

## CHAPTER III

### RESEARCH METHODOLOGY

#### A. Research Method and Research Design

##### 1. Research Method

The research method used in this research was a quasi experiments. Creswell (2012) stated that quasi experiment includes the assignments, but not random assignment of participants to group because the experimenter cannot artificially create groups for the experiment. This method is appropriate with the purpose of the research which investigate the comparison between pre and post role play towards students understanding in a learning solar system.

##### 2. Research Design

The design that was used in this research is pre-test and post-test design (Creswell, 2012). The researcher assigns intact groups the pre role play and post role play treatments, administers a pre-test to both groups, conducts pre role play activities for first class (A) and conduct post role play for the second class (B), and then administer a post-test to assess the differences between the two classes.

**Table 3.1 Pre-test and Post-test Design**

Experiment class 1	Pre-test	Role Play	Mid-test	Virtual Lab	Post-test
Experiment class 2	Pre-test	Virtual Lab	Mid-test	Role Play	Post-test

*(Creswell, 2012)*

### 3. Population and Sample

The location of this research was International Junior High School “X” in Bandung. The population of this research was all 8<sup>th</sup> grade students at International Junior High School “X” in Bandung. The samples were 8<sup>th</sup> grade students from two different classes in International Junior High School “X” in Bandung. The sampling technique was Cluster Random Sampling. Fraenkel and Wallen (2007) stated that simple random sampling is one in which each and every member of the population has an equal and independent chance of being selected.

## B. Research Instrument

In this research, instrument is necessary to be used for gaining data. There are three types of instrument that was used in this research which are objective test, rubric, and questionnaire. Those instrument are describe below.

### 1. Objective test

Objective test is conducted to describe cognitive ability of students in mastering the concept. Objective test consist of two sections that is pre-test, and post-test. Pre-test was given to students before teacher conduct the instruction in classroom, while post-test was given to students after teacher conduct the instruction. Pre-test is intended to know students prior knowledge about the concept of solar system. Post-test is conducting to know students’ cognitive is gained after teacher conducting instruction or not.

Multiple choice question consist of cognitive domain C2 which is about students’ comprehension including summarize, convert, defend, paraphrase, interpret, give examples, classify, infer, compare, explain, paraphrase, and discuss (Anderson et al., 2001). Cognitive paper test firstly consist of fifteen questions before passing judgment by experts. It is used to look students’ comprehension. After judged by the expert the objective is only ten questions as a representative for each learning indicators. Then, test was distribute to students in grade 8 as a limited

test. The blueprint of instrument before passing instrument analysis step is describe in Table 3.2 below.

**Table 3.2. Blueprint of Objective Test Question**

No	Sub Topic	Indicator	Comprehension domain
1	Moon Eclipse	Describe movement of the moon towards the sun	Classifying / Conceptual
2	Earth Revolution	Describe the earth revolution	Exemplifying / Conceptual
3	Heliocentric and Geocentric	Explain the component of the solar system	Comparing / Conceptual
4	Diurnal Motion of the Sun	Describe various impacts of earth rotation and revolution	Explaining / Conceptual
5	Solar Eclipse	Describe the earth movement towards the sun	Classifying / Conceptual
6	Earth Rotation	Explain the earth rotation phenomena	Explaining / Factual
7	Time measurement, time zone and International Date Line	Describe various impacts of earth rotation and revolution	Interpreting / Factual
8	Time measurement,	Describe various impacts of earth	Paraphrasing / Factual

No	Sub Topic	Indicator	Comprehension domain
	time zone and International Date Line	rotation and revolution	
9	Earth Rotation and Revolution	Mention the impacts of earth rotation and revolution	Classifying / Factual
10	Change of season	Describe various impacts of earth rotation and revolution	Clarifying / Factual

The next step after conducting limited test to X grade students is analyzing this objective test using ANATES to measure the validity, reliability, difficulty level, discriminating power and distractor. The explanation of each aspect will explain bellow.

#### **a. Validity**

According to Fraenkel (2011) 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. 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 stated by Pearson, which is usually called as correlation formula, as follows:

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

(Fraenkel, 2011)

Where:

- r = correlation coefficient between x and y variable
- N = amount of student
- X = total score in test item
- Y = total score of student

#### b. Reliability

Kaplan and Saccuzzo (2012) stated that Reliability is one of the basic foundations of behavioral research. If a test is not reliable, then one cannot demonstrate that it has any meaning.

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

(Kaplan and Saccuzzo, 2012)

Where

- KR<sub>20</sub> = the reliability estimate (r)
- N = the number of items on the test
- S<sup>2</sup> = the variance of the total test score
- p = the proportion of the people getting each item correct (this is found separately for each item)
- q = the proportion of people getting each item incorrect. For each item, q equals 1 – p.

$\sum pq$  = sum of the products of p times q for each item on the test

### c. Difficulty level

Crocker, and Algina (2006) stated that when an item is dichotomously scored, the mean item score corresponds to the proportion of examinees who answer the item correctly. This proportion for item is usually denoted as  $P_i$  and is called the item difficulty.

$$\mu_p$$

(Crocker and Algina, 2006)

### d. Discriminating power

According Boopahiraj and Chellamani (2013), 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 had low test scores got the item incorrect.

Discrimination power estimated using the following formula:

$$\text{Discrimination power} = \frac{(R_u - R_l)}{(N_u \text{ (or) } N_l)}$$

(Boopahiraj and Chellamani, 2013)

Where:

Ru	= The number students in the upper group who responded correctly
Rl	= The number students in the lower group who responded correctly
Nu	= Number of students in the upper group
Nl	= Number of students in the lower group

#### 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.

## 2. Observation sheet

Observation sheets has been created so that teaching staff can take the opportunity to observe and reflect on the particular positive teaching and behavior management strategies employed. A range of different observation sheets are provided, so that teachers can choose the ones most appropriate to their observations focus (Coram Life Education, 2014).

In this research the observation sheet is based on Craciun (2010) to evaluate the students' performance and to differentiate from sessions pre and post role-playing activities, there are 8 aspects that observed used a scale from 1(lowest) to 5(highest). Those aspect are expected can cover all of the aspect in the learning activity using role play as a methodology, the observation sheet will describe in Table 3.3 below.

**Table 3.3. Observation Sheet**

No	Aspect	Score					Comment
		1	2	3	4	5	
1.	Active Presence						
2.	Cooperative group work						
3.	Creative performance						
4.	Scientific knowledge						
5.	Students confidence						
6.	Students communication skills						
7.	Students responsibility						
8.	Students leadership skills						

(Craciun, 2010)

### 3. Questionnaire

Questionnaire is an instrument which is distribute to the students the purpose is for investigate and describe students' perspective of role play as a learning method. Students are asked to assess their learning in terms of course content, teaching or research skills and technology use. They reflect on the course learning objectives as well as the advantages or limitations of the teaching method.

From the perspective of the future teacher, it is analyzed how these experiences can be used in teaching and how it can make teachers aware of the way students emotional learn, to what degree students are conscious of their own learning activity and how students evaluate their own understanding of the learned material. The evaluation was done by letting the students complete an anonymous questionnaire at the end of the period in which the method was applied (Curciun, 2010). The ten questions are presented in Table 3.4.



**Table 3.4. The anonymous questionnaire fulfilled by students**

No.	Question
1.	Did you like creative role playing activities? Why?
2.	Do you prefer science learning and teaching with or without role playing?
3.	What role playing activities did you like the most? The least?
4.	Do you like science learning and teaching more after these activities?
5.	Did you adopt some of the role playing techniques in your future teaching activities?
6.	Do you spend more time to design a role playing scenario?
7.	Do you need to have more knowledge about the temper, learning style and intellectual level of the students to engage them in the class scenario?
8.	Do you consider that these activities are easier or harder to control?
9.	Do you consider that these activities are generally valuable or must be adapted to the audience?
10	Other comments

(Craciun, 2010)

### C. Research Procedure

In order to have a good sequence systematically in this research, the research procedure is arranged in three stages that should be done. Those three stages are preparation stage, implementation stage, and completion stage.

#### 1. Preparation Stage

Preparation stage in this research include:

- a. Conducting study on characteristic of school, students, teacher, and teaching method which will be the part of the research

letter. This is a very initial step to look for the problem and gain the idea which will be taken for the research.

- b. Conducting literature study. It could be taken from various resources such as book, journal, article, and etc.
- c. Defining and analyzing a topic for research including variable.
- d. Defining population and sample which will be used in the research.
- e. Contacting the school and science teacher to ask the permission letter for taking data and doing research at that school.
- f. Constructing the instrument
- g. Judging all instrument such as objective test, questionnaire, and observation sheet to the expert.
- h. Revising the instrument based on expert suggestion.
- i. Conducting limit test to 9 grade students.
- j. Analyzing the result of limit test by ANATES.
- k. Revising the instrument become a valid instrument which will be used in the data taking process.

## **2. Implementation Stage**

Implementation stage in this research include,

- a. Conducting research by giving pre-test to both experiment class 1 and experiment class 2.
- b. Conducting instruction using pre role play class (A) and conducting post role play in class (B)
- c. Conducting post-test to both control class and experimental class.
- d. Distributing questionnaire of classroom learning environment to the students.
- e. Research data is finally taken.

## **3. Completion Stage**

Completion stage in this research include,

- a. Analyzing research result such as objective test, observation sheet and questionnaire result.
- b. Discussing the research result based on related theoretical foundation.
- c. Consulting the research result with the lecture regarding to the finishing of this research paper.
- d. Drawing conclusion of research based on the research result, discussion, and analysis
- e. Research paper is finally constructed done.

#### **D. Data Analysis**

In this research, the first step in analysis is testing the instrument. The data was gained from 30 students of X grade in a senior high school. After the data have already been collected, ANATES was used to analysis the Validity, Reliability, Discriminating power, Difficulty Level and Distractor. The next is collecting the quantitative and qualitative data from experiment class 1 and experiment class 2, quantitative data in the form of pre-test, mid-test, and post-test. While, the qualitative data in the form of rubric of students' role play and students' impression through the questionnaire. 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 are 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

$H_0$ : There are no differences of students' understanding in learning solar system through virtual lab and role plai in different sequence

$H_1$ : There are differences of students' understanding in learning solar system through virtual lab and role plai in different sequence

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).

### 1. Qualitative Data Processing

The qualitative data is obtained from rubric of students' performance, peer and self-assessment and questioners. The analysis of rubrics is conducted the average of the teacher assessment, peer, and self-assessment.

$$Score = \frac{Teacher + peer + Self}{3}$$

According to Craciun (2010), the score results can be grouped into various categories, such as very bad performance, bad performance, enough performance, good performance, and very good performance.

**Table 3.6 Determination the Level of Students' Performance**

Score	Categories
4,1 – 5	Very good
3,1 – 4	Good
2,1 – 3	Enough
1,1 – 2	Bad
0 – 1	Very bad

(Craciun, 2010)

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 solar system by implementing role play. The data processing is done by calculating Likert scale. It consists of positive statements. Each statement is given five answer choices, those are strongly agree, agree, not sure, 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	Agree	Not Sure	Disagree	Strongly Disagree
Positive Statement	5	4	3	2	1

(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:

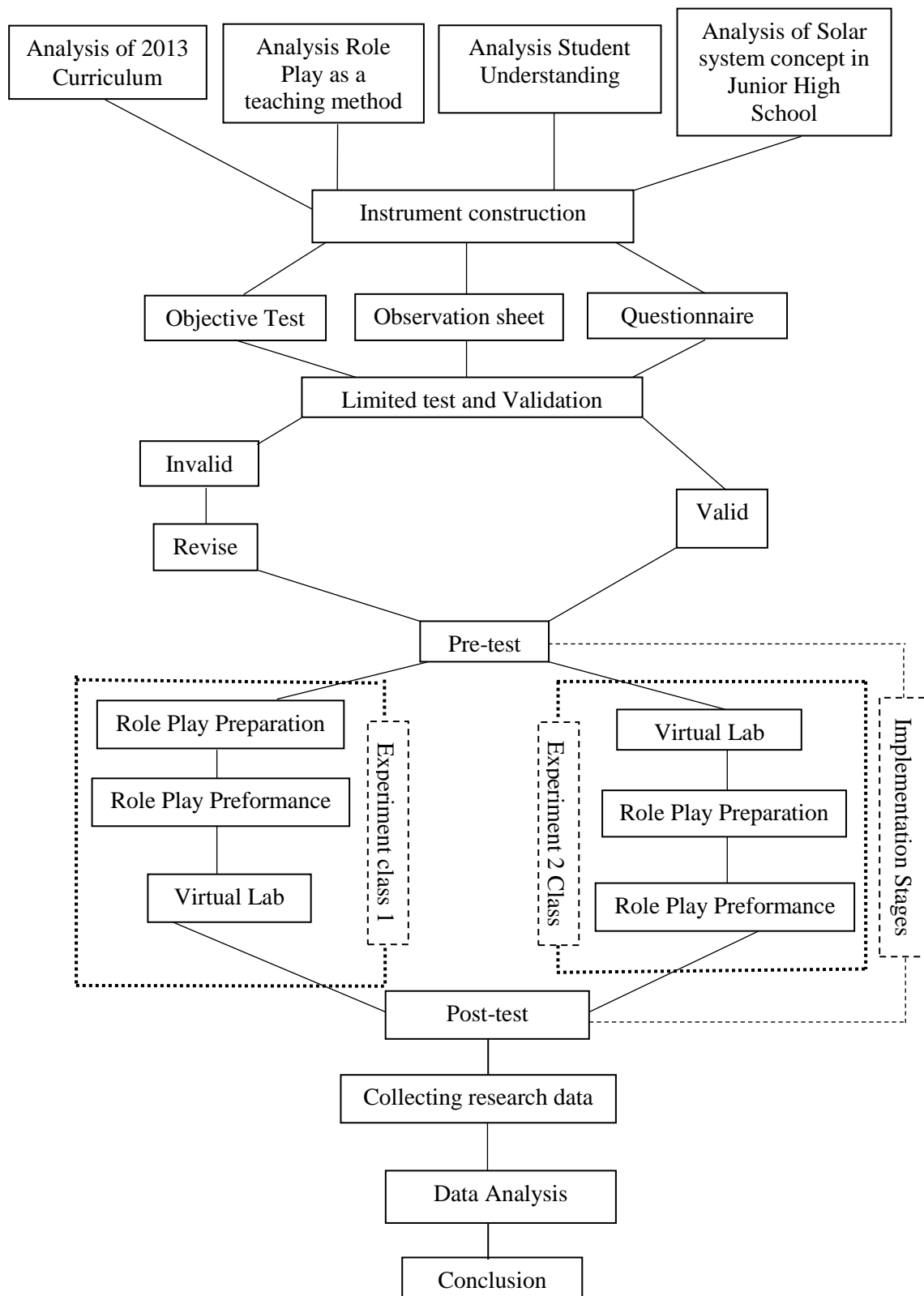
P = Percentage

f = score from frequency of the answer

n = score from total response

(Sudjana, 2005)





### **Figure 3.1 Research Scheme**