

## CHAPTER III

### RESEARCH METHODOLOGY

#### A. Research Method and Research Design

##### 1. Research Method

This research that was used in this research was quasi experiment. Quasi experiment include assignment, but not random assignment of participant to groups (Cresswell, 2012). Due to the experiment cannot artificially create groups for the experiment. By applying this method, there were two group, control and experimental group. This method is appropriate with the purpose of the research which is investigating pop-up book and smash book on students' creativity and understanding in learning plant organs.

##### 2. Research Design

Consider that the number of classes involved in this research are two classes, there were experimental class and control class. The design that was used in this research is pre-test and post-test design (Creswell, 2012). Pretest provides a measure on some attribute or characteristic that's assessed for participants before receive a treatment, while posttest measure on some attribute or characteristic after a treatment (Creswell, 2012). The researcher assigned intact groups the experimental and control treatment, administered a pretest to both groups, conduct experimental treatment activities with both of group, and administered a post-test to assess the differences between the two groups.

**Table 3.1 Research Design: Matching Pretest and Posttest Comparison Group**

Select Control Group	Pre-test	Control Treatment using smash book ( <i>kliping</i> )	Post-test
Select Experimental Group	Pre-test	Experiment Treatment using pop-up book	Post-test

*(Cresswell, 2012)*

## B. Population and Sample

The location of this research was one of Junior High School in Bandung. The class of this school was conducted in Indonesian as instructional language. The curriculum implemented in this school is National Curriculum 2013.

The population in this research was all of students' creativity and understanding that belong to 8<sup>th</sup> grades. The samples were 8<sup>th</sup> grades students from two different classes at the Junior High School in Bandung. The sampling technique was Cluster Random Sampling. The samples of the students were two classes of eighth grades, which were 8-C and 8-F. The research took place in class of 8-C which learn the topic of plant organs by implementing the method of smash book (*kliping*) project, as the control class. Another class, 8-F as experiment class, which learn the same topic by implementing the pop-up book project as the method.

The sampling technique of this research was Cluster Random Sampling, because Cluster Random Sampling is the sampling technique in which each and every member of population has and every member of population has equal and independent chance of being selected (Frenkel and Wallen, 2007). The consideration is because once a cluster is selected, all the members of the cluster must be included in the sample. They also stated that cluster random sampling is more effective with larger number of clusters and this sampling technique is appropriate for the quasi experiment method.

## C. Operational Definition

In order to avoid misconception about this research, so some operational definitions are explained in this research. Those terminologies are explained as follow:

1. Pop-up book is a book contain delightful paper craft which when the book is open three-dimensional structure appears and when the book is closed then the three dimensional folded flat. Pop-up book that is used in this research is three dimensioned book which is developed as teaching aids in instructional process. The pop-up book contains delightful scene

and interesting paper craft which is filled with picture flaps to lift to reveal the structure of plant organs, while the picture of plant organs flaps can be lifted to see the structure of plant organs. Learning process is conducted by using pop-up book which uses picture and sentences that is integrated into the concept.

2. Students' creativity that is measured in this research involves the dimensions of creativity. Those are novelty, resolution, and synthesis and elaboration (Munandar, 2009). Students' creativity in this research is measured through their pop-up book that use rubric of Creativity Product Analysis Matrix (CPAM) as the instrument.
3. Students' understanding that is measured in this research is the competence of students that cover the level cognitive of remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). This competence is measured by using multiple choices (pre-test and post-test) as the objective test.

#### **D. Assumption**

The assumption as the foundation of this study as follow:

1. The manipulation of paper will enhance and illustrate the transformation of text subject and picture in order to build understanding and long term knowledge retention.
2. Making paper craft such as pop-up has shown to improve children's creativity, spatial reasoning skills, and performing ability.
3. Pop-up book as students' assignment will become useful project that can help students to get better result in exam because when making pop-up book session review help students to understand the literacy of the concept easily.
4. Students love pop-up book because it's brings unique features in each page when opened then making learning experience more effective, interactive and memorable.

#### **E. Hypothesis**

Hypothesis to be tested in this study are as follow

$H_0$  : There is no difference of students understanding in learning plant

organs between using pop-up book and smash book

$H_1$  : There is difference of students understanding in learning plant organs between using pop-up book and smash book

## F. Research Instrument

In this research some instruments is necessary to be used for gaining data. There are four type instruments that used in this research which are objective test, students' creativity rubric, questionnaire and peer and self-assessment. Those instruments are described below:

### 1. Creativity rubric

There are indicators or criteria in assessing students' creativity when create book project which are smash book and pop-up book. The books made by the students were assessed into some indicators which available in the rubrics. The product will be evaluated to measure students' creativity. This kind of creativity test can be assessed by giving score on the rubric. The Table 3.2 is shown the blue print of students' creativity rubric:

**Table 3.2 Blue Print of Students' creativity Rubric**

Creativity dimension	Indicator	Score				Note
		Excellent (4)	Good (3)	Fair (2)	Poor (1)	
Novelty	Original Score : ....					
	Surprising Score : ....					
Resolution	Valuable Score : ....					
	Useful Score : ....					
Elaboration and synthesis	Organsic Score : ....					
	Elegant Score : ....					
	Complex Score : ....					
	Understandable Score : ....					
	Artistic Score : ....					

## 2. Objective Test

Objective test is form of instrument in order to obtain the quantitative data that was gained from this research. The data was collected through pretest and posttest in the form of multiple choices to measure students understanding before and after treated by using pop-up book in learning plant organs. The objective test consists of 30 questions with the cognitive domain of remembering (C1), understanding (C2), applying (C3), analyzing (C4), and evaluating (C5). The instrument questions were be analyzed with the following requirements

### a. Validity

Validity refers to the appropriateness, meaningful-ness, correctness, and usefulness of the inferences a researcher makes. Validity is the most important idea to consider when preparing or selecting an instrument for use. Researchers want the information they obtain through the use of an instrument to serve their purposes. Validation is the process of collecting and analyzing evidence to support such inference (Frankell, 2011). To determine the validity of the instrument in this study is by using software ANATES . The validity of each test item can be measured by using formula of correlation which was stated by Pearson, which is usually called as correlation formula, as follows:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Note:

- R : correlation coefficient between x and y variable
- N : number of students
- X : total score in test item
- Y : total score of students

*(Kaplan and Saccuzo, 2012)*

### b. Reliability

Reliability refers to the accuracy, dependability, consistency, or repeatability of test results. In more technical terms, reliability refers to the degree to which test scores are free of measurement errors. As you will learn, there are many ways a test can be reliable. For example, test results may be reliable over time, which means that when the same test is given twice within any given time interval, the results tend to be the same or highly similar (Kaplan, 2012). Statistically, a test reliability measures the degree to which individuals' deviation scores, or z-scores, remain relatively consistent over repeated administration of the same test or alternate test forms (Crocker and Algina, 2006). The formula for calculating the reliability of a test:

$$KR_{20} = r = \frac{N}{N-1} \left( \frac{S^2 \sum pq}{S^2} \right)$$

Note:

- $r_{20}$  : reliability coefficient
- $n$  : amount of test item
- $S_{i_2}$  : score variant each test item
- $S_{t_2}$  : total score variant

*(Kaplan and Saccuzo, 2012)*

### c. Item Difficulty Index

Item difficulty index is the proportion of test takers who answer an item correctly. Based on Boopahiraj and Chellamani (2013), item difficulty defined as the proportion of the examinees marked the item correctly. Item difficulty is the percentage of the students that correctly answered the item, also referred to as the p-value. P values indicate the difficult items and should be reviewed for possible confusing language or the contents needs re0instruction. Optimum difficulty level is 0.50 for maximum

discrimination between high and low achievers. The following formula is used to find difficulty level:

$$DL = \frac{(Ru + R_1)}{(Nu + N_1)}$$

Note :

Ru : the number students in the upper group who responded correctly

R<sub>1</sub> : the number students in the lower group who responded correctly

Nu : Number of students in the upper group

N<sub>1</sub> : Number of students in the lower group

*(Boopahiraj and Chellamani,2013)*

#### d. Item Discrimination

Item Discrimination or discriminating power of a test items refers to the degree to which success or failure on an item indicates possession of the ability being measured. It determines the extent to which the given item discriminates among examinees in the function or ability by the item. The value ranges between 0.0 and 1.00. The higher the value, the more discrimination of the item is. A highly discriminating item indicates that the students who had high test scores got the item correct whereas students who low test scores had got the item incorrect (Boopahiraj and Chellamani, 2013). Discrimination power estimated using the following formula:

$$\text{Discrimination power} = \frac{(Ru - R_1)}{(Nu \text{ (or) } N_1)}$$

Note

Ru : the number students in the upper group who responded correctly

R<sub>1</sub> : the number students in the lower group who responded correctly

Nu : Number of students in the upper group

N<sub>1</sub> : Number of students in the lower group

*(Boopahiraj and Chellamani,2013)*

#### e. Distractor

Distractor are incorrect alternative on a multiple choice item. A distractor analysis allows to examine how many students in the top and bottom groups selected each option on a multiple choice item. A distractor analysis assists in distinguishing plausible distractors from implausible ones. A high percentage of 70% from the total distractors were regarded as implausible due to the fact that those distractors were selected neither by the top scorer nor the low score. One item clearly indicates a confusing items seeing that one distractor is selected by more students than the correct answer (Sabri, 2013).

### 3. Questionnaire

The questionnaire was used to detect the impression of the students toward the implementation of pop-up book and smash book as their project in concept of plant organs during the lesson. The questionnaire will be given to students in the end of learning activity. The data will be obtained from students' answer in the questionnaire. The questionnaire contains of statements which are negative statement and positive statement. The Table 3.3 showed the blue print of students' impression questionnaire.

**Table 3.3 Blueprint of Students Impression Questionnaire**

Indicator Questionnaire	Statement	
	(+) /(-)	Number
Students response toward creating pop-up book as the project in learning plant organs	Positive	1, 2
	Negative	3, 4
Students' response toward pop-up book as source to the concept of plant organs	Positive	5, 7
	Negative	6, 8

### 4. Peer and self-assessment

Peer and self-assessment were used to detect the contribution of group teamwork ability, feedback of the students toward the implementation of pop-up book and smash book as their project in concept of plant organs and give them motivation during lesson. Students were given the peer and self-assessment sheet by the teacher. Before students assess them self and their peer, students should know who were going to assess and understand the



criteria to be assess. Students were given time by the teacher to assess their self and their peer. After being filled by the students the assessment sheets were collected to the teacher. The result was calculated by Likert scale.

## **G. Research Procedure**

### **1. Preparation Stage**

In this stage, the researcher conducts several steps that support the research, there are as follows.

- a. Analysis of *Kurikulum*2013
- b. Analysis of pop-up book literature
- c. Analysis of students' creativity literature
- d. Analysis of students understanding literature
- e. Analysis of concept plant organs and function literature
- f. Research instrument making
- g. Research instrument validation by expert
- h. Research instrument revision

### **2. Implementation Stage**

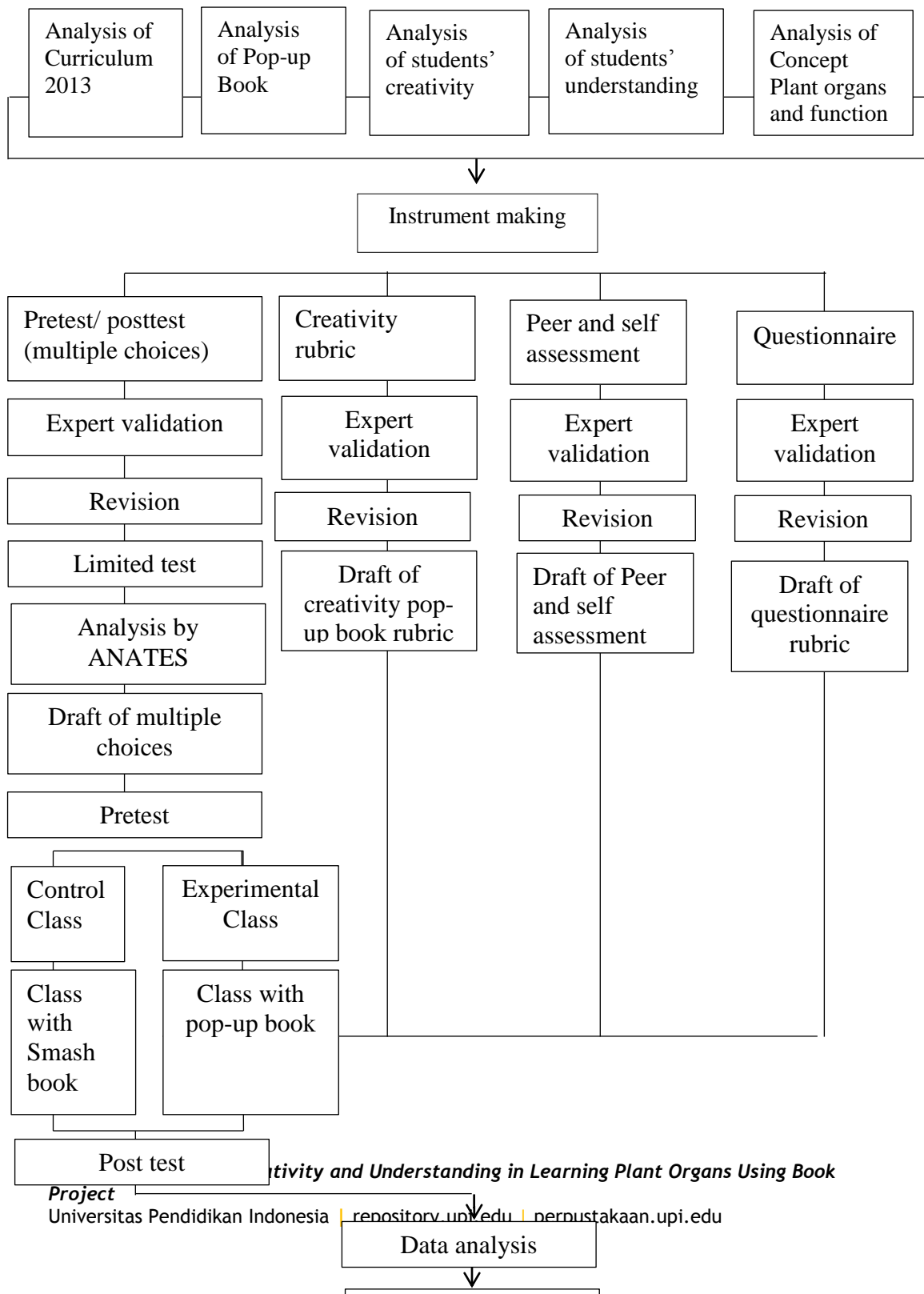
This stage explains the step of how research was implemented, it consists of:

- a. Determination of experimental class and control class
- b. Pretest will be given to the sample class to get initial condition of students
- c. Processing pretest result.
- d. Conduct research activity by implementing pop-up book project in experimental class
- e. Give post-test in the sample class to recognize the improvement of students understanding

### **3. Completion Stage**

This is the final stage of research design, the steps that were conducted in this stage is explained as the following steps:

- 1) Analyze the data of the whole research.
- 2) Make a conclusion from data analysis result.



## H. Research Instrument Judgment

### 1. Objective Test Validation

In this study, objective test was used to measure the improvement of students' concept mastery in the form pre-test and post-test. Before implementing the objective test on experiment and control classes, the objective test needs to be validated. The reliability, difficulty level, discriminating power, and distraction point of the objective test were investigated. Therefore, the test consists of 35 multiple choice questions which tested to 8<sup>th</sup> grade students in secondary school level. The questions which accepted were 30 questions. Table 3.4 presents the recapitulation of test items based on cognitive level. Reliability test was 0.87 (Very high degree).

**Table 3.4 Blue Print of Pretest and Posttest Item Specification and Recapitulation**

Topic	Cognitive Domain					Σ	%
	C1	C2	C3	C4	C5		
Plant organs that made up root system and shoot system	1,2,3,5	4	-	-	-	5	16,67
Vascular tissue in plant	6	7,8,9	-	-	-	4	13,33
Function of root system and shoot system and its relationship with transportation in plant	-	11,12	10,13	16,17,19	20,21	9	30
The component of root system and shoot system in monocotyledon and dicotyledon plants	22	23,24,25	-	27,26		6	20
Factor that affect transportation in plant	-	-	14,15,18,29		28,30	6	20
Amount	6	9	6	5	4		
(%)	20	30	20	16,6	13,3	30	100

## 2. Objective Test Categorization

After the data of the test item score is obtained, then the data was processed by calculating gain score and normalize gain score. Gain is calculated to know the differences between pretest and posttest score so that gain score reflects improvement result from pretest to the posttest. It could be assumed as the effect of treatment. After the gain score is obtained, then Normalized Gain (N-Gain) can be obtained. The normalized gain score is used to determine the categories of students' improvement (Hake, 1999). According to Hake (1999), Formula of gain is

$$G = S_f - S_i$$

Where

$G$  = Gain Score

$S_f$  = Posttest score

$S_i$  = Pretest score

(Hake, 1999)

Meanwhile, implementation pop-up book in assessing students' understanding in plant organs can be seen from the result of the normalized gain that achieved by students during the learning process. The normalized gain better to show the improvement rather than actual gain score because the improvement of higher and lower achiever students can be shown clearly (Hake, 1999). The N-Gain can be calculated by the following formula

$$\langle g \rangle = \frac{S_f - S_i}{S_{max} - S_i}$$

Where

$\langle g \rangle$  = Normalized Gain Score

$S_f$  = Posttest score

$S_i$  = Pretest score

$S_{max}$  = Maximum score

(Hake, 1999)

Then, the Normalized gain value is determined based on Table 3.5.

**Table 3.5 N-gain Categorization**

<b>N-gain Score Category</b>	
<b>Result</b>	<b>Category</b>
$g > 0,7$	High
$0,3 > g \geq 0,7$	Medium
$g \leq 0,3$	Low

*(Hake, 1999)*

### 3. Data Statistical Analysis

Data statistical analysis is needed to support the data of improvement students' comprehension and to prove the hypothesis test. Data statistical analysis is helped by IBM SPSS Statistics version 23. The steps were obtained as follow.

#### a. Normality test

The first to process data statistic is testing the normality of the data. Normality test aims to know the sample which comes from population has normal population distribution or not. Normality statistic test is done by using SPSS 23, Kolmogorov-Smirnov or Shapiro-Wilk with significance level ( $\alpha$ ) 0.05.

In this study the researcher used Shapiro-Wilk to test the normality. The Shapiro-Wilk test is used to calculate a **W** statistic to know whether a random samples comes from normal distribution. The **W** Statistic is calculated as follows:

$$W = \frac{(\sum_{i=1}^n a_i x_{(i)})^2}{(\sum_{i=1}^n (x_i - \bar{x})^2)}$$

*(Shapiro and Wilk, 1965)*

Hypothesis to be tested in this study are as follows

$H_0$ : Data (control and experiment class) comes from normal distribution.

$H_a$ : Data (control and experiment class) comes from not normal distribution.

The normality test is tested using Shapiro-Wilk at the significance level ( $\alpha = 0.05$ ), with test criteria are as follow:

- a) If significance score  $< 0.05$ , thus data is not from normal distribution
- b) If significance score  $\geq 0.05$ , thus data is from normal distribution

The ways to know the data are normal just see the significant of Shapiro-Wilk or Kolmogorov-Smirnov, if the result  $> 0.05$  indicates the data are normally distributed.

#### **b. Homogeneity Test**

The data was obtained is from normal distributed, the next step is homogeneity test. In this study Levene's test was chosen. Levene's test (Levene, 1960) is used to tests if k samples have equal variances. The equal variance across sample is called homogeneity variance. Homogeneity test is needed because to determine a sample from population that is originated from two classes that homogenous. The homogeneity test used significance level ( $\alpha$ ) 0.05. When significance value is  $\geq 0.05$ , data is considered as homogenous (Sudjana, 2005).

Hypothesis that is tested in this study are as follows

- $H_0$ : Data (control and experiment class) have variances homogenous.
- $H_a$ : Data (control and experiment class) haven't variances homogenous.

The homogeneity test is tested using ANOVA (one-way) at the significance level ( $\alpha = 0.05$ ), with test criteria are as follow:

- a) If significance score  $< 0.05$ , thus data haven't variances homogenous.
- b) If significance score  $\geq 0.05$ , thus data have variances homogenous.

If two samples of are homogenous variance hence difference of both means can be done by using T test. On the contrary, if the data are not homogenous variance, the differences of two means can be done using non-parametric test.

### c. Hypothesis Test : Parametric Test

Parametric test is used in certain condition of result data research; the normal data distribution and homogeneity data. Parametric test method is classify in to one sample T-test, independent sample T-test, Summary Independent sample T-test and paired sample T-test. Meanwhile, this research was adapted the Independent sample T-test because the data is two unrelated groups on the same continuous, dependent variable.

### d. Independent Sample T-test

The independent-samples t-test is one of type parametric test. Independent sample t-test is compares the means between two unrelated groups on the same continuous, dependent variable. The Independent t method tests the null hypothesis that the population means related to two unpaired data, random samples from an approximately normal distribution are equal (Altman, 1991; Armitage and Berry, 1994 as cited in Woodward, 2013 ). Assuming equal variances, the test statistic is calculated as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

$$s^2 = \frac{\sum_{j=1}^{n_1} (x_j - \bar{x}_1)^2 + \sum_{i=1}^{n_2} (x_i - \bar{x}_1)^2}{n_1 + n_2 - 2}$$

Where

- $\bar{x}$  = the sample means
- $s^2$  = the pooled sample variance
- $n_1$  and  $n_2$  = the sample sizes
- $t$  = is a Student t quantile with  $n_1 + n_2 - 2$  degrees of freedom

(Minium et al., 1993)

According to Sudjana (2005), if the level of significance (sig) is  $\leq 0.05$   $H_0$  is rejected. Meanwhile if the level of significance (sig)  $\geq 0.05$   $H_0$  is retained.

The hypothesis of the difference of the average posttest result in experiment class is determined as follows

H<sub>0</sub>: There are no differences in students' understanding in learning plant organs through pop-up book

H<sub>1</sub>: There are differences in students' understanding in learning plant organs through pop-up book

As the independent sample t-test does assume normality in the data, and homogeneity if the data does not homogenous and normal distribution use non-parametric statistics; Mann-Whitney test. The Independent Samples t-test can only compare the means for two (and only two) groups. It cannot make comparisons among more than two groups (Sudjana, 2005).

#### 4. Qualitative Data Processing

The qualitative data is obtained from creativity rubrics of students' book project, peer and self-assessment and questioners. The analysis of rubrics is conducted by converting the raw score into form of percentage. The technique of converting score into percentage is used formula as follows:

$$P = \frac{R}{MS} \times 100\%$$

Explanation:

P = percentage  
R = raw score  
MS = maximum score

(Arikunto, 2010)

Score obtained are interpreted in the form of a percentage. According Syah (2003), the score results in the form of percentage can be grouped into various categories, such as very high, high, enough, low, and very low.

**Table 3.6 Determination the Level of Creativity Based On the Score of Creative Products**

Score	Categories
81 – 100%	Very high
61 – 80 %	High
41 – 60 %	Enough
21 – 40 %	Low



0 – 20%	Very Low
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(Syah, 2003)

Peer and self-assessment was analyzed qualitatively. The data processing is done by calculating Likert scale. It consists 13 statement regarding the contributions toward the groups. Each statement is given four answer choices, those are all of the time, most of time, some of the time and none of the time. The result is calculated into score and then converted into percentage. The scoring guideline is shown in the Table 3.7 as follows.

**Table 3.7 Scoring Guideline of Peer and Self-Assessment**

Answer	Score
all of the time	4
most of time	3
some of the time	2
none of the time	1

Besides from the rubric and peer and self-assessment sheet, the data that is analyzed qualitatively is from questionnaire result. The qualitative analysis describes the real situation of the research result and also the result of students' respond in learning plant organs by creating pop-up book. The data processing is done by calculating Likert scale. It consists of positive and negative statement. Each statement is given four answer choices, those are strongly agree, slightly agree, slightly disagree, and strongly disagree. The result is calculated into score and then converted into percentage. The scoring guideline is shown in the Table 3.8 as follows.

**Table 3.8 Scoring Guideline of Students' Response**

	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
Positive Statement	4	3	2	1
Negative Statement	1	2	3	4

(Arikunto, 2013)

The percentage of each likert scale in each indicator determines the students' respond toward project based learning implementation. The percentage data is gained by calculating through the following formula:

$$P = \frac{f}{n} \times 100\%$$

Explanation:

P = percentage

f = score from frequency of the answer

n = score from total response

*(Sudjana, 2005)*



