The analysis of the application of learning materials based on project-based learning to improve the elementary school students’ creative thinking skills in solving contextual division problems

N H Shalihah, Dafik, and T D Prastiti

1SDN Dadapan1, Bondowoso, Indonesia
2Universitas Terbuka, Jember, Indonesia
3Department of Mathematic Education, University of Jember, Indonesia

Email: ayunurul05@gmail.com

Abstract: This study aims to investigate the analysis learning materials implementation based on project-based learning to improve the elementary school students’ creative thinking skills in solving contextual division problems. This type of research is using a mixed research, which is a combination of quantitative and qualitative methods. The research respondents consist of two classes, namely a control class as many as 19 students and an experimental class as many as 20 students. The results show after the implementation using the application learning materials base on project-based learning, it was found that the presentation of students’ creative thinking skills for the control class are 77,19% for fluency, 70,18% for flexibility, and 56,14% for novelty. While the experimental class are 82,5% for fluency, 91,67% for flexibility, and 67,5% for novelty. Then the score of the independent sample t-test from post-test shows that there is a significant difference between the control class and the experimental class with the sig (2-tailed) value is 0.000 (p = <0,05). It can be concluded that the application learning materials base on project-based learning can improve students’ creative thinking skills in solving contextual division problems.

1. Introduction

Education is very important in life, because it can support the improvement of the human resources quality. Mathematics is one of the objects of study that is always present at every level of education. Mathematics has a role which is not only provides educational value that focuses on students but also helps the character of students, including critical thinking and creative thinking [1]. Creative thinking makes students actively learn mathematics systematically, find and know problems, formulate and design innovative ways of solving problems. Balka and Torrance have developed an instrument to measure the mathematical creative thinking abilities [2]. Torrance developed the Torrance Tests of Creative Thinking (TTCT) and Balka developed the Creative Mathematical Ability Test (CAMT) [3]. Mathematical tasks based on information which contains daily life problem are created by TTCT and CAMT. Creative thinking will make students move “sideways” to try different perceptions, different concepts, different points of entry [4]. The thought process that is expected to reach the highest level is creation level. This concept of achievement is known as higher order thinking (HOTS).
HOTS is a part of the cognitive aspects of Bloom's Taxonomy. In 2001, it was revised by Anderson, Karthwol, et al, from one dimension to two dimensions, namely the dimension of knowledge and the dimensions of cognitive processes [5]. Then, Bloom's Taxonomy develops and classifies cognitive aspects into six categories, they are remembering, understanding, applying, analyzing, evaluating, and creating.

Silver explained that to measure the sensitivity of creative thinking of children and adults is divided into three aspects, they are fluency, flexibility, and novelty [6]. Fluency leads to generate many ideas, ideas and questions in response to commands. Flexibility leads to someone’s ability in adapting and working effectively in different situations. Novelty is the ability to find new and unique ideas in response the command. Here are the detail aspects :

Table 1. Indicators and sub-indicators of creative thinking skills in solving division problems

| Indicators | Sub Indicators |
|------------|----------------|
| Fluency    | 1) the ability to produce many ideas  
2) asking many questions |
| Flexibility| 1) thinking ideas in problem solving  
2) generating ideas, answering problem from different points of view  
3) the ability to find different alternative solutions  
4) the ability to change the way of thinking |
| Novelty    | 1) the ability to produce a new and unique idea  
2) thinking of unusual ways to express themselves |

The application of learning tools that can improve the ability to think creatively is in line with Project Based Learning based learning. One of learning models that can be an alternative in developing innovative learning processes in the classroom is Project Based Learning [7]. Project Based Learning is a way of learning related to the content and goal provided by giving freedom to students [8]. Project-based classes allow students to investigate questions, propose hypotheses and explanations, discuss their ideas, challenge others’ ideas, and try new ideas [9]. The core idea of Project Based Learning is that problems in the real world attract interest and provoke serious thinking when students acquire and apply new knowledge in the context of problem solving [10]. PBL is the main strategy for creating independent thinkers and learners [11]. Beside, Project-Based Learning is a systematic teaching approach that involves students in learning, real-world problem and life-enhancing skills through creative, scientific, authentic, challenging process and ensuing a product [12].

Based on the experts’ opinions above, it can be concluded that project based learning is a learning model that can create student knowledge to stimulate new ideas and develop students’ intellectuals also involve student activeness in the learning process.

The following stages of project-based learning based on learning can be illustrated in the following chart. (see figure 1)

The purposes of this study are: 1) To find out that the process of learning materials implementation based on project-based learning can improve the elementary school students’ creative thinking skills in solving contextual division problems. 2) To find out that the results of learning materials implementation based on project-based learning can improve the elementary school students’ creative thinking skills in solving contextual division problems. 3) To find out the effectiveness of learning materials implementation based on project-based learning to improve the elementary school students’ creative thinking skills in solving contextual division problems. 4) To analyze students’ activities when learning materials based on project-based learning are applied and 5) To analyze phase portraits of creative thinking skills students in solving contextual division problems through learning materials implementation based on project-based learning.
2. Methods

The research method used is a mixed research method. Mixed methods is a research method that is combining quantitative and qualitative approaches in a research activity, so that the data obtained are more comprehensive, valid, reliable, and objective [13]. Data on the quantitative method is used to analyze student work in solving problems of operations compute division after becoming the subject of PBL learning models. While the data on the qualitative method is used to analyze the results of interviews conducted on students to find out their opinions about the PBL learning model. Interviews were conducted in the experimental class to find out the increase students’ creative thinking abilities in solving the problem of operations count division in PBL learning models.

To analyze learning materials implementation based on project-based learning to improve the elementary school students’ creative thinking skills in solving division problems, the researcher used a mixed method. In brief, we can depict the triangulation model as described in the following figure (see figure 2)

It can be seen from the figure that we started the research by determining the two classes as an experimental class and a 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, starting from qualitative, quantitative and ended by qualitative. The learning control class is carried out using conventional learning tools while the learning experiment class is carried out using learning tools that have been developed through the application of the Project Based Learning model. 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 creative thinking skills as well as to know the level of students’ creative thinking skills and to convince the improvement of students’ creative thinking skill.

![Flow of Activities of Scientific Investigation Project Implementation](image-url)
2.1. Population and Sample
In this study, the research subjects were grade IV students at SD Negeri Dadapan 1 and students from other schools that is SD Negeri Dadapan 2 as a comparison and equal in terms of their abilities. While the random sample selection was taken from all grade IV students of SD Negeri Dadapan 1 as the experimental class consisting 20 students and all grade IV students at SD Negeri Dadapan 2 as a control class consisting 19 students.

Figure 2. The model of triangulation of mixed method [14]
2.2. Instrument
The test instrument used in this study were written tests, an observation, an interview. The test instrument was a pre-test and post-test of essay type. The test instrument was used to measure students’ creative thinking skills which were analyzed using a Likert scale of 0-4 where a value of 4 means very creative, value 3 means creative, value 2 means quite creative, value 1 means less creative, and value 0 means not creative. Observations were made to measure student activity while interviews were conducted to get the potential thinking phase of students.

2.3. Task
In this study students in the control class and the experimental class were given essay assignments about the problem of division operations. To measure the ability of students used instruments in accordance with the indicators [15]. Assignments in the form of essay tests were given to the control class and the experimental class at the time of the pretest and posttest which contained several quick techniques in dividing a number. Here's a quick way to divide a number.

1) Category 1
There is no number remaining at the result when we did division operation

\[
\begin{array}{c}
9 3 6 \div 3 = 312 \\
3 1 2
\end{array} \quad \begin{array}{c}
4 2 8 \div 2 = 214 \\
2 1 4
\end{array}
\]

Contextual division problem 1
In your school you counted 246 hands. How many students were in your school?

Solution:
Total number of hands = 246
We have 2 hands.
To find how many students were in my school, divide the total number of hands by the number of hands we have.
We get, divide 246 by 2

\[
\begin{array}{c}
2 4 6 \div 2 = 123 \\
1 2 3
\end{array}
\]

Therefore, there were 123 students in my school.

2) Category 2
There is number remaining at the result when we did division operation

\[
\begin{array}{c}
3 \ 4 2 \div 2 = 171 \\
3 : 2 = 1 \text{ remains } 1 \\
1 4 : 2 = 7 \\
2 : 2 = 1
\end{array} \quad \begin{array}{c}
2 3 4 \div 3 = 78 \\
2 3 : 3 = 7 \text{ remains } 2 \\
2 3 : 3 = 8
\end{array}
\]

Contextual division problem 2
If 325 kg of flour is packed in 5 bags, how much flour will each bag contain?
Solution:
Since 5 bags contain flour 325 kg
Therefore, 1 bag contains flour \((325 \div 5)\) kg

\[
\begin{align*}
325 \div 5 & = 65 \\
32 : 5 & = 6 \text{ remains } 2 \\
25 : 5 & = 5 \\
\end{align*}
\]

Each bag contains flour = 65 kg

In a problem sum involving division, we have to be careful about using the remainder.

3) Category 3
If the divisor number is greater than the number we divided, we can use the following steps:

\[
\begin{align*}
749 \div 7 & = 107 \\
7 : 7 & = 1 \\
4 : 7 & = 0 \\
49 & = 7 \\
\end{align*}
\]

\[
\begin{align*}
468 \div 6 & = 78 \\
46 : 6 & = 7 \text{ remains } 4 \\
48 & = 6 \\
\end{align*}
\]

\[
\begin{align*}
672 \div 3 & = 224 \\
6 : 3 & = 2 \\
7 : 3 & = 2 \text{ remains } 1 \\
12 & = 3 \\
\end{align*}
\]

If the number behind is smaller than the divisor, we can use the following steps:

\[
\begin{align*}
6730 \div 4 & = 167.5 \\
6 : 4 & = 1 \text{ remains } 2 \\
27 : 4 & = 6 \text{ remains } 3 \\
30 : 4 & = 7 \text{ remains } 2 \\
2 : 4 & = 0 \text{,} \\
20 : 4 & = 5 \\
\end{align*}
\]

Contextual division problem 3
There are 690 desks in a school building. If there are 3 floors with 4 classrooms on each floor, how many desks are there at each classroom?

Solution:
Known:
- There are 690 desks in a school building
- There are 3 floors in a school building
- There are 4 classrooms in a floor
Asked:
- how many desks are there at each classroom?

Answer:
- 3 floors x 4 classrooms = 12 in a school building (multiplication operation)
- 21 in a school building x 2 school = 42 classrooms (multiplication operation)
- \(69 \div 0.6 = 57.5\) \(\rightarrow\) 60 desk (rounding off) (division operation)

\[69 : 12 = 5 \text{ remains } 9\]
\[90 : 12 = 7 \text{ remains } 6\]
\[6 : 12 = 0\]
\[60 : 12 = 5\]

There are 60 desks @ a classroom

3. Results and Discussion

3.1 Result
The results were obtained from the results of quantitative and qualitative data analysis, each of which used inferential and descriptive statistics. Quantitative analysis was tested using t-tests on the results of pre-test and post-test. While, qualitative analysis was carried out using interviews and observation instruments. While, student learning outcomes were obtained from pre-test and post-test scores given to both classes, the experimental class and the control class.

3.1.1 Results of validity and reliability tests
Before carrying out the test, we need to test the validity and reliability of the questions of the three validators. The following table shows the results of the validity and reliability test.

| Table 2. The Result of The Validity test | Correlations |
|----------------------------------------|--------------|
|                                        | Correlations |
|                                        | No_1 | No_2 | No_3 | No_4 | Total |
| No_1 Pearson Correlation               | 1    | .426 | .707 | .707 | .776  |
| Sig. (2-tailed)                        |      | .574 | .293 | .293 | .224  |
| N                                      | 4    | 4    | 4    | 4    | 4     |
| No_2 Pearson Correlation               | .426 | 1    | .905 | .905 | .894  |
| Sig. (2-tailed)                        | .574 | 1    | .905 | .905 | .106  |
| N                                      | 4    | 4    | 4    | 4    | 4     |
| No_3 Pearson Correlation               | .707 | .905 | 1    | 1.000**| .988* |
| Sig. (2-tailed)                        | .293 | .095 | .000 | .000 | .012  |
| N                                      | 4    | 4    | 4    | 4    | 4     |
| No_4 Pearson Correlation               | .707 | .905 | 1.000**| 1    | .988* |
| Sig. (2-tailed)                        | .293 | .095 | .000 | .000 | .012  |
| N                                      | 4    | 4    | 4    | 4    | 4     |
| Total Pearson Correlation              | .776 | .894 | .988*| .988*| 1     |
| Sig. (2-tailed)                        | .224 | .106 | .012 | .012 | .012  |
| N                                      | 4    | 4    | 4    | 4    | 4     |

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Based on table 2, it can be seen that the r count of each item is greater than 0.6 (minimum Cronbach alpha value) where the r count for No. 1 is 0.776, No. 2 in the amount of 0.894, No. 3 in the amount of 0.988, and No. 4 is 0.988, so it can be concluded that the four questions are valid and can be used.
Table 3. The Result Of The Reliability Posttest

| Reliability Statistics | Cronbach's Alpha | N of Items |
|------------------------|-----------------|-----------|
|                        | .900            | 4         |

Based on table 3, it can be seen that the reliability value is 0.900 with the number of items that are 4 items. Since, Cronbach's Alpha value is 0.900> of 0.6 (minimal Cronbach alpha value), so it can be concluded that all four items are reliable and consistent.

3.1.2 Distribution of students' creative thinking based on pre-test
After conducting the instrument test, the next step is giving a pre-test to the control class and the experimental class to find out that both classes have the same variant. The following diagram of the percentage of the distribution of students’ creative thinking in the two classes from the pre-test results in each indicator is:

Figure 3. Distribution of students’ creative thinking skills in each indicator of the control class based on pre-test result

Figure 4. Distribution of students’ creative thinking skills in each indicator of the experimental class based on pre-test result
Based on figure 5 and 6, it can be seen that the results of the pre-test analysis of the two classes have the same variant. The results showed that the results of the pre-test of creative thinking skills in the control class with a category of 43% was not good, 45% was quite good, 11% was good, and 1% was very good while the results of the pre-test of creative thinking skills in the experimental class was 24% not good, 65% was good, 10% was s good, and 1% was very good.

Furthermore, the results of the pretest analysis based on students' creative thinking skills in solving the problem of operating the division between the control class and the experimental class can be seen in Figure 7 and Table 4 below.

**Table 4. The comparison of pre-test analysis based on students’ creative thinking skills between control and experimental class**

| No | Level     | Control Class | Experimental Class |
|----|-----------|---------------|--------------------|
| 1  | Very Good | 0 1%          | 0 1%               |
| 2  | Good      | 2 11%         | 2 10%              |
| 3  | Fair      | 9 45%         | 13 65%             |
| 4  | Poor      | 8 43%         | 5 24%              |
|    | Total     | 19 100%       | 20 100%            |

**Figure 5. The comparison of pre-test analysis based on students’ creative thinking skills between control and experimental class**

Based on table 4 and figure 7, it can be seen that the results of pretest creative thinking skills of students in solving the problem of division operations between the control class and the experimental class were not different significantly.

The next step is to analyze the data obtained from the pretest with a homogeneity test and normality test, and analyze the average difference with an independent sample T-test. Homogeneity test is to find out whether the control class and the experimental class are in a homogeneous population or not. Using SPSS version 25 the output of homogeneity test results can be seen in the table below.

Based on table 5, it can be seen that the homogeneity test results obtained sig value of 0.884> 0.05. So the second variant of the class is homogeneous. So that both classes can be used as research samples.

Based on table 6, with a significance level of 0.05, it can be seen that the control class has a significance value of 0.164 > 0.05. while the experimental class has a significance value of 0.119> 0.05. Thus, the pre-test scores of both classes were normally distributed. From the results of the normality test
above, the data of both the control class and the experimental class were eligible for an average difference test with an independent sample test.

**Table 5.** The analysis of the homogeneity of pre-test.

| Test of Homogeneity of Variances | Levene Statistic | df1 | df2 | Sig.  |
|---------------------------------|-----------------|-----|-----|-------|
| Pretest Based on Mean           | .016            | 1   | 37  | .899  |
| Pretest Based on Median         | .007            | 1   | 37  | .932  |
| Pretest Based on Median and with adjusted df | .007            | 1   | 37,000 | .932 |
| Pretest Based on trimmed mean   | .021            | 1   | 37  | .884  |

**Table 6.** The analysis of the normality test posttest between control and experimental classes for the pre-test.

| Tests of Normality |        |        |        |        |        |
|--------------------|--------|--------|--------|--------|--------|
| Class              | Kolmogorov-Smirnov<sup>a</sup> | Statistic | df | Sig.  | Shapiro-Wilk | Statistic | df | Sig.  |
| Pretest            | Control Class | .177 | 19  | .118  | .929 | 19  | .164  |
|                    | Experimental Class | .158 | 20  | .200<sup>*</sup> | .924 | 20  | .119  |

* This is a lower bound of the true significance.

a. Lilliefors Significance Correction

3.1.3 **Distribution of students' creative thinking based on posttest**

The next step is to provide a posttest which is also used to measure students' creative thinking skills. The following percentage of the distribution of students' creative thinking in the two classes from the results of the posttest in each indicator can be seen in the diagram below.

**Figure 6.** Distribution of students’ creative thinking skills in each indicator of the control class based on posttest result.

Based on figures 8 and 9, it can be seen that the results of the posttest analysis between the two classes have different creative thinking skills. The results of the analysis in the control class showed very good 4%, good 19%, 55% good enough, and 22% less good while in the experimental class very
good 7%, 42% good, 51% good enough, and not good 0%. Based on the distribution, it can be seen that the creative thinking skills of the experimental class are better than the control class.

**Figure 7.** Distribution of students’ creative thinking skills in each indikator of the experimental class based on posttest result

**Table 7.** The comparison of posttest analysis based on students’ creative thinking skills between control and experimental class.

| No | Level   | Control Class | Experimental Class |
|----|---------|---------------|--------------------|
|    | Sum     | Percentage    | Sum                | Percentage    |
| 1  | Very Good | 1             | 4%                 | 1             | 7%               |
| 2  | Good     | 4             | 19%                | 9             | 42%              |
| 3  | Fair     | 10            | 55%                | 10            | 51%              |
| 4  | Poor     | 4             | 22%                | 0             | 0%               |
|    | Total    | 19            | 100%               | 20            | 100%             |

**Figure 8.** The comparison of posttest analysis based on students’ creative thinking skills between control and experimental class.
Based on table 7 and figure 10, it can be seen that the results of pretest creative thinking skills of students in solving the problem of division operations between the control class and the experimental class have significant differences. In the control class, students in the excellent category were 4%, good 19%, good enough 55%, and not good 22%. While, in experimental class, the categories were excellent 7%, 42% good, 51% good, and 0% not so good.

Table 8. The analysis of the normality test posttest between control and experimental classes for the posttest.

| Tests of Normality | Kolmogorov-Smirnov^a | Shapiro-Wilk |
|-------------------|-----------------------|--------------|
|                   | Statistic | df | Sig. | Statistic | df | Sig. |
| Postest           |           |    |      |           |    |      |
| Control class     | .211      | 19 | .025 | .923      | 19 | .127 |
| Experiment class  | .182      | 20 | .080 | .917      | 20 | .087 |

Based on table 8 above, with a significance level of 0.05, it can be seen that the control class has a significance value of 0.127 > 0.05. While, in the experimental class has a significance value of 0.087 > 0.05. Thus, the posttest scores of both classes were normally distributed. From the results of the normality test above, the data of the two classes meet the requirements for an average difference test with an independent sample test.

Table 9. The result of independent sample t-test.

| Independent Samples Test | Levene's Test for Equality of Variances | t-test for Equality of Means |
|--------------------------|----------------------------------------|----------------------------|
|                          | F        | Sig.     | t   | df | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|                          | .255     | .616     | -6.802 | 37 | -.17,3289 | 2.5476 | -22,4908 -12,1670 |
| Equal variances assumed  | Equal variances not assumed | -6.768 | 34,911 | .000 | -17,3289 | 2.5606 | -22,5276 -12,1302 |

Based on table 9, it can be seen that a significance level of 0.05 Sig (2-tailed) value from the posttest results of the control class and the experimental class of 0.616 (p <0.05) means that there are significant differences. So the application of learning tools based on project based learning has a significant effect in improving students' creative thinking skills in solving problems of arithmetic operations.

3.1.4 Student activities with the application of PBL

The observations of all student activities in project-based learning are conducted by 3 observers and are assessed using a Likert scale that includes very active (score 4), active (score 3), fair (score 2), and poor (score 1). The level of student activity was observed using an activity sheet that follows the syntax of the application of project based learning.

Based on Figure 11, it can be seen that during the implementation of PBL-based learning, students are actively involved in problem solving, 8% of students reach the very active level, 64% of students reach the active level, 25% of students reach the moderately active level, and 3% are not active. From
the figure above, it can be concluded that PBL can work well to improve the ability to think creatively in the learning process of solving arithmetic operations.

3.1.5 Students’ test result

From the posttest results, 3 samples were taken representing creative thinking skills in the category of highly creative skills, creative skills and less creative categories.

Figure 9. The distribution of the observation result on the student’s activities in mathematics learning based on project-based learning.

3.1.5.1 Student test results with less creative categories

- **a.** Know:
  - 162 kg of sugar
  - Teacher buy 15 packs of sugar
  - Asked:
    - How many kg of sugar each group will get

  - **The answer is incomplete**

- **b.** Addition, multiplication, division

  - 15 x 18 = 270 kg
  - 162 kg + 270 kg = 432 kg
  - \[ \frac{432}{16} = 27 \]
  - So the group will have 16 kg of sugar

  - **The student’s answer wasn’t sequential**

- **c.**

  - The students could not analyze the questions using other methods

- **d.** No answer

  - The students could not find the easiest techniques

Figure 10. Less creative category student’s test result.
Based on the example of the worksheet in figure 12, the student who has less creative thinking skills could not describe mathematical symbols and the answers were not coherent. He couldn't find the easiest technique so he finished the task slower than the others and he couldn't analyze the questions using other methods.

3.1.5.2 Student's test results with creative categories
Based on the sample worksheet below, the student who has creative thinking skills could describe mathematical symbols and the answers are coherent. He could find the easiest technique but he could not complete the task faster than students who have very creative thinking skills. He could analyze the question but could not explain it.

**Figure 11. Creative category student’s test result.**

3.1.5.3 Student’s test results with very creative categories
Based on the example worksheet above, the student who has very creative thinking skills could describe mathematical symbols and the answers were very coherent. He could find the easiest technique and complete assignments faster than other students. He could analyze questions and elaborate on the answers.

3.1.5.4 Potrait phase of student’ creative thinking skills

To find out the level of thinking of students in solving problems of arithmetic operations with the development of learning tools based on project based learning, researchers conducted interviews with students who have creative thinking skills in the very creative category. Data obtained through the interview process are transcribed below.

Student: "What information is obtained when working on the problem?"
Researcher: "How to do addition, multiplication and division problems"
Student: "Are the questions given difficult, moderate, or easy?"
Researcher: "Easy."
Student: "How do you solve this division problem?" (while showing the matter of division)
Researcher: "How do you answers the problem provided by the teacher?"
Student: "By writing what is known from the problem"
Researcher: "Fine, try to explain how you solve problem number 1?"
Student: "First 15 packs of sugar times 18 kg then add the results with sugar at school. After that divide the result into 27 groups"
Researcher: (researchers proceed to the next problem). "For this matter, can you determine how many plastics are needed to pack all the rice?"
Student: (students think, then start trying to count on a worksheet). "The first 20 sacks of rice times 50 kg then divided by 5 kg so that 20 x 50 = 1000 kg, then 1000 kg divided by 5kg = 200 so we need 200 plastic bags needed".
Researcher: "Alright, you try to do the next problem. How many paper is used at your school in a year and how many trees are cut down to make paper used at your school?"
Student: (students begin to think and write to the worksheet)
Researcher: "Good. Explain how you finished it?"

![The student could find the easiest techniques.](image1)

![The student could analyze the question and explain it.](image2)
Student: “The fact is that 250 kg of paper requires about one tree as raw material. The number of papers used for a year is 100 sheets for one day are used then in one year there are 100 x 365 = 36,500 sheets. The weight of one paper is 5 gsm (the weight of paper is 5 g/m²), it means that in a year 36,500 x 5 g = 182,500 g = 182.5 kg so 182.5 kg is used. If there are 1,000 schools, in a year, it can be spent 1000 x 182.5 kg = 182,500 kg. Since 250 kg is needed for 1 tree, then for 182,500 kg divided by 250 kg = 730 trees. (Students could solve the problem in their own way).

The student’s portrait phase of creative thinking flow is as follows

![Phase portrait of creative thinking skills](image)

**Figure 13.** The student’s portrait phase of creative thinking skill.

### 3.2. Discussion

This research was to analyze the implementation of learning materials based on project-based learning to improve students’ creative thinking skills in solving division problems. The findings of this research indicate that the implementation of learning materials based on project-based learning has a significant effect on improving students’ creative thinking skills. The result showed the learning outcomes of creative thinking skills in the control class were less creative 22%, fairly creative 55%, creative 19% and very creative 4% while in the experimental class with less creative 0%, fairly creative 51%, creative 42%, and very creative 7%. From these results, the experimental class students showed their creative thinking skills higher than the control class students.

The learning achievement in the experimental class applying PBL was better than the control class applying conventional learning. This shows that the application of PBL is effective in increasing student’s learning achievement creative thinking skills. The results are in line with the result of research conducted by several previous researchers who concluded that PBL can effectively improve student learning outcomes [5, 7, 8]. The implementation of PBL can motivate students’ activeness in mathematics learning.

### 4. Conclusions

The implementation of project-based learning can improve the elementary school students’ creative thinking skills. This evidenced by the results of the t-test which showed significant differences in the posttest results between the control class and the experimental class. In addition, the value of the experimental class is better because it implement project-based learning.

Phase portraits of creative thinking skills students shows that there are difference and vary greatly according to the ability of each students.

### Acknowledgments

I am gratefully acknowledge from the support of the SDN Dadapan 1, CEREBEL the University of Jember, and Universitas Terbuka, Jember Indonesia of the year 2020.
References
[1] Siswono T Y E 2018 Mathematical learning based on submission and problem solving (Bandung: PT Remaja Rosdakarya)
[2] Silver E A 1997 Fostering creativity through instruction rich in mathematical problem solving and thinking in problem posing ZDM International Reviews on Mathematical Education 29 (3)
[3] Maharani H R 2014 Creative thinking in mathematic: are we able to solve mathematical problems in a variety way? International Conference on Mathematic, Science, and Education (ICMSE 2014) 120-125
[4] Awang H & Ramli I 2008 Creative thinking skill approach through problem based learning: pedagogy and practice in the engineering classroom International Journal of Social Sciences 3(1) 18-23
[5] Widodo A 2005 Learning objectives taxonomy Didaktis 4(2) 61-69
[6] Siswono T Y E 2006 Implementation theories about the level of creative thinking in mathematics Educational Research and Review 6 (7) 548-553
[7] Tinetti Yanti Rosinda 2018 Project based learning model (PBP) and its application in the learning process in classroom (Yogyakarta: CV Budi Utama)
[8] Daryanto 2009 Guide to the creative &innovative learning process (Jakarta: AV Publisher)
[9] Krajcik J S & Blumenfeld P C 2006 Project-based learning, In R.K. Swyer (ED) (The Cambridge handbook of the learning sciences pp. 317-334)
[10] Waliyanti S, Dafik & Slamin 2019 The analysis of project based learning implementation to improve students creative thinking skill in solving the problem of tiles coloring combination. J. Phys. Phys. Conf. Ser. 1211 012089
[11] Bell Stephanie 2010 Project-based learning for the 21st century: skills for the future The Clearing House 83(2) pp. 39-43
[12] Mustapha R, Nasir M I M and Sadrina 2018 Project-based learning evaluation fromstudents’ and supervisors’ perspectives: a qualitative research at polytechnic malaysia JIP-The International Journal of Social Sciences doi: 10.26811/peuradeun.v6i3.238 pp. 397-408
[13] Sugiyono 2017 Quantitative, Qualitative, and R&D research methods (Bandung: CV Alfabeta)
[14] Dafik Sucianto B Irvan M & Rohim M A 2019 The analysis of student metacognition skill in solving rainbow connection problem under the implementation of research-based learning model International Journal of Intruction 12(4) 593_610
[15] Suntusia Dafik Hobri 2018 The effectiveness of research based learning in improving students’ achievement in solving two-dimensionel arithmetic sequence problem. International journal of intruction 12 pp 17-32