of reading, writing, number order and place value, (2) error pattern of procedure, basic fact, and counting operation technique (addition, subtraction, multiplication and division), (3) error pattern of mixed counting operation, (4) error pattern of concept, order, and fraction counting operation, (5) error pattern of length, time, weight, and angle measurement concepts, (6) error pattern of plane concept, and (7) error pattern of currency concept. Meanwhile the causes of error include: (1) inadequate mastery of reading, writing, number order and place value, (2) inadequate mastery of procedure, basic fact, and counting operation technique, (3) inadequate mastery of mixed counting operation, (4) inadequate mastery of concept, order, and fraction counting operation, (5) inadequate mastery of length, time, weight, and angle measurement concepts, (6) inadequate mastery of plane concept, and (7) inadequate mastery of currency conversion concept [6], [7], [8].

IV. CONCLUSION

Considering the result of data analysis, the following conclusions can be drawn. (1) Mathematic Basic Ability level of the 3rd graders of elementary school is 49.16%. (2) The error pattern includes: (a) reading, writing, number order and place value, (b) procedure, basic fact, and counting operation technique, (c) mixed counting operation, (d) concept, order, and fraction counting operation, (e) length, time, weight, and angle measurement concepts, (f) plane concept, and (g) currency concept. (3) The causes of error include: (a) inadequate mastery of reading, writing, number order and place value, (b) inadequate mastery of procedure, basic fact, and counting operation technique, (c) inadequate mastery of mixed counting operation, (d) inadequate mastery of concept, order, and fraction counting operation, (e) inadequate mastery of length, time, weight, and angle measurement concepts, (f) inadequate mastery of plane concept, and (g) inadequate mastery of currency conversion concept.

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