

CHAPTER III

RESEARCH METHODOLOGY

A. Research Method and Research Design

1. Research Method

The research methods used in this study is Quasi Experiment. This is related with the research which is to investigate the effectiveness of dioramas on students' creativity and understanding in learning ecosystem. Creswell (2012) stated that quasi experiments include assignment, but not random assignment of participants to groups. This is because the experiments cannot artificially create groups for the experiment. Quasi experiment provides the research with the opportunity to assess the effects of interventions or treatments. By applying this method, there were two group which are experiment and control class.

2. Research Design

The research design used in this study is pre-test and post-test design /post-test only design (Creswell, 2012). The research assign intact groups the experimental and control treatments, administers a pre-test to both groups, conducts experimental treatment activities with the experimental group only, and then administers a post-test to assess the differences between the two groups.

Table 3.1 Pre-test and Post-test Design

Select Control Group	Pre-test	2-D Model Treatment using Flanel Board	Post-test
Select Experimental Group	Pre-test	3-D Model Treatment using Dioramas	Post-test

(Creswell, 2012)

B. Research Subject

2. Research Location

This research is conducted in one of School in Bandung which applied *Kurikulum 2013* in the teaching and learning process. The data collection was done in May 2016.

3. Population and Sample

The population in this research was 7th grade student at Junior High School in one of the Bandung School year 2015/2016. After observation, the Samples was taken are 7th grade students from two different classes in Junior High School "X" Bandung. Researcher conducted the research in class of 7D which learn the topic about ecosystem by implementing of dioramas project as task as the experiment class. Then, another class for compare is class of 7E as control class, which learn the same topic by implementing of common project/Flanel board as task for students.

The sampling technique used is Cluster Random Sampling, Fraenkel and Wallen (2007) stated that cluster random sampling is one obtained by using groups as the sampling unit rather that individuals. 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 with the quasi experiment method that is used in the research.

C. Assumption

The assumption as the foundation of this study as follow:

1. **Dioramas project** enables students to learn in collaborative learning centered which is can improve students' autonomy, confidence, and responsibility using project based learning approaches.
2. **Dioramas as learning media** in 3-D that is describes the phenomenon in the current setting of time will explain about the concept material in detail, specific, and show in concrete real object for the students' understanding.

3. **Dioramas as student'assessment** will become useful project that can help students to master the concept easily and get better score result in final exam.
4. **Dioramas presentation** help to encourage a good communication skill between students and teacher and among the students.
5. **Dioramas project** will develop their skill to make innovation using their imagination about the concept in the learning material so that it will be improve their creativity.

D. Hypothesis

The hypothesis in this research are two hypothesis. The explanation like below:

H_0 : There is no effect on students' understanding in learning ecosystem between experiment class and control class using dioramas and flanel board.

H_1 : There is an effect on students' understanding in learning ecosystem between experiment class and control class using dioramas and flanel board.

E. Research Procedures

There are several procedures that are conducted in this research. Therefore, the procedure is generally will classify into three stages which are preparation stage, implementation stage, and completion stage. Each of stages consists of several activities which are conducted during the experiments.

1. Preparation Stage

The steps are including the following activities below:

- a) Literature review was conducted in analyzing the information about:
 - 1) Dioramas
 - 2) Students' Creativity
 - 3) Students' Understanding

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Keefektifan Diorama Pada Kreativitas Dan Pemahaman Siswa Dalam Pembelajaran Ekosistem

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- 4) Ecosystem
- b) As the result of literature review, research problem is identified and elaborated into several research question arranged. In order to answering research questions, instruments will be arranged as tools to obtain the data. Arrangement of instrument including:
 - 1) Objective test
 - 2) Observation rubric
 - 3) Creativity rubric
 - 4) Questionnaire

Instructional tools which used are lesson plan and worksheet was arranged to help the implementation of dioramas in learning process.

- c) Judgment of instrument was conducted by experts.
- d) Trial test of objective test instrument was conducted to identify the quality of instrument.
- e) The result of multiple choices trial was analyzed.
- f) Revision of instruments was done based on judgment result and test item analysis.

2. Implementation Stage

These activities below are conducted in the implementation stage which consists of four main activities. The activities are:

- 1) Pre-test was conducted to identify student preliminary skills.
- 2) Treatment was conducted in two meetings as follow:
 - 1st meeting: Discussion about the topic and doing the experiment
 - 2nd meeting: Presentation and developing problem
- 3) Post-test was conducted.

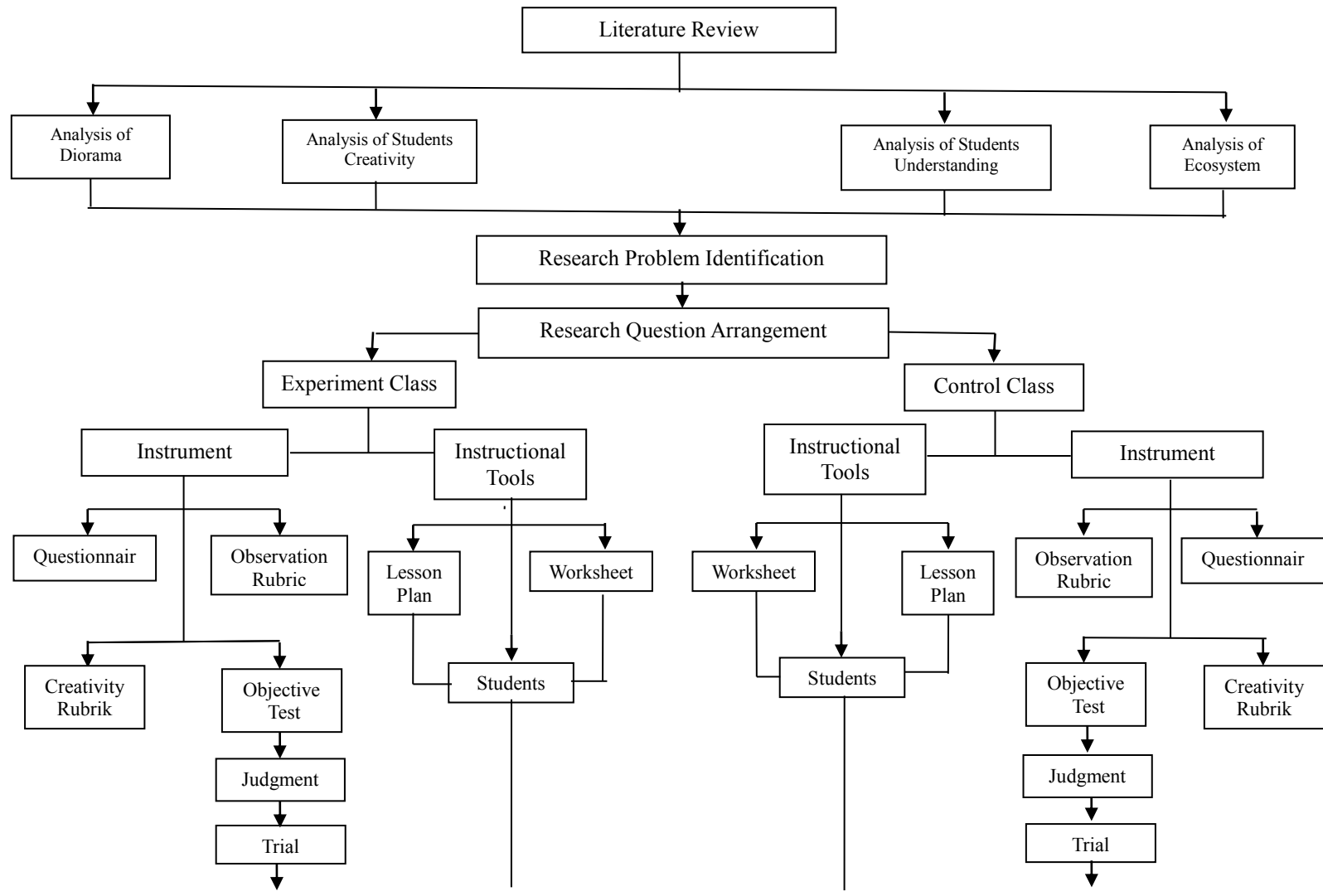
3. Completion Stage

Completion stage consists of four stages, as follows:

- 1) All of data which is obtained was calculated.
- 2) The result of data calculation was analyzed.
- 3) Discussion was done to elaborate the result of analysis.
- 4) Conclusion was obtained based on the result.

In a way of analyzing the plot of the procedures above, it is represented in

the following chart which illustrates the framework of research as follow:



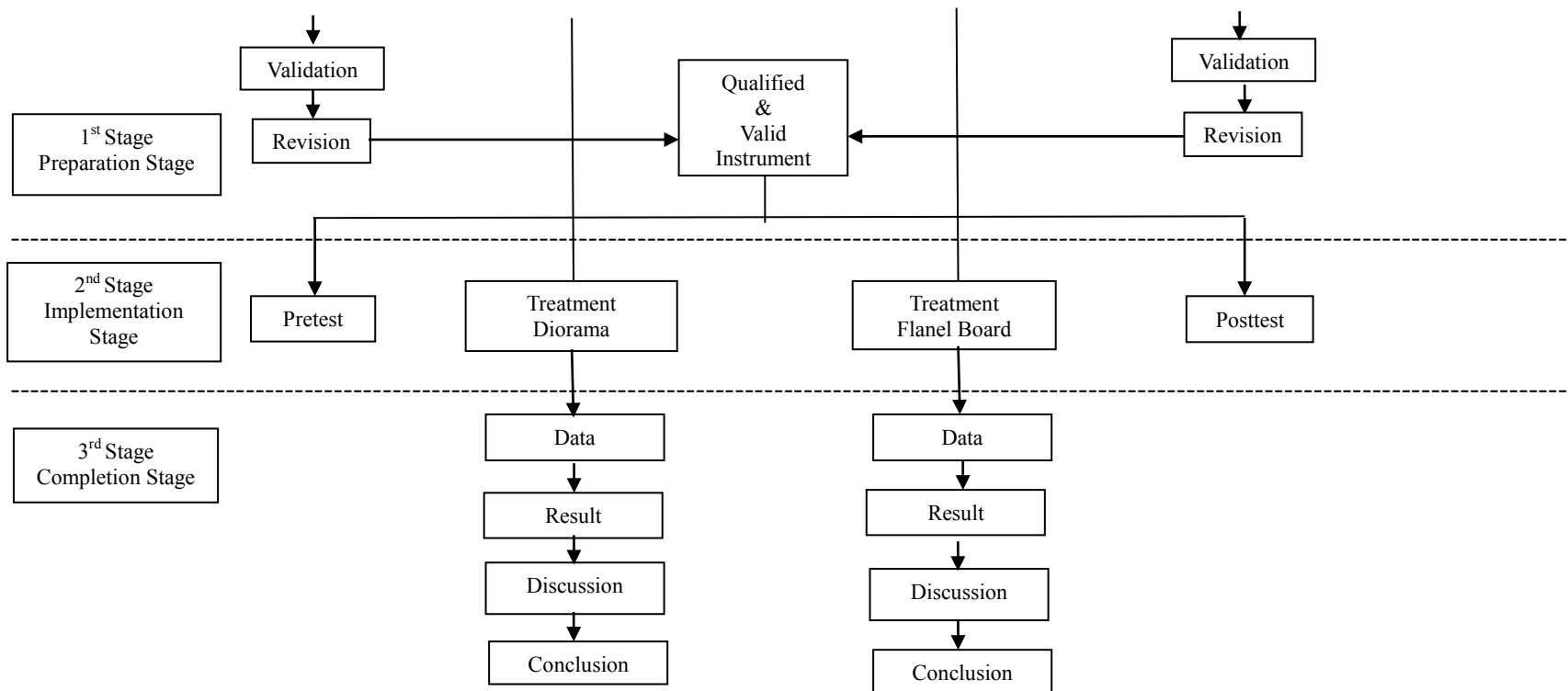


Figure 3.1 Research Plot

F. Instructional Tools

Instructional tools in this research is all about the instrument that support the research, there are lesson plan, worksheet, and project design sheet. This is the explanation about instructional tools as follows:

1. Lesson Plan

Lesson plan is the design of instructional arrangement that used in the control and experiment class. The arrangement of lesson plan refers to the syntax of Project Based Learning which include the planning, creating, and processing. There are mainly some syntaxes that should be conducted in the implementation of diorama in the class activity based on their creativity that expressed on diorama. However, the implementation of problem based experiments in this research is arranged divided into two meetings.

2. Worksheet

Worksheet is additional tools that helps the implementation of lesson plan in the real activity. Worksheet is used as students' guidance during the experiment. The worksheet consists of the question and also the problem that should be solved by students through watching the video that already prepared by teacher.

3. Project Design Sheet

Project design sheet is additional tools that help the implementation of project based learning in planning stage. The students made design based on their creativity and understanding in this sheet. This project design sheet consist of group which respectively arranged based on syntax of project based learning and the scope of learning objective is ecosystem.

G. Research Instruments

In this research, instrument is necessary to be used for gaining data. There are four types instrument that are used in this research. This instrument are creativity rubric for assessment of diorama as project, objective test relation with students' understanding in the form of multiple

choice, observation sheet to make sure teacher done the step of learning process based on lesson plan that already arranged, and questionnaire that measure the impression of diorama as learning media in the students' point of view.

Before this instrument used in the research, researcher do judgment to expert judgment. Instructional tools that is used in the implemetation of this research as the table follows:

Table 3.2 Research Instruments

No	Instruments	Aspects	Source of Data
1.	Objective test	Understanding about the material that must be mastery by students	Answer the questions of multiple choice about ecosystem
2.	Observation sheet	Teaching strategy in classroom	Teacher activity in classroom based on lesson plan that already arranged
3.	Creativity rubrik based on novelty, resolution, elaboration, and sintetic	Creativity level	Diorama made by students
4.	Questionner	Impression of diorama as learning media based on students' opinion	Answer the question of questionner about the students' impression

In this research, there are four types instrument that was used in this research which are objective test, observation sheet, creativity rubric, and questionner. Those instrument are described below:

1. Objective Test

Objective test is form of instrument in order to obtain the quantitative data that was gained from the research. The data was collected through post test and pretest in form of multiple choice to mewasure the student's understanding before and after treated by using diorama in learning ecosystem. The objective test consist of 25 questions with the cognitive domain of remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6).

The instrument needs to be judgment by the concerned lecturer and some experts in related fields. After being judged, the instrument which not appropriate enough was revised. After the instrument had been revised, it also tried to the class that already learn about the topic before.

Based on miller on “Measurement and Teaching’s book” stated that objective test items are easy to write and score and can sample large amounts of content. As the form of instrument used is in multiple choices, thus the calculation is only done to identify validity, reliability, difficulty level, discriminating power, and distracter. The more explanation will be explained as below:

a. Validity

Validity is the extent to which a test measures what it was intended to measure. Validity is the most important characteristic of any test. Even if other practical and technical considerations are satisfactory, the test’s quality is doubtful without supportive evidence of validity. The four types of test validity are content, construct, concurrent, and predictive. Content validity is the most common type of validation used by researcher to ascertain if a test provides an accurate assessment of instructional objectives (Miller, 2008). Each type of validity follows specific procedures and has primary use.

Table 3.3 Types of Validity Test

Validity	Procedures	Primary Use
Content	Compares test items with instructional objectives	Assessment of content
Construct	Identifies underlying concepts measured by the test	Assessment of adequacy
Concurrent	Compares test with similar measure of present performance	Provision for more convenient test that measures desired behavior
Predictive	Compares test performance with future outcome	Selection and classification of students

(Miller, 2008)

So that the researcher choose the content validity to measure the validity of instructional objectives. Test items are individually analyzed

and compared with levels of behavior specified in the objectives. Usually content area experts review what will be taught with what is content validity is concerned with making sure that the test measures what students are expected to learn. To establish content validity, so that the researcher using the validation test in one classroom of 8th grade then the result was analyzed. The researcher also using two expert judgment to carefully review the test before it is administered to students. To complete the task, expert judgment was given the following information:

1) Objectives and corresponding test items

Instrument that already used by researcher is multiple choice to measure the student's understanding. This test obtained the level of cognitive from C1 until C5.

2) Test direction

Researcher also using project design sheet that include directions for entire project based learning. In the project design sheet, student should make a design before making the project. This test direction include the planning stage in the project based learning.

3) Description of students for whom the test is being prepared

The researcher attempting to establish the content validity should check test question about ecosystem. The researcher using 8th D grade class to doing the validation test and that class is appropriate for taking the test.

After receiving feedback, researcher was consider the reviewer's comment or expert judgment's comment and make appropriate corrections. The test was valid and appropriate to done research using the instrument that already valid by validation test and reviewing by expert judgment.

Hence, by having this validity test it can measure whether the data that is resulted from the test is valid with the variable that want to be measured and interpreted. To determine the validity of the instruments in this study is done by using software ANATES. The validity of each

item can be measured by using the formula of correlation (Arikunto, 2010), which is usually called as correlation formula of Product Moment, as follows:

$$r_{xy} = \frac{n \sum xy - [(\sum x) (\sum y)]}{\sqrt{[n \sum x^2 - (\sum x)^2] [n \sum y^2 - (\sum y)^2]}}$$

(Arikunto, 2010)

Note:

r_{xy} : correlation coefficient between x and y variable

n : amount of student

x : total score in test item

y : total score of student

According to Minium et al. (1993), interpretation about correlation coefficient between x and y variable is divided into different categories as shown on the following table.

Table 3.4 Interpretation of Validity

Value r	Interpretation
0,80 $r \leq 1,00$	Very High
0,60 $r \leq 0,80$	High
0,40 $r \leq 0,60$	Enough
0,20 $r \leq 0,40$	Low
0,00 $r \leq 0,20$	Very Low

(Minium et al, 1993)

b. Reliability

Reliability provides an estimate of consistency of test results. Next to validity, reliability is the most important characteristic of a test. Without reliability, little confidence should be placed in test results. The four types of reliability are stability, equivalence, internal consistency using split half, and internal consistency using Kuder-Richardson 21. Kuder-Richardson 21 is the most common method used by teachers to establish reliability (Miller, 2008). The researcher should in detail, however, expect test results to be perfectly reliable.

As a test is administered to different students and/or groups, variations in test scores should be expected because of factors other than test quality. Reliability (r) is expressed as a correlation coefficient (measure of relationship) reported on a scale ranging from 0.00 (no relationship) to 1.00 (perfect positive relationship). Standardized tests will often yield reliability coefficients of .90 or higher. In contrast, teacher developed tests with reliability coefficients of .80 or higher are usually considered good. Reliability coefficients used with researcher developed tests are usually identified by the method used to calculate reliability. The methods used to establish test reliability are stability (across time), equivalence (across forms), and internal consistency split half method (across items), Kuder- Richardson 21 is another internal consistency method based on the test mean (\bar{X}) and deviation standard (SD).

Table 3.5 Types of Reliability Test

Reliability	Method	Procedures
Stability (Across time)	Test-Retest	Administer the same test twice to the same students. Second administration at later time, i.e., a few days to several months
Equivalence (Across forms)	Equivalent Forms	Administer two (or more) forms of the test to the same students at about the same time. Form A today and form B a short time later
Internal Consistency (Across items)	Split-Half	Administer test once. Score two halves of test (e.g., odd and even test items). Apply Spearman-Brown correction formula
Internal Consistency (Users the test mean and deviation standard)	Kuder-Richardson 21	Administer test onnce. Score test and calculate mean and deviation standard.

Reliability	Method	Procedures
		Apply Kuder-Richardson 21 formula.

(Miller, 2008)

So that, the researcher using internal consistency (Kuder-Richardson 21 Method). It is an internal consistency method of establishing reliability (r) that requires a single administration of a test. The KR21 reliability method is easily determined if the mean (\bar{X}) and deviation standard (SD) of the test have been previously calculated. KR21 is easily determined with a calculator or computer software program.

$$KR21 = \frac{A}{A-1} \left(1 - \frac{\bar{X}(A-\bar{X})}{A(SD^2)} \right) = \text{Reliability (r)}$$

(Miller, 2008)

Note:

A = Number of test items

\bar{X} = Mean

SD = Deviation standard

According to Arikunto (2010), the instrument which is reliable, will also produce reliable data. The value of reliability is determined based on coefficient value which is reliable, will also produce reliable data. The value of reliability is determined based on coefficient value which is gained by Alpha formula, as follows:

$$r_{11} = \left(\frac{n}{n-1} \right) \left(1 - \frac{\sum si^2}{st^2} \right)$$

(Arikunto, 2010)

Note:

r₁₁ : Reliability coefficient

n : Amount of test item

Si² : Score variant each of item

St² : Total score

Table 3.6 Interpretation of Reliability

Value r	Interpretation
$0,80 < r \leq 1,00$	Very High
$0,60 < r \leq 0,80$	High
$0,40 \leq r \leq 0,60$	Enough
$0,20 < r \leq 0,40$	Low
$0,00 < r \leq 0,20$	Very Low

(Minium et al, 1993)

c. Difficulty Index

Difficulty index indicates the percentage of students who responded correctly to a test item. Item difficulty is expressed on a scale from 0.00 to 1.00. A value of 0.00 indicates that no students responded correctly, a value of 1.00 indicates that all students responded correctly. For example, a difficulty index of .90 indicates that 90% of students responded correctly to a particular test item. Conversely, a difficulty index of .20 indicates that 20% of students responded correctly to a particular test item (Miller, 2008).

$$DI = \frac{\text{Number of students responding correctly to item test}}{\text{Number of students responding to test item (including no responses)}}$$

(Miller, 2008)

According to Arikunto (2013), good question are the question which is not too easy or too difficult to be answered and state that the questions which are too easy will not stimulate the students to try harder to solve it. In the other hand. difficulty question also will make the students give up and lose heart. There are three categories to describe it, they are easy medium, and difficult. The proportion of the categories based on normal curve. Means that, most of the problems are in the medium category, some are included into easy and difficult with balance proportions. The formula shown in the bellow that used in the research to determine the level of difficulty:

$$P = \frac{B}{JS}$$

(Arikunto, 2013)

Note:

P : Difficulty level

B : Number of students who answer correctly

N : Total number of students

The number which indicates the difficulty and how easy a certain question is called as difficulty index (Arikunto, 2013). The range of difficulty index is start from 0,00 until 1,00. The difficulty index criteria are shown in table bellows:

Table 3.7 Difficulty Index

Value	Criteria
0,00 – 0,30	Difficult
0,31 – 0,70	Medium
0,71 – 1,00	Easy

(Arikunto, 2013)

d. Discriminating Power

Difficulty index include one simple discrimination parameter, called the index of discrimination. Item discrimination provides an index of how an item discriminates between students who scored high and low on a test. Test items can indicate positive, negative, or no discrimination. Positive discrimination occurs when more high than low scoring students respond correctly to a test item. Maximum positive discrimination occurs when all high scoring students respond correctly to the item and no low scoring students succeed on it. The discrimination for such an item would be +1.00. Negative discrimination occurs when more low than high scoring students respond correctly to a test item. Such items often have serious problems and must be revised or discarded. Maximum negative discrimination occurs when all low scoring students respond correctly to the item and no high scoring students succeed on it. The discrimination for such an item would be -1.00. This is a rare situation. No discrimination occurs when an equal number of high and low scoring students respond correctly to a test item. The discrimination for such an item would be 0.00. A test item with no discrimination should be reviewed and in all likelihood rewritten because it does not differentiate

between the high and low scoring groups (Miller, 2008).

According to Arikunto (2009) stated that Discriminating Power (DP) is ability for differentiate among the student who have high ability with the student who have low ability in solve the problem. Calculation in manually use the formula, this formula as follows:

$$DP = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B$$

(Arikunto, 2009)

Note:

J = Amount of students

J_A = Amount of up group

J_B = Amount of down group

B_A = Amount of up group that answer the question correctly

B_B = $\frac{B_A}{J_A}$ = Amount of down group that answer the question correctly

P_A = $\frac{B_B}{J_B}$ = Proposion of up group that answer the question correctly

P_B = Proposion of down group that answer the question correctly

Table 3.8 Classification of Discriminating Power

Value	Criteria
0,70 – 1,00	Excellent
0,40 – 0,70	Good
0,20 – 0,40	Satisfactory
0,00 – 0,20	Poor
Negative	Very Poor (Must be rejected)

(Arikunto, 2009)

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. Based on Sabri (2013), a distractor analysis assist 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.

According to Arikunto (2013), the pattern of the choice answer can be determined whether the distractor works well or not. He also stated that the distractor which is chosen at all means that the distractor is not good or bad. Oppositely, the distractor is impressed has good function, if that distractor has big attraction to participants who are not really mastering the concept. Distractor can be treated with three following methods:

- 1) Accepted, because it has been good
- 2) Rejected, because it's bad
- 3) Rewritten/Revised, because it's not really good

2. Observation Sheet

Observation sheet is the analysis of teacher's activity that conducted to identify the quality of implementation for coherence of treatment was arranged by researcher. In obtaining data, observation sheet contain all of teacher activity that happen in classroom. The arrangement of observation sheet relates with teaching and learning activities that is arranged in lesson plan before. Observation sheet as completed by observer which have obligation to analyze and observe the whole implementation and judge whether the implementation is in line with the procedure or not. This observation sheet can be assessed by giving checklist on the sheet if there is teacher's activity that appears in the classroom based on lesson plan that have been arranged.

3. Creativity Rubric

Diorama as media for assesses the student's creativity use creativity rubric that provided by researcher. This rubric based on the expert using rubric of Creative Product Analysis Matrix (CPAM) by Besemer & Treffinger (1981) is one of the most comprehensive works addressing the creative product.

4. Questionnaire

In this research using questionnaire to know the impression from students about diorama and flanel board as their project in learning ecosystem during the lesson. It was arranged by researcher using indicator that appropriate and measure level of impression. The questionnaire arranged using some of questions. It is using Likert Scale, where respondents ask to choose among any of scale to answers. Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions (Bowling, 1997; Burns, & Grove, 1997). These ordinal scales measure levels of agreement/disagreement. All of item show the effectiveness and attractiveness using diorama and flannel board as learning model to measure students' creativity and understanding in learning ecosystem. In the questionnaire, the likert scale is a five point scale which is used to allow the individual to express how much they agree or disagree with a particular statement. The researcher analyzed the data by two steps are summarize using a median or a mode (not a mean) the mode is probably the most suitable for easy interpretation and then display the distribution of research in a bar chart and circle/pie diagram to show the result in graphic to draw the conclusion.

H. Instrument Analysis Results

1. Recapitulation of Students' Understanding Instrument

The Instrument for measuring students' understanding using objective test. The researcher was arranged 39 questions. The instruments was tested in term of validity, reliability, difficulty level, discriminating power and distractor as explained before. The test was given to 48 students which have learned about the material that is learned for the research. The recapitulation of item test analysis is shown in the Table 3.9.

Item Test Recapitulation:

Reliability Test : 0,96 (Very High Degree)

Table 3.9 Recapitulation of Item Test for Students' Understanding

Question Number	Discriminating Power	Validity	Difficulty Level	Status
1	Satisfactory	Low	Very Easy	Accepted
2	Poor	Enough	Very Easy	Accepted
3	Poor	Invalid	Very Easy	Rejected
4	Good	Low	Middle	Accepted
5	Satisfactory	Low	Easy	Accepted
6	Good	Low	Middle	Rejected
7	Excellent	Enough	Difficult	Rejected
8	Excellent	Enough	Middle	Rejected
9	Satisfactory	Low	Easy	Accepted
10	Excellent	Enough	Middle	Accepted
11	Excellent	Enough	Middle	Accepted
12	Satisfactory	Low	Easy	Accepted
13	Excellent	High	Middle	Accepted
14	Excellent	High	Middle	Accepted
15	Excellent	High	Middle	Rejected
16	Good	Enough	Very Easy	Rejected
17	Good	Enough	Easy	Rejected
18	Good	Enough	Easy	Rejected
19	Good	High	Easy	Rejected
20	Good	High	Easy	Accepted
21	Excellent	High	Middle	Accepted
22	Excellent	High	Easy	Accepted
23	Satisfactory	Low	Easy	Rejected
24	Satisfactory	Enough	Easy	Rejected
25	Good	Enough	Easy	Accepted
26	Good	Enough	Easy	Accepted
27	Very Poor	Invalid	Very Easy	Rejected
28	Very Poor	Invalid	Very Easy	Revised
29	Poor	Very Low	Very Easy	Accepted
30	Good	Enough	Easy	Accepted
31	Excellent	High	Easy	Accepted
32	Good	Enough	Easy	Accepted
33	Poor	Very Low	Easy	Accepted
34	Poor	Very Low	Very Easy	Accepted
35	Poor	Very Low	Middle	Accepted
36	Poor	Invalid	Very Easy	Revised
37	Poor	Invalid	Very Easy	Revised
38	Poor	Invalid	Very Easy	Rejected
39	Poor	Invalid	Very Easy	Rejected

2. Instrument Non- Test Requirements

In this research, there are two kinds of instruments that is not form of test in order to get qualitative data. Rubric of creativity and questionnaire are instrument that used to measure the students' creativity and students' impression in learning ecosystem. Dioramas are assessed into some criteria which are available in the rubric of Creative Product Analysis Matrix. The rubric was fulfilled by observer to measure students' creativity based on their dioramas project. The rubric contain the statement of creativity from expert and the observer was fill it by give a checklist if there is sub indicators that appears in students' creative product.

Questionnaire was used to know the students' impression toward the implementation of dioramas and flannel board in learning ecosystem during the lesson. This questionnaire contain the statement that include of learning process using dioramas and flannel board to improve their creativity and understanding the concept of material. This data was obtained in the end of the lesson.

I. Data Processing

In the research, there are different data which are obtained from both quantitative and qualitative data. For the quantitative data is obtained from pre test and post test to measure students' understanding in learning ecosystem. Meanwhile, qualitative data was obtained from rubric of Creative Product Analysis Matrix (CPAM) and questionnaire of students' impression. Based on that, the research use data processing technique that done as follows:

1. Quantitative Data Processing

The quantitative data is done by using Microsoft Excel calculation to determine the result and score of pre test and post test. The value of quantitative data is gained by the result of N-Gain (Normalized Gain). In the process of calculating data is explained as follows:

a. Score of Item Test

In this research, score of item test used to measure the improvement of students' understanding. This test is objective test in the form of multiple choice consists of 25 item tests. Each multiple choice is given score 1 (one) if the correct answer and 0 (zero) if the incorrect answer.

b. Calculation of Gain Score and Normalized Gain

The next step after obtain the score of item test, the researcher was calculating the gain. Gain is calculated to determine differences between pre test and post test score so that, the improvement of learning process can be seen clearly and the effect of treatment will be seen. Then, Normalized Gain (N-Gain) can be obtained to determine the categories of students' achievement improvement.

For the calculating thae data, the researcher using the formula by Hake (1999), According Hake (1999), Gain can be obtained by this formula as follows:

$$G = S_f - S_i$$

(Hake, 1999)

Note:

G = Gain Score

S_f = Post Test Score

S_i = Pre Test Score

The result of Normalized Gain (N-Gain) show that the effectiveness of dioramas implementation in increasing students' understanding in learning ecosystem. Normalized Gain (N-Gain) can be shown the improvement of higher achiever and lower achiever clearly. The formula to calculate the N-Gain as follows

$$\langle g \rangle = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

(Hake, 1999)

Note:

$\langle g \rangle$ = Normalized Gain

S_{post} = Post Test Score

S_{pre} = Pre Test Score

S_{max} = Maximum Score

After that, the value of Normalized Gain (N-Gain) is determined based on categories below:

Table 3.10 Categories of Normalized Gain Value

Value $\langle g \rangle$	Category
$\langle g \rangle \geq 0,7$	High
$0,7 > \langle g \rangle \geq 0,3$	Medium
$\langle g \rangle < 0,3$	Low

(Hake, 1999)

c. Normality Test

This test using parametric test statistic that deal with assumption that each of analyzed variable is normal distribution. If, the data is abnormal so that homogeneity variant test can not be done or it can not use the parametric test. Meanwhile if the data is normal and homogenous, the parametric technique can be used. This research using SPSS 22, Kolmogorov-Smirnov with significance level 0,05, hence H_0 is accepted and if significance value more than 0,05, then h_0 is rejected or denied. Normality test aims to know the sample which comes from population has normal distribution or not. For analyzed the data, this research must be arrange the hypotheses to be tested. The hypotheses are:

H_0 : The sample comes from population that has normal distribution

H_1 : The sample comes from population that has not normal distribution

d. Homogeneity Test

This test used to determine a sample from population that is originated from two classes that homogenous. In this research uses statistics from SPSS 22, with significance level (α) is 0,05. When

significance value $\geq 0,05$, the data is considered as homogenous (Sudjana, 2005).

There is qualification to determine homogeneity variance so the difference of both means can be tested by using T test, but if the data shown non homogeny variances, so that the difference of two means can be test by using T-test.

e. Independent T-Test and Mann-Whitney Test

Independent T-Test is one of method to measured hypothesis which is used independent data. It was done to analysis the data whether both experiment and control have same of mean or not after the implementation of dioramas and flannel board. This test is represented by the result of pre test and post test result in form of score both of experiment and control class. T-test requires data which is normal and homogenous. In this research use SPSS 22, the test used Independent T-Test. According to Sudjana (2005), if the level of significance (sig) $\leq 0,05$ H_0 is rejected. If the level of significance (sig) $> 0,05$ H_0 is retained.

Mann-Whitney test is non-parametric analysis test that used when the data shown that one or all the data was not distributed normally. So that, if level of significance (Assymp. Sig) $> 0,05$ H_1 is retained.

So, this research arrange the hypothesis of average differences pre test result in experimental and control class as follows:

H_0 : There is no difference of students' understanding in learning ecosystem between using dioramas and flannel board.

H_1 : There is difference of students' understanding in learning ecosystem between using dioramas and flannel board.

f. Correlation between Students' Creativity and Understanding

Correlation analysis in this research was performed to find the value of r or it is called as correlation coefficient. According to Tanner (2012) stated that correlation can be define as the strength of relationship between two variables, in this case are students' creativity

and understanding. For processing the value of correlation used Microsoft Excel. The analysis of correlation can be interpreted in some categories by Tanner (2012) as follows:

Table 3.11 Interpretation of Correlation Coefficient

Correlation Coefficient	Interpretation
0,00 - 0,30	Weak
0,31 - 0,70	Moderate
0,71 - 1,00	Strong

(Tanner, 2012)

2. Qualitative Data Processing

In this research, to calculate the qualitative data using rubric of Creative Product Analysis Matrix (CPAM) to measure the students' creativity and questionnaire to measure the students' impression of dioramas in learning ecosystem. The analysis of rubris is conducted by converting the raw score into form of percentage. To convert the raw score into percentage, the technique of this used the formula as follows:

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

(Arikunto, 2010)

Note:

P : Percentage

R : Raw Score

MS : Maximum Score

Based on the result of the calculation above, so that the percentage of students' creativity can be interpreted and categorized into certain criteria according to Arikunto (2013) as shown in the following Table 3.12:

Table 3.12 Interpretation of Percentage

Percentage (%)	Criteria
80 - 100 %	Very Good
66 - 79 %	Good
56 - 65 %	Enough
40 - 55 %	Lack
<40 %	Very Lack/Failed

(Arikunto, 2013)

Meanwhile questionnaire can be analyzed qualitatively based on the students' answer the questionnaire sheet. The analysis of questionnaire describes the real situation of the research result and also the students respond in learning ecosystem by creating dioramas and flannel board project.

The data processing is done used calculating Likert scale. It is consist of statement about the students' impression in learning process relation with creating dioramas and flannel board project and also the effectiveness of dioramas for learning ecosystem. Each of statement is given five answer choices, those are strongly disagree, disagree, netral, agree, and stongly agree. The result is calculated into score and then converted into percentage. Each of answers have a scale is 1 – 5. The scoring guideline is shown in Table 3.13 as follows:

Table 3.13 Scoring Guideline of Students' Response

	<i>Strongly Agree</i>	<i>Agree</i>	<i>Netral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
<i>Statement</i>	5	4	3	2	1

The students' respond toward project based learning implementation can be determined by percentage of each likert scale in each of indicator that determines through statements in questionnaire. To get the percentage data is gained by calculating use formula in the following:

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

(Sudjana, 2005)

Note:

P : Percentage (%)

f : Score from Frequency of Answer

n : Score from Total Response