The analysis of the implementation of multi techniques based learning media in improving the elementary school students’ higher order thinking skill in solving exponential problem

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Abstract: This study aims to investigate the analysis of the implementation of multi techniques based learning media in improving the elementary school students’ higher order thinking skill in solving exponential problem. This is caused by the lesson plans cannot motivate students to improve higher order thinking skills. The method used in this study is a mixed method which is a combination of quantitative and qualitative methods. The research subjects were the fifth grade students of elementary school consisting of 25 students of experimental class and 24 students of the control class. The instruments of this research are an interview, a questionnaire, observation, and documentation. Quantitative method is applied to analyze the difference of student achievement result among two classes, while the qualitative method is applied to analyze the students' higher order thinking skills. The results show that there are significant differences between the two classes that applied multi techniques based learning and conventional learning. The statistical result indicates that the (2-tailed) significance of the independent sample t-test in the pre-test was 0.000 or \( \alpha \leq 0.05 \). It implies that the implementation of multi techniques media affects the students' higher order thinking skill in solving exponential problem.

1. Introduction

In teaching and learning process, especially on the subject of Discrete Mathematics the aim is not only to understand the math materials taught by lecturers, but also the ability of reasoning, communication, representation, problem solving, and good behavior after studying mathematics is a general purpose that must be mastered by students [1]. Mathematics education at higher education tends to direct learners to understand mathematics formula by applying it in the subject involving problem solving. This is the special case when the material contains certain formulas, such as arithmetic sequences and series. It should not be done by a teacher now days, since in this modern era, it demands a global competition, specifically in the development information technology and communication rapidly in all aspects of life. The development of technology has the changed of qualifications and competences of the workforce. The issue of developing 21st century skills should become an attention for education researchers.
To improve students’ thinking skills, teachers must be creative in creating a learning atmosphere that supports and uses a variety of learning strategies as well as a number of factors that can facilitate learners [2]. One of the abilities that must be possessed in the 21st century is HOTS [3]. HOTS means students’ thinking ability who is able to apply the knowledge and skills that have been developed and use them to solve new problems through concepts that have been taught. HOTS consist of several aspects including analysis, evaluation and creation [4]. Revision to the Curriculum 2013 in 2017 requires teachers to make a number of improvements. Among others, one is for the teacher to be creative in integrating literacy, 21st 4C skills (creative, critical, communicative, and collaborative), and HOTS in their classroom instruction that the ability to involve analysis, evaluation, and creativity is a higher-order ability [5]. In general, thinking skill can be divided into Low Order Thinking (LOT) and High Order Thinking (HOT). HOT is important to be developed because it can make someone able to manage information obtained previously to bring up ideas as a solution to new problems. In Bloom’s taxonomy, HOT is at level C4 to C6 while in the dimension of the cognitive process are analysis, evaluation and creating activities. This is in line with the development of education which focuses on developing critical and creative thinking skills. The ability to think critically and creatively is part of HOT [6]. However, in fact, thinking skills passed by most Indonesian students are still weak when resolving contextual problems. Especially if given a complicated problem. To deal with this situation, a teacher is required to make teaching and learning activities run efficiently and pleasantly. One effort that can be done is to use an interactive learning model so that students can be interested in participating in learning and can also develop HOT students’ abilities [7].

Based on some of these opinions, it can be concluded that Higher Order Thinking Skills (HOTS) is the ability to think that is not only remembering, restating, referring without processing, but also the ability to think to examine information critically, creatively, creatively and able to solve problems.

**Table 1.** The indicators of higher order thinking skill [8].

| No. | Indicator | Sub Indicator |
|-----|-----------|---------------|
| 1   | Analyze   | A1 = Analyzing information |
|     |           | A2 = Able to recognize |
|     |           | A3 = Identify questions |
|     |           | E1 = Give a rating |
| 2   | Evaluate  | E2 = Make a hypothesis |
|     |           | E3 = Accept or reject a statement |
|     |           | C1 = Generating |
| 3   | Create    | C2 = Design |
|     |           | C3 = Organizing |

Thinking levels for cognitive abilities are coded by using C. The lowest thinking level is encoded by using C1 and up to the highest level with C6 code: C1, C2, and C3 being low order thinking C4, C5, and C6 being high order thinking [9]. Creative thinking is associated with the highest category in the cognitive aspects of Bloom’s Taxonomy. Bloom divides the level of thinking into six levels, namely knowledge, comprehension, application, analysis, synthesis, and evaluation. Then the taxonomy was revised by Anderson into remembering, understanding, applying, analyzing, evaluating and creating. The highest category is creating, which means putting elements together to form a related and functional whole or reorganizing elements into new structures or patterns. In creating it is associated with three cognitive processes, namely generation (generating), planning (planning) and producing (producing) [10]. Indicators for measuring higher-order thinking cover 3 levels that is analysis level, evaluation level and level creation, and 3 levels under those level is a low-ability [11]. However, before accomplishing high level thinking, the three levels of remembering, understanding and applying must be achieved [12]. This thinking is based on the fact that some types of learning require more cognitive processes than others, but it has more general benefits in the bloom taxonomy. For example, the ability to involve analysis, evaluation and create are considered by higher-order
thinking. Higher Order Thinking Skills (HOTS) are high-level thinking skills that consist of the ability to analyze, evaluate and create. Thinking skills according to Bloom are divided into two levels, namely Lower Order Thinking Skills and Higher Order Thinking Skills. Lower Order Thinking Skills (LOTS) consist of knowledge, understanding and application while HOTS consists of analysis, synthesis and evaluation activities related to mathematic concepts [13]. Achievements to this level in learning theory are known as the achievement of higher level thinking skills translated from the sentences indicating Higher Order Thinking Skills (HOTS) [14].

Students' higher order thinking skills vary from one student to another. In this study related to solve exponential problem. Learning media in the form of lesson plans are still unable to motivate students in improving higher order thinking skills. This is caused by the teacher being less creative in making lesson plans that only copy from the teacher's book. While competency achievement indicators were not developed to improve higher-order thinking skills. Therefore, in this study, we applied the development of multi-techniques based learning media in improving students' higher-order thinking skills. Learning media is a learning system that allows students individually or in groups to actively search, explore, and determine scientific concepts and principles holistically, meaningfully and authentically. Learning media is designed to make students integrate all data from several fields of science and produce higher-order thinking. This learning media requires the ability to think highly for students. The selected techniques do not require a complicated design. The techniques used are 5 learning techniques to solve exponential problems. In this study, using multiple techniques in calculating the material for the operation, they are; 1) Technique of counting with flanked, 2) Technique of counting with marbles, 3) Technique of squaring the number of a number, 4) Squaring three large numbers quickly, 5) Multiplication of cube with quadratic equations.

Based on the multi-techniques learning steps the syntax can be described as follows: 1) The teacher starts from the actual facts in accordance with the teaching material through verbal questions and answers 2) The teacher motivates students to identify problems and selective focus, 3) The teacher guides students to process mind so that the original idea arises to determine the solution, 4) Students are able to present. The conventional model refers to student-centered learning of Think-Pair-Shares (TPS) technique. TPS is a simple group discussion technique, 1) students are divided into several groups, 2) teachers distribute worksheets for each group, 3) students start thinking to solve problems arising from open or unsolved problems of the research group, 4) one group member gathers to synchronize the problem-solving ideas with another group member, and 3) the last, share problem-solving techniques.

The purposes of this study are : 1) To find out that the process of multi-techniques based mathematics learning media can improve students' high orderthinking skills in solving exponential problem. 2) To find out that the results of the development of Mathematics learning media can improve students' higher-order thinking skills in solving exponential problems. 3) To find out that the effectiveness of the implementation multi-techniques based mathematics learning media in improving students' higher-order thinking skills in solving exponential problems. 4) To analyze students’ activities when multi-techniques based Mathematics learning media are applied and 5) To analyze phase portraits of higher order thinking skills students in solving exponential problems through the implementation of multi-techniques based mathematics learning media.

In this study, we propose the following research question: are there significant differences between the class applied multi-techniques based mathematics learning media and the class applied conventional learning technique? To answer the research question, we have done some preliminaries study and the results tend to contribute a positive effect. Those, we state the following positive hypothesis: there are significant differences between the two classes that applied multi-techniques based mathematics learning media and conventional learning technique.
To analyze the implementation of multi techniques based learning Mathematics media in improving the elementary school students’ higher order thinking skill in solving exponential problem, the researcher used a mixed method. A mixed method is the research method that is combining qualitative and quantitative methods [14]. In brief, we can depict the triangulation model in Figure 1. It can be seen from the figure; we started the research by determining the two classes of the 5th grade students of elementary school as an experimental class and a control class. Those consisted of 25 students of the experimental class and 24 students of the control class. Further, we developed a pre-test and we gave to both two classes and analyzed the result for the next steps. We did a sequential mixed method,

![Triangulation Model](image-url)
starting from qualitative, quantitative and ended by qualitative. Since the qualitative results gave the result analysis narratively, we convince the result by statistical inferential and then we ended with doing an in-depth interview to some respondents to capture their portrait phase of their higher order thinking skills as well as to know the level of students’ higher order thinking skills and to convince the improvement of students’ higher order thinking skill. The combination of the two methods also aims to resolve the weaknesses of each method. The statement based on the reasoning process where its truth is not yet certain. Quantitative research was experimental research model by using pre-test and post-test [16]. The following table describes the research design.

| Group                  | Pre-Test | Treatment | Post-test |
|------------------------|----------|-----------|-----------|
| A (experimental class) | O₁       | X         | O₂        |
| B (control class)      | O₃       |           | O₄        |

2.1. Population and Sample
The research subjects were the 5th grade students of elementary school at SDN 5 PATOKAN Situbondo of academic year 2019/2020 consisting of 25 students of the experimental class and 24 students of the control class. The sampling technique used was cluster random sampling that was done by randomly choosing two classes, the first class was the experimental class with the implementation of multi techniques based learning media, and the second class was control class with the implementation of a conventional learning.

2.2. Instrument
The instruments used in this study were a test, an observation, an interview and documentation. The test instrument is a pre-test and post-test of essay type. The observation instrument used a Linkert scale encompassing into four categories, namely very good (score 4), good (score 3), quite good (score 2), poor (score 1), and the last is an interview completed with an open questionnaire to the students’ worksheet.

2.3. Tasks
In this study students in the control class and the experimental class were given assignments in the form of essay about the exponential problem. Inferential statistics use the independent sample t-test to test the difference between the experimental class and the control class by comparing the mean values of the two groups with a significance level of 0.05. To measure the level of higher order thinking skills used essay tests. The teacher gave an explanation of some techniques. Students answered the questions related to the material using the easiest multi techniques.

The best multi techniques used in this study are as follows:

1. The counting technique is enclosed in. Multiplication exponential above 10 under 20
   How to count: "friends x friends", write the unit number, dozens are stored. Add up the numbers multiplied by its friends (unit number) , the result are added by numbers stored in step 1 and the results of step 2, coincided with unit step 1.
   Example : 14 x 14 = ...
   a) 4 is friend (unit number) of 14
   b) (14 + 4) + 1 = 19
   c) 19 is coincided by 6, so 196 is 14x14 = 196

2. Multiplication of cube number with quadratic equations
   Cube number formula :
   
   \[ ab^3 = (a+b)(a^2+2ab+b^2) = a^3+2a^2b+ab^2+b^3 \]

   \[ a^3+3a^2b+3ab^2+b^3 \]
Example:
\[ 23^3 = 2^3 + 3^2 \cdot 3 + 3 \cdot 2^3 + 3^3 \]
\[ = 8 + 36 + 54 + 27 \]
\[ = 12167 \]

Explanation \(23^3\)

a) Same as the method in quadrates.

b) After obtaining 4 numbers, 8, 36, 54, 27, write the results from the back of the number 7, the rest numbers 2 add up to the previous number.

c) After that the number of 4 + 2, the rest of the previous result is 6 which is still remaining 5 in the previous number.

d) 5 + 6 is 11, then write the number 1 as the result, add 1 as the rest number with 3 so the rest is 4.

e) 4 + 8 the result is 12.

f) So the result of \(23^3\) is 12,167.

3. Result and discussion

3.1. Result

We gave pre-test and post-test to both experimental and control class. We also apply observation, interview and documentations with the subject research. The quantitative analysis was applied by using a t-test on the pre-test and post-test results. The qualitative analysis was carried out by using interview and observation instruments. The inferential and descriptive statistics were applied to analyze respectively quantitative and qualitative data. The derived data from the research result were a frequency, mean, and a standard deviation. Moreover, the inferential statistic used independent sample t-test to test the difference between the experimental class and the control class (Hilton et al, 2004). The independent samples t-test were used to compare the mean score of the two groups with a significance level of 0.05.

3.1.1. The results of the validity and reliability test

Before showing the results, we need to test the reliability and validity of our post-test instrument. The reliability and validity of the post-test results can be seen in the following table:

| Correlations | problem1 | problem2 | problem3 | problem4 | problem5 | total |
|--------------|----------|----------|----------|----------|----------|-------|
| problem1     | Pearson Correlation | 1        | -0.35    | 0.81     | -2.37    | 0.081 | 0.412* |
|              | Sign. (2-tailed)     |          | 0.868    | 0.701    | 0.254    | 0.701 | 0.041  |
|              | N                   | 25       | 25       | 25       | 25       | 25    | 25     |
| problem2     | Pearson Correlation | -0.035  | 1        | -2.10    | 0.400*   | -2.10 | 0.450* |
|              | Sign. (2-tailed)     |          | 0.868    | 0.314    | 0.048    | 0.314 | 0.024  |
|              | N                   | 25       | 25       | 25       | 25       | 25    | 25     |
| problem3     | Pearson Correlation | 0.081   | -2.10    | 1        | -0.046   | 0.265 | 0.497* |
|              | Sign. (2-tailed)     |          | 0.701    | 0.314    | 0.828    | 0.201 | 0.012  |
|              | N                   | 25       | 25       | 25       | 25       | 25    | 25     |
| problem4     | Pearson Correlation | -2.37   | 0.400*   | -0.046   | 1        | -2.37 | 0.397* |
|              |                      |          |          |          |          |       |        |
Based on Table 3, it can be seen that the value of $r_{count}$ of problem 1 is 0.412, problem 2 is 0.450, problem 3 is 0.497, problem 4 is 0.397, and problem 5 is 0.412. The value of $r_{table} = 0.396$ with degree of freedom $df = n - 2 = 25 - 2 = 23$. All of the problem have $r_{count} > r_{table}$. It means that all of the problems are valid.

**Table 4.** The test result of the reliability question reliability statistics.

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .977             | 5          |

Based on Table 4, it can be seen that the overall reliability value is 0.977 and is $r_{table}$ from the 5% significance level with $dk = N - 1 = 24$, $r_{table} = 0.878$. Therefore $r_{count} > r_{table}$. It was concluded that the instrument items were reliable.

### 3.1.2. The distribution of students’ higher order thinking skills based on Pretest

Furthermore, we will show the distribution of students’ higher order thinking skills of both control and experimental classes based on their pre-test result as follow:

**Figure 2.** The distribution of students’ higher order thinking skills of the control class based on pre-test result.
Figure 3. The distribution of students' higher order thinking skills of the experimental class based on pre-test result.

Based on Figure 2 and Figure 3, the analysis of the pre-test results between the two classes can be seen that both classes have the same variant. The results show high order thinking skill in the control class is very good 4%, good 33%, good enough 38%, and poor 25% while in the experimental class the high level thinking ability of students is very good 4%, good 32%, good enough 40%, and poor less than 24%. Through this distribution, it can help to interpret the effect of the use of multi-techniques based mathematics learning media on students’ higher order thinking skills in solving exponential problem.

Furthermore, pretest results were analyzed based on the level of students' higher order thinking skills in solving powers and numbers problems between the control class and the experimental class as in the figure 4 and table 5 below:

Table 5. The comparison of pret-test higher order thinking skill between control and experimental class.

| No | Level    | Control Class | Experimental Class |
|----|----------|---------------|--------------------|
|    | Sum  | Percentage   | Sum  | Percentage   |
| 1  | Very Good | 1  | 4% | 1  | 4%          |
| 2  | Good     | 8  | 33% | 8  | 32%         |
| 3  | Fair     | 9  | 38% | 10 | 40%         |
| 4  | Poor     | 6  | 25% | 6  | 24%         |
|    | Total    | 24 | 100% | 25 | 100%        |

Figure 4. The comparison of pret-test higher order thinking skill between control and experimental class.
Based on table 5 and figure 4 show that The result of the pre-test of higher-order thinking skills in control and experimental class is not different significantly. In the control class, students with very good level are 4% same as experimental class. The good level's students are 33% in the control class. It is almost as large as in the experimental class i.e 32%. The fair level is 38% in the control class and 40% in the experimental class. The poor level is 25% in the control class and 24% in the experimental class.

The next step, we will analyze the homogeneity test and normality test, and finally, we will analyze the mean difference by using the independent sample t-test.

Table 6. The analysis of the homogeneity of pre-test.

| Test of Homogeneity of Variances |
|----------------------------------|
| pre_test                         |
| Levene Statistic                 |
| df1                              |
| df2                              |
| Sig.                             |
| 2.660                            |
| 1                                |
| 47                               |
| .110                             |

Table 6 shows the results of the pre-test homogeneity test. The significance value (Sig.) Is 0.110. It can be concluded that the assumption of variance homogeneity is fulfilled. The significance value produced is greater than 0.05 which indicates that the data is homogeneous.

Table 7. The result of mean scores of pre-test between control and experimental classes.

| Class       | N  | Mean   | Std. Deviation | Std. Error Mean |
|-------------|----|--------|----------------|-----------------|
| pre_test pre test control | 24 | 63,7500| 10,55524       | 2,15458         |
| pre_test pre test experimental | 25 | 62,6000| 7,65398       | 1,53080         |

Based on table 7, it can be seen that the mean pre-test value of the control class was 63.75 (SD = 10.55524) while the average pre-test value of the experimental class was 62.6 (SD = 7.65398).

3.1.3. The distribution of students' higher order thinking skills based on posttest

Students' higher order thinking skills are measured based on the results of the posttest, that is the answer to the essay question. Students' answers were analyzed on a Likert scale with a range of 1 to 4 according to aspects and indicators of higher order thinking skills in solving exponential problems. The results of the analysis are calculated on the percentage of each assessment indicator to determine the distribution of students' higher order thinking skills.

Figure 5. The distribution of student higher order thinking skills in the control class based on the post-test result.
Based on Figure 5 and 6, the analysis of the post-test result between the two classes can be seen that the ability to think of a high level in the control class is very good 46%, 42% good, 12% good enough, and 0% poor while in the experimental class the ability to think the high level of students is very good 56%, good 36%, quite good 8%, and poor 0. Through this distribution, it can be seen that the higher order thinking skill of the experimental class students is better than the control class. Furthermore, post-test results were analyzed based on the level of students’ higher order thinking skills in solving powers and numbers problems between the control class and the experimental class as in the figure 7 and table 8 below:

**Table 8. The comparison of post-test of higher-order thinking skills.**

| No | Level     | Control Class | Experimental Class |
|----|-----------|---------------|--------------------|
|    | Sum       | Percentage    | Sum               | Percentage    |
| 1  | Very Good | 11            | 46%               | 14             | 56%            |
| 2  | Good      | 10            | 42%               | 9              | 36%            |
| 3  | Fair      | 3             | 13%               | 2              | 8%             |
| 4  | Poor      | 0             | 0%                | 0              | 0%             |
|    | Total     | 24            | 100%              | 25             | 100%           |

**Figure 7.** The comparison of post-test of higher-order thinking skills.

Based on Table 8 and figure 7 show that the post-test of higher-order thinking skills result of control and experimental class is different significantly. In the control class, students with very good
level are 46% that less than the experimental class at 56%. The good level students are 42% in the control class that greater than the experimental class at 36%. The fair level is 13% in the control class. It is greater than the experimental class that has 8% for the fair level. But there are no students at the poor level in both classes.

Furthermore, inferential statistical analysis is performed to determine the differences in the implementation of multi techniques based learning media in improving the elementary school students’ higher order thinking skill in solving exponential problem by independent sample t-test. Previously, the researchers conducted a prerequisite test, which is the normality test.

Table 9. The analysis of the normality test of both class for the post-test.

| Normal Parameters\(^{a,b}\) | Post-test control | Post-test experimental |
|-----------------------------|-------------------|------------------------|
| Mean                        | 73.5417           | 82.2000                |
| Std. Deviation              | 6.16427           | 8.30161                |
| Most Extreme Differences    |                   |                        |
| Absolute                    | .219              | .232                   |
| Positive                    | .156              | .167                   |
| Negative                    | -.219             | -.232                  |
| Test Statistic              | 1.070             | 1.160                  |
| Asymp. Sig. (2-tailed)      | .202              | .135                   |

\(a.\) Test distribution is Normal.
\(b.\) Calculated from data.

Based on Table 9, Normality test results show us the significance value of the control class is 0.202 and the significance value of the experimental class is 0.135. The significance value of the two classes is greater than 0.05 so it can be concluded that both of the study samples are normally distributed.

Table 10. The comparison of post-test score of experimental class and control class score using independent sample t-test.

| Levene\'s Test for Equality of Variances | t-test for Equality of Means |
|-----------------------------------------|------------------------------|
| F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|---|------|---|----|-----------------|-----------------|------------------------|-----------------------------------------|
| Equal variances assumed                 | 3.6 | .048 | 42 | 4,1 | .000 | 8,6583 | .048 | -2,095 | 12,874 | 4,420 |
| Equal variances not assumed             | - 44,2 | .000 | - 2,083 | - 4 | 12,856 | 4,4605 |
| Equal variances assumed                 | 4,1 | 31 | 3 | 8,6583 | 3 | 12,856 | 4,4605 |
| Equal variances not assumed             | 4,1 | 53 | 3 | 8,6583 | 3 | 12,856 | 4,4605 |
Table 10 shows a significant difference between the two classes obtained from the significance value of 0.042 (p <0.05). While the significance value of the t-test sig. (2-tailed) of the independent sample t-test the post-test value was 0.000 (p <0.05). It shows that the implementation of multi techniques based mathematics learning media significantly influences students’ higher order thinking skills in solving the exponential problem.

3.1.4. Students’ activity during the multi techniques implementation
To convince our result, we did an observation of all students activities in mathematics learning based on multi technique. The observation items were done by 4 observers, and it was assessed by using a Likert scale encompassing very active (score 4), active (score 3), fair (score 2), and poor (score 1). The level of students’ activity was observed using an activity sheet that followed the syntax of implementation multi techniques.

Figure 8. The distribution of the observation result on the students’ activities in mathematics learning based on multi technique.

Based on figure 8, the student involved in the observation was 25 students. It was found that the highest score of observation criteria reached 44%. It indicates that during multi techniques implementation, students are active to engage with the solving the problem, 28% of students reach the fair level, 16% of students reach the very active level, and the rest of 12% are on poor levels. It can be concluded that multi technique can work well in the learning process on solving operations with power problem, it is able to improve the students’ higher order thinking skills.

3.1.5. Students’ test results
From the results of the posttest, 3 samples were taken representing higher order thinking skills in the category of very good skill, good skill, and poor skill categories.

3.1.5.1. Student test results with very good categories

The Student could analyze the questions using enclosed in technique. Using Multiplication exponential above 10 under 20 is easier to do
Figure 9. Very good skill student’s test result.

Based on the worksheet sample above, the student who had a very good higher order thinking skill could solve the exponential problem. The student could also use the easiest and most effective multi techniques that had been explained by the teacher. Students who had higher-order thinking skills could solve the assignment faster than others.
3.1.5.2. Student’s test results with good skill categories

The Student could analyze the questions using enclosed in technique. Using Multiplication exponential above 10 under 20 is easier to do.

The Student could analyze the questions by using the calculation of quadrate operation.

The Student could analyze the questions using enclosed in technique because it is easier to do.

The Student could analyze the questions by using the calculation of cube operation.
Based on the worksheet sample above, student who had good higher order thinking skills could solve the exponential problem. But she made a little mistake in doing the assignment. She could find the easiest techniques but she could not solve the assignment faster than the student who had very good higher order thinking skills.

3.1.5.3. Student test results poor skill categories

Figure 10. Good skill student’s test result.

Based on the worksheet sample above, student who had good higher order thinking skills could solve the exponential problem. But she made a little mistake in doing the assignment. She could find the easiest techniques but she could not solve the assignment faster than the student who had very good higher order thinking skills.
Based on the worksheet sample above, student who had poor higher order thinking skills could not solve the exponential problem. She made some mistakes in doing the assignment. She could not find the easiest techniques and solve the assignment slower than others.

3.1.5.4. Portrait phase of student higher order thinking skill
To find out the students’ perception of the implementation of multi techniques based learning media, the researcher performed an interview on student S04. The student is selected due to this student has gained high criteria of higher order thinking skill. The data obtained through the interview process was transcribed below:

Teacher: "What is the task about?"
Student: "it’s about quadrate and cubic"
Teacher: " Do the questions belong to the difficult, medium, or easy category?"
Student: " The questions can be said easy."
Teacher: " What do you need in working on the problem?"

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**Figure 11.** Poor skill student’s test result.
Student: "Concentration in calculating and choosing techniques to work on."
Teacher: "Can you choose the right and effective technique?"
Student: "Yes, using the counting technique by being enclosed"
Teacher: "Please explain the way you work with the enclosed technique!"
Student: "Add up the numbers to be multiplied by the number of friends.
Multiplication 12 x 12, 12 friends 2 so 12 + 2 = 14 as the initial result.
Then 2x2 = 4 as the final result. The start and end steps are squeezed into 144 as a result of 12 x 12.""
Teacher: "Very good. Then how do you solve the cubic problem?"
Student: "According to the way the teacher explained to the cubic numbers formula that is $ab^3 = a^3 + 3a^2b + 3ab^2 + b^3$"
Teacher: "Please explain how you solved the problem!"
Student: "$29^3 = 2^3 + 3, 2^2.9 + 3.2.9^2 + 9^3 = 8 + 108 + 486 + 729$ After getting 4 numbers i.e. 8,108,486,729 then
The number 9 is saved, the number 72 is added to 6 = 78
The number 8 is saved, the number 7 is added by 48 and 8 = 63
The number 3 is saved, the number 6 is added by 10 and 8 = 24
Written from the final result 24,389 ""
Teacher: "Is the question done with discussion?"
Student: "Yes, but the teacher also helps"
Teacher: "Can you find your answers without the help of teacher?"
Student: "Yes, after understanding the technique described, I was able to do it myself."
Teacher: "After getting the teacher's help in solving a problem, can you solve a new problem without the teacher's help?"
Student: "At first I was having a hard time, but I tried using another method."
Teacher: "Can you solve this problem?"
Student: "Yes, I can work on other techniques taught by the teacher. It is star cross for example $29^3$. The first step is we must find the square."

\[ \begin{align*}
9 \times 9 &= 81, \text{ save } 8, \text{ put } 1 \text{ at the back} \\
8^41 \\
29 \\
29x  \\
\end{align*} \]

Then cross star means cross-counting then added.
\[ \begin{align*}
2 \times 9 &= 18 \\
2 \times 9 &= 18 \\
36 &= 36 + 8 = 44, \text{ save } 4, \text{ put the unit number } 4 \text{ in front of number } 1. \\
The next step is } 2 \times 2 = 4 \text{ then } 4 + 4 = 8 \\
29^2 = 841 \\
\text{After that } 841 \times 29 \\
\text{Then } 1 \times 9 \\
\end{align*} \]

Next is cross multiplication
\[ \begin{align*} 
243^{38}89 \\
84 \times 9 &= 756 \\
2 \times 1 &= 2 + \\
758 (\text{ put } 8 \text{ in front of } 9, \text{ save } 75) \\
The last step is } 84 \times 2 = 168 + 75 = 243. \\
\text{Put } 243 \text{ in front of } 8 
\end{align*} \]
The student’s portrait phase of higher order thinking flow is as follows:

![Diagram](image)

**Figure 12.** The student’s portrait phase of higher order thinking skill.

3.2. Discussion

The results showed the learning outcomes of high order thinking in the control class were very good 4%, good 33%, good enough 38%, and not good 25% while in the experimental class the high level thinking ability of students was very good 4%, good 32%, sufficient good 40%, and not good 24%. The results showed learning outcomes in the posttest high order thinking skill in the control class was very good 46%, 42% good, 12% good enough, and not good 0% while in the experimental class the high order thinking ability of the students was very good 56%, good 36%, good enough 8%, and not good 0. Through this distribution, it can be seen that the high order thinking ability of the experimental class students is better than the control class.

The multi-techniques learning media is intended to accustom students to think at a higher level so that with these habits students have good higher order thinking skills. The results of the study showed that the development of a multi-techniques learning media can improve the higher order thinking skill students in solving exponential problem. The result is in line with [5] which states that by having HOTS, a person will have ability to learn, be able to give reasons, think creatively, make decisions, and solve problems. This opinion explains that HOTS is able to improve several competencies, one of them is mathematical higher order thinking skill.

The success of this research is supported by studies that have been carried out previously by [2] with the results of the benefits or advantages of higher order thinking skills is increased motivation for learning because high order thinking skills connect subject matter in class with real world contexts so that learning is more meaningful. In addition, higher order thinking skills can improve students’ learning outcomes because it can train students to think creatively and critically, namely the ability to think that is not merely to recall, restate, or refer without doing processing (recite), and higher order thinking skill can improve the achievement of student learning outcomes so that students are able to compete nationally and internationally. From this opinion, it can be said that by designing multi-techniques based learning make students who use these multi-techniques to have higher order thinking skills. During the course of the research, the use of multi-techniques learning media had a significant influence on students learning activities. So it can be concluded that multi techniques based learning can improve students’ higher order thinking skill.

4. Conclusions

The implementation of multi-techniques based learning media can improve students' higher-order thinking skills. This is evidenced by the results of the t-test which showed significant differences in the average posttest results between the control class and the experimental class. In addition, the
implementation of multi-techniques based learning media can improve students’ activity so that learning takes place more effectively.

Phase portraits of higher order thinking skills students solve the problem of passing through the application of multi-techniques based Mathematics learning media shows that there are differences in the pattern of phase portraits. This is according to the ability of different students so that students’ answers are varied.

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