THE RESULT OF ASSESSMENT FOR STUDENTS IN SOLVING EXPONENTS AND LOGARITHMS PROBLEMS
(CASE STUDY IN GRADE X CLASS MATHEMATICS AND NATURAL SCIENCE (MIA) 2 STATE SENIOR HIGH SCHOOL 1 DEPOK 2014/2015)

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Abstract

The objective of this research is to describe the result of assessment for students in solving exponents and logarithms problems in class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman included the rate of achievements level of solving the problem, the percentage of completion of each items, and the absorption percentage of students in exponents and logarithms material. In addition, the objective of this research is to describe the mistake that being done by students of class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman. This research is categorized into an explorative research with mixed-methods (quantitative and qualitative approach) with the participant-selection (qualitative-emphasized) model involving 32 students of class X Mathematics and Natural Science (MIA) 2 in Senior High School 1 Depok, Sleman. The 12 items of the instruments used are an essay on exponents and logarithms materials. The result of this research show that from the result of the essay test, the rate of achievements level of solving exponents and logarithms problem is about 54,59%, the percentage of completion of question 1a is 97%, question 1b is 79%, question 2a is 49%, question 2b is 41%, question 3a is 86%, question 3b is 55%, question 4 is 90%, question 5 is 53%, question 6 is 17%, question 7 is 74%, question 8 is 25%, and question 9 is 33%. The absorption percentage of students in exponents and logarithms materials is about 15,625%. Types of mistake that found on class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok in solving Exponents and Logarithms problem are, 1) change the negative exponential form to the positive exponential form, 2) change the root form into the sum of the roots, 3) change the fraction exponential form into a root form and determine the result, 4) algebraic operations of root form, 5) rationalize the denominator of a fraction of root form, and 6) simplify the logarithms.

Keyword: *Result of Assessment, Exponents and Logarithms Test, Types of Mistake*

Introduction

Teaching and learning activities (KBM) is an activity that is routinely done by educators and learners both inside and outside the classroom. Similarly, it is performed by university students in the Activities Practice Experience (PPL). University student practitioners who are studying as a teacher or educator also has the same function as the teacher that is as a facilitator who provide facilities as convenient as possible for their students in the learning process. A series of actions that occur between teachers and students in learning activities called learning process, that are discussion, question and answer, solving the problems, and others. A learning process is closely related to the process of understanding the concept of the material being studied. Especially for mathematics courses, build a good concept for students is not easy. The materials in mathematics are related to each other, which is a material may be a prerequisite for further material. If the understanding of the

concept will be a matter dominated and not well understood, it can inhibit the further understanding of the concept of matter that has a relationship with the material. Therefore, to determine the extent of students' understanding mastered in each material, a teacher doing an evaluation learning in the form of a test. Although Activities Practice Experience (PPL) is only done for 2.5 months, but to learn to be a good teacher, a university student practitioner is required to be able to evaluate learning, especially in the material being taught that is Exponent and Logarithm. Based on the test results, educators will know the extent to which the concept was mastered by the students to look at the mistakes in working on it.

Exponent and logarithm is a mathematical subject in class X SMA semester of learning about the concept of exponential, positive exponential form, negative exponential form, fraction exponential form, and the relationship with the fraction exponential form and the root form, standard form of a very small and very large numbers, algebraic operations of the root form, change the root form to the sum of the roots, logarithms and its concepts. Exponents and Logarithms is not easy for high school students because a lot of properties, both properties of exponents and logarithms to be learned. It also occurs in SMA Negeri 1 Depok class X Mathematics and Natural Sciences (MIA) 2 in Sleman. From the learning outcomes of PPL, students are still has many questions about the material, or asking how to accomplish the task / homework given by teachers related to Exponent and Logarithm. In addition, teacher also gave daily tasks for to be done by students. From the results of the completion of daily tasks performed by the students, it found that many students make mistakes. Before the remedial, the average score of students who are under the minimum completeness criteria (KKM) is determined by each school reaches 54.59%. This is indicates that students have difficulty in understanding the subject of Exponents and Logarithms. Mistakes that made by students is a natural thing, but if it happens continuously then it will lead students to less successful in understanding subsequent material that requiring prerequisites such material.

This is the benefits of error analysis in solving Exponents and Logarithms problems can be seen. By analyzing the errors made by the student, a teacher can determine the level of understanding and teachers will be easier to do the planning stages of enrichment learning material so the students can better understand and diminish mistakes made by students when solving problems exponents and logarithms in the next tests. Based on these problems, researchers are interested in analyzing the mistakes made by students of State Senior High School 1 Depok class X Mathematics and Natural Sciences (MIA) 2.

The objective of this research is to describe the result of assessment for students in solving exponents and logarithms problems in class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman included the rate of achievements level of

solving the problem, the percentage of completion of each items, and the absorption percentage of students in exponents and logarithms material. In addition, the objective of this research is to describe the mistake that being done by students of class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman.

The significance of this research is of practical significance. Practically expected to benefit and become material for the evaluation of teachers and students in learning mathematics, especially for Exponent and Logarithm subject.

Research Method

This research is categorized into an explorative research with mixed-methods (quantitative and qualitative approach) with the participant-selection (qualitative-emphasized) model. The population of the research is students in class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman. The sample of the research are students in class X Mathematics and Natural Science (MIA) 2, Senior High School 1 Depok whose value is in that the minimum completeness criteria (KKM) is 73 for a total of 27 students. The research instrument used 12 test items Exponents and Logarithms problems made by researchers. According to Arikunto (1993: 207-209) an essay test, there are no standard guidelines in conducting the analysis in question, then the way is taken role in assessing the test item used is one of them held a checking validity. The validity of the items was done using expert judgment that is the teachers of mathematics Senior High School 1 Depok, Sleman.

There are two types of data collected in this research: quantitative data in the form of scores of students based on the test results of the students' work in the Exponent and Logarithm, absorption, average student scores, and the percentage of achievement attained by students; as well as qualitative data in the form of a description of the mistakes made by students. Assuming that the student has learned the material Exponents and Logarithms include exponent concepts, properties of exponents, zero power of a number, negative exponential form, fraction exponential form, root form and its relationship to fraction exponential form, algebraic operation of the root form, rationalize the denominator of a fraction of the root form, change the root form into the sum of the root form, the concept of logarithms, properties of logarithms, and standard form of numbers.

Techniques of data analysis done with reference to the criteria of errors made on each of the following aspects:

1. If students do the following things:

a. Not able to compare some of the concepts in the solution of problems. It is said that the student made a mistake in understanding the concept.

2. If students do the following things:
    a. Did not write down the formula used.
        It is said that the student made a mistake in the application of the principle.

3. If students do the following things:
    a. Made a mistake in determining the strategy
    b. Using a mathematical formula that is outside the norm of the solution of problems.
        It is said that the student made a mistake in the technical.

Research Findings and Discussion

The objective of this research is to describe the result of assessment for students in solving exponents and logarithms problems in class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman included the rate of achievements level of solving the problem, the percentage of completion of each items, and the absorption percentage of students in exponents and logarithms material. In addition, the objective of this research is to describe the mistake that being done by students of class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman viewed from the aspects of understanding the concept, aspects of the implementation of the principles, and technical aspects.

This research was carried out by giving the exponents and logarithms test in essay test form. The number of items used in this study was 12 items about Exponents and Logarithms. The table below show the value achieved by students of class X Mathematics and Natural Science (MIA) 2 Senior High School 1 Depok, Sleman:

No	Nama Siswa	No Soal	Skor yang diperoleh													Tumbuhan	Jumlah skor	Ketercapaian (%)	Perbaikan	
			1		2		3		4	5	6	7	8	9					Ya	Tidak
			a	b	a	b	a	b												
		Bobot	2	8	8	12	6	4	8	6	10	10	8	14	4	100			Ya	Tidak
1	Siswa 1		2	8	1	1	6	1	1	1	2	0	0	0	4	27	27	v	-
2	Siswa 2		2	8	3	3	5	4	3	5	1	1	8	1	4	48	48	v	-
3	Siswa 3		2	8	3	12	6	4	8	1	2	9	1	12	4	72	72	v	-
4	Siswa 4		2	8	8	0	5	2	8	6	0	10	2	1	4	56	56	v	-
5	Siswa 5		2	8	3	1	6	1	8	6	1	6	1	1	4	48	48	v	-
6	Siswa 6		2	8	1	1	6	1	8	1	1	5	1	1	4	40	40	v	-
7	Siswa 7		2	3	8	9	5	1	8	1	1	10	1	3	4	56	56	v	-
8	Siswa 8		2	8	6	8	6	2	8	6	3	10	2	14	4	79	79	-	v
9	Siswa 9		2	1	5	8	5	3	8	6	1	9	1	1	4	54	54	v	-
10	Siswa 10		2	3	2	12	5	3	8	1	1	10	1	3	4	55	55	v	-
11	Siswa 11		2	8	5	12	6	4	8	6	1	10	3	14	4	83	83	-	v
12	Siswa 12		2	8	8	2	1	3	8	4	5	6	1	5	4	57	57	v	-
13	Siswa 13		2	7	3	3	6	3	8	6	1	9	1	5	4	58	58	v	-
14	Siswa 14		1	5	1	2	6	2	8	1	2	10	1	9	4	52	52	v	-
15	Siswa 15		2	6	3	1	6	3	8	1	1	1	1	1	4	38	38	v	-
16	Siswa 16		1	8	6	12	3	4	8	6	1	10	1	14	4	78	78	-	v
17	Siswa 17		2	8	5	5	4	1	1	1	1	10	2	1	4	45	45	v	-
18	Siswa 18		2	8	3	3	6	1	8	1	4	10	1	2	4	53	53	v	-
19	Siswa 19		2	4	3	0	3	0	8	1	2	1	0	1	4	29	29	v	-
20	Siswa 20		2	8	6	10	6	4	8	6	8	10	8	11	4	91	91	-	v
21	Siswa 21		2	8	3	4	6	1	8	1	1	10	1	2	4	51	51	v	-
22	Siswa 22		2	5	3	2	5	1	8	2	1	9	1	1	4	44	44	v	-
23	Siswa 23		2	2	3	6	6	1	8	1	1	2	1	14	4	51	51	v	-
24	Siswa 24		2	2	1	1	5	6	8	6	1	10	3	7	4	56	56	v	-
25	Siswa 25		2	3	6	6	6	4	8	1	1	2	1	14	4	58	58	v	-
26	Siswa 26		2	8	3	4	6	1	8	2	1	8	8	1	4	56	56	v	-
27	Siswa 27		2	8	5	0	0	0	8	1	3	10	1	0	4	42	42	v	-
28	Siswa 28		2	8	2	9	6	1	8	1	1	10	1	1	4	54	54	v	-
29	Siswa 29		2	4	5	5	6	1	8	6	1	10	1	3	4	56	56	v	-
30	Siswa 30		2	8	6	3	6	1	8	4	1	0	0	0	4	43	43	v	-
31	Siswa 31		2	8	3	12	6	4	8	5	1	10	8	6	4	77	77	-	v
32	Siswa 32		2	5	2	1	5	2	2	4	1	10	1	1	4	40	40	v	-

From the result of the research show that the rate of achievements level of solving exponents and logarithms problem is about 54,59%. From these results can be assessed that the level of student achievement in working on Exponents and Logarithms problems are still very low. Whereas, question 1b is an easy question with the percentage of completion is 97%, question 1b is 79%, question 2a, 2b, and 3a are quiet difficult questions with the percentage of completion consecutively are 49%, 41%, and 86%. Question 3b is a difficult question with the percentage of completion is 55%. Question 4 is an easy question with the percentage of completion is 90%. Question 5 is a quite difficult question with the percentage of completion is 53%, question 6 is a difficult question with the percentage of completion is 17%. Question 7 is an easy question with the percentage of completion is 74%, question 8 is a quite difficult question with the percentage of completion is 25%, and question 9 is a difficult question with the percentage of completion is 33%. The absorption percentage of students in Exponents and Logarithms materials is about 15,625%. It is a very low category of absorption percentage.

The students' answers to the Exponents and Logarithms problems also analyzed descriptively with the steps that have been made. The results of the analysis of the types of errors made by students in solving Exponents and Logarithms problems described as follows:
1. Error understanding concepts (Students are not able to compare several concepts in the solution of problems)
   a. Students make mistakes in understanding the concept of the negative exponential form.

Students make mistakes in understanding the concept of the negative exponential form is in the question number 1b. Students assume that solving the problems of the negative power of a number mean just eliminate the negative sign only. There are also students who think that the negative power would be a subtrahend for the base form of the rank numbers. For example:

$$2^{-3} = 2 - 3 = -1$$

b. Students make mistakes in understanding the concept of zero power of a number.

Students make mistakes in understanding the concept of zero power of a number is at question number 7 that is after changing the logarithm into exponential form. Many students assume that if a number with the power of 0, the result is also 0.

2. Error applying the principle (did not write down the formula used)

   a. Students do not write a formula or a general form in question 3b is about changing the shape of the root to the sum of the root. This is according to the discussion with the students because the students are still confused in the use of formula, there are also students who have forgotten the formula.

3. Technical error

   Made a mistake in determining the strategy

   a. Students made a mistake in changing the fraction exponential form into the root form.

   Students make mistakes in changing the fraction exponential form into the root form is in the question number 1a. There is one student who has difficulty in changing fraction exponential to the root form.

   b. Students made a mistake in changing the negative exponential form into positive exponential form.

   Students make mistakes in changing the negative exponential form into positive exponential form is in the question number 1b.

      a. Students make mistakes in simplifying the positive exponential

      Students make mistakes in simplifying the positive exponential is in the question number 1b.

      b. Students made a mistake in choosing the form of the opposite sign form in rationalizing the denominator fractional root form

      Students make mistakes in choosing the form of the opposite sign form in rationalizing the denominator fractional root form is in the question number 2a and 2b.

      c. Students make mistakes in algebraic operations of the root form

Students make mistakes in algebraic operations of the root form is in the question number 2a, 2b, 3a, 4, and 5. From the analysis of the test results found that many students were wrong in doing subtraction and multiplication operations

d. Students make the mistakes in equating the denominator of a fraction of the root

Students make mistakes in equating the denominator of a fraction of the root is in the question number 2b.

e. Students made a mistake in determining the steps in the solution of the equation

Students make mistakes in determining the steps in the solution of equation in the question number 5. The step right that is make the exponent of the number equal to 0, but a lot of students wrote the exponent is equal to 1.

f. Students make mistakes in the use of the properties of logarithms to solve the problem

Students make mistakes in the use of the properties of logarithms to solve the problem is in the question number 6 and 8. According to the discussion with the students this is happening because there are many properties of logarithms, so when do the problems students will become confused to choose the properties.

g. Students have difficulty in changing the logarithms form to the exponential form

Students make mistakes in changing the logarithms form to the exponential form is in the question number 7. Students are still confused in using the relationship between the logarithms and exponents:

$$a^b = c \Leftrightarrow \log_a c = b$$

Using a mathematical formula that is outside the norm of the solution of problems

a. Students write a wrong formula or the formula that is outside of the rules of mathematics.

Students write a wrong formula or the formula that is outside of the rules of mathematics is in question number 9. The right formula is presented below:

$$\sqrt{a} + \sqrt{b} = \sqrt{(a + b) + 2\sqrt{ab}}$$

But students write as follow:

$$\sqrt{a} + \sqrt{b} = \sqrt{(ab) + 2\sqrt{a + b}}$$

Conclusions and Suggestions

Types of mistake that found in class X Mathematics and Natural Sciences (MIA) 2 State Senior High School 1 Depok in Exponent and Logarithm test given by the researchers according to the theory referred to in this research are:

1. Error understanding concepts (Students are not able to compare several concepts in the solution of problems)

   a. Students make mistakes in understanding the concept of the negative power of a number

   b. Students make mistakes in understanding the concept of zero power of a number

2. Error applying the principle (did not write down the formula used)

   a. Students do not write a formula or a general form that is changing the shape of the root to the sum of the root.

3. Technical error

   Made a mistake in determining the strategy

   a. Students made a mistake in changing the fraction exponential form into the root form

   b. Students made a mistake in changing the negative exponential form into positive exponential form

   c. Students make mistakes in simplifying the positive exponential

   d. Students made a mistake in choosing the form of the opposite sign form in rationalizing the denominator fractional root form

   e. Students make mistakes in algebraic operations of the root form

   f. Students make the mistakes in equating the denominator of a fraction of the root

   g. Students made a mistake in determining the steps in the solution of the equation

   h. Students make mistakes in the use of the properties of logarithms to solve the problem

   i. Students have difficulty in changing the logarithms form to the exponential form

   Using a mathematical formula that is outside the norm of the solution of problems

   a. Students write a wrong formula or the formula that is outside of the rules of mathematics.

References

Eko Putro Widoyoko. (2009). *Evaluasi Program Pembelajaran: Panduan Praktis Bagi Pendidik dan Calon Pendidik*. Yogyakarta: Pustaka Pelajar

Rachmadi Widdiharto. (2008). *Diagnosis Kesulitan Belajar Matematika SMP dan Alternatif Proses Remidinya*. Yogyakarta: Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan Matematika

Suharsimi Arikunto. 1993. *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.