CHAPTER III

RESEARCH METHODOLOGY

A. Research Method

The research method that was used in this research is non-experimental research that using descriptive researchand also compiles descriptive correlational research, in order to make the description of students' critical thinking profile more general and clearer. From McMillan and Schumacher(2001), it means that the factual and accurate data obtained should be described systematically as representative of characteristics of specific population based on literature and the field. Descriptive correlational was added to explore the relationships that exist among variables such as students' science score and students; logical thinking. This method is appropriate with the purpose of the research which is profiling the students' critical thinking in Junior High School by using Science Virtual Test.

B. Research Subject

The location of this research was conducted in three public schools in Tasikmalaya city. Those schools were chosen because they have the same curriculum that used, that is 2013 Curriculum.

The population in this research was all 8^{th} grade students at three public schools in Tasikmlaya. The samples are 8^{th} grade students from two classes in each school.

Technique sampling that was used for this research is purposive sampling that include in non-random sampling technique. Purposive sampling was chosen because the population of this research is three junior high schools in one certain city with the same curriculum or with the same status, which is public school.

C. Operational Definition

To avoid misconception related to this research, there are some operational definitions that explained in this research. Those terminologies are described as follows:

1. Students' Critical Thinking in this research measured by the elements from Inch's, which consist of eight interrelated functions which are question at issue, purpose, information, concepts, assumptions, point of view, interpretation and inference, implications and consequences. In this research, students' critical thinking is measured by using Science Virtual Test that has been developed by Rusyati and Firman (2017). Then, the result is categorized into low, moderate and high levels based on standard deviation and mean score calculation.
2. Science Virtual Test is a set of multiple choice questions by using computer-based test. The question was made based on eight Inch's interrelated elements. Each element consists of 2 – 4 question items with high reliability and validity.
3. Students' Science Score is the result of students' latest achievement of science subject in the previous semester. The data was collected from science teachers in those research subject schools. Then, the data is categorized into low, moderate and high level based in standard deviation and mean score calculation.
4. Students' logical thinking is measured by Test of Logical Thinking (TOLT) that developed by Tobin and Capie (1981). There are five modes of formal reasoning that measured in this test, which are controlling variables, proportional reasoning, combinatorial reasoning, probabilistic reasoning, and correlational reasoning. The result is categorized into formal level, transitional level and concrete level.

D. Research Instrument

1. Science Virtual Test (multiple choice)

Science Virtual Test is kind of computer based test to measure critical thinking skill that has been developed by Firman and Rusyati (2015). This instrument contains 26 multiple choices questions provided with some features such as video, pictures, animation and etc. Those test items has been validated through several processes, including experts judgment. It is also cover eight elements of critical thinking skill by Inch (2006). The elements are generates purposes, raises questions, uses information, utilizes concepts, makes inferences, makes assumptions, generates implications and embodies a point of view.

The theme for those test items are about living things and environment for 8th grade science in Junior High School with 2013 curriculum standard. The sub-topics of this test items are structure and function of plant, reproduction system, radiation, season change, and population. A table data of test items based on topic and critical thinking elements are shown below, which follows on the Table 3.1:

Table 3.1 Test Items Based on Topic and Inch's Elements

No	Inch's element	Sub Topics				
		Plant Tissue and Structure	Radiation	Greenhouse Effect	Reproduc-tionsystem	Season change
1	Purpose	√	√		√	√
2	Question at issue		√		√	√ (2)
3	Assumption		√			√
4	Point of view	√ (2)			√	
5	Information			√ (2)	√	√
6	Concept				√ (3)	
7	Interpretation	√				√ (2)
8	Implication		√ (2)			√

This science virtual test can measure students' ciritical thinking with good consistency since a coefficient alpha was 0.747, the realibility of the test is including as 'high' and value of XY correlation was 0.63 which means the validity is including as 'high' (Akbar, 2016).

2. Test of Logical Thinking (TOLT)

Test of Logical Thinking (TOLT) is used to measure students' formal reasoning skill that hasbeen developed by Tobin and Capie (1981). TOLT has have a good validation through obtain astudy that assessed on TOLT and interview task (Tabin and Capie, 1981) and high reliability (coefficient 0.85). it is also has strong correlation 0.80 with $p < 0.0001$.

The test items consist of 10 questions. First eight numbers of TOLT was provided with multiple question and multiple reasons. Then, the last two questions were provided with short answer question that should be answered by students.

3. Students' Impression towards Science Virtual Test.

Respond scale that used for this questionnaire is likert scale. The questionnaires are given to the students in order to know the students' impression after using science virtual test. Whether the result positive or negative for the students. In likert scale, the respondents are asked to give a respond of each statement with multiple answers which are Strongly agree, Agree, Neutral, Disagree, Strongly disagree. In this research, the 'neutral' answer were omitted in order to avoid the hesitation of students' impression whether the impression is positive or negative.

E. **Data Analysis**

1. Scoring and Analyzing Students' Critical Thinking Attainment

Students' Critical Thinking Skill was measured by Science Virtual Test (SVT) which consists of eight elements from Inch. Each element consist of 2 – 4 questions with the total number of a whole test is 26 multiple questions. Since the number of questions in each element is various, so the result was converted into proper scale (to 100 as maximum).

The main data for analyzing critical thinking skill is mean and its standard deviation. Those were used to categorize three level of students' critical thinking attainment; High, Moderate and Low level. Grouping critical thinking attainment was interpreted through the table 3.2.

Table 3.2Students' Critical Thinking Grouping Formula

Interval	**Category**
$X \geq x + SD$	High
$x - SD \leq X \geq x + SD$	Moderate
$X < x - SD$	Low

Where,

X = Students' score

x = Overall students' mean score (61.81)

SD = Standard Deviation (13.67)

(Arikunto, 2013)

By measuring the standard deviation and mean score, the interval of each category is shown in Table 3.3. Based on the category, students' critical thinking can be categorized on the following levels.

Table 3.3 Students' Critical Thinking Grouping

Interval	**Category**
$X \geq 75.48$	High
$48.14 \leq X \geq 75.48$	Moderate
$X < 48.14$	Low

2. Investigating critical thinking based on science score and logical thinking skill levels

Science score and logical thinking score were divided into three category levels. For science score is high level, moderate level and low level. While for logical thinking is formal level, transitional level and concrete level.

Analysis statistics were used by SPSS version 23. The first step to do was checking the normality of the data. After that, check the homogeneity of the data.

The data of science score was not distributed normally, hence Kruskal-Walis test were conducted. For logical thinking test, the data was normally distributed. Therefore, ANOVA test were conducted. In order to describe clearly for significant differences, Post Hoc LSD were conducted to find the exactly result and its comparison.

3. Investigating correlation between critical thinking with science score and logical thinking skill levels

To find out the correlation between critical thinking with science score, and critical thinking with logical thinking skill, Pearson Correlation was conducted. The data used should distributed normal, hence the correlation only use students' critical thinking attainment overall data.

The significant coefficient is between 0 –1 or 0 – (-1). If the coefficient close to 1 or -1 then the result shows the strong correlation, while if the coefficient close to 0 then the results shows weaker in correlation.

4. Students' Impression towards Science Virtual Test.

By using likert scale, each answer has certain value. For positive statement (favorable) Strongly agree was given 5, agree means 4, disagree means 2 and strongly disagree means 1. However, the value is vice versa if the statement was negative. According to Suherman

(2003), if the data result shows the value more than 3 for each aspect, then the respondent gives a positive respond or good impression. Otherwise, if the mean of value for each aspect is less than 3, then the respondent gives negative respond or bad impression.

F. Research Procedure

These research activities are conducted from the beginning which is determining variables until construct the conclusion. The research procedures consist of three main stages. Those are preparation stage, implementation stage and completion stage.

1. Preparation Stage
    a. Determining variables of the research
    b. Proposing problems and objectives of the research
    c. Literature review about students' critical thinking, students' logical thinking, students' motivation and computer based-test
    d. Determining research instruments
    e. Determining sample and population
    f. Constructing and designing research proposal
    g. Revising research proposal
    h. Managing research administration and schools' permission
    i. Managing the schedule for gaining research data
2. Implementation Stage

The steps for collecting research data consist of 3 steps which are

    a. Profiling students' critical thinking skill
    b. Testing students' logical thinking to measure formal reasoning
    c. Giving questionnaire of students' impression after using SVT

3. Completion Stage
    a. Gathering the research data
    b. Analyzing the data
    c. Discussing the findings
    d. Constructing the result and conclusion

In order to analyze the plot of research procedure easier, figure 3.1 on the next page shows the flowchart which illustrates the framework of research.

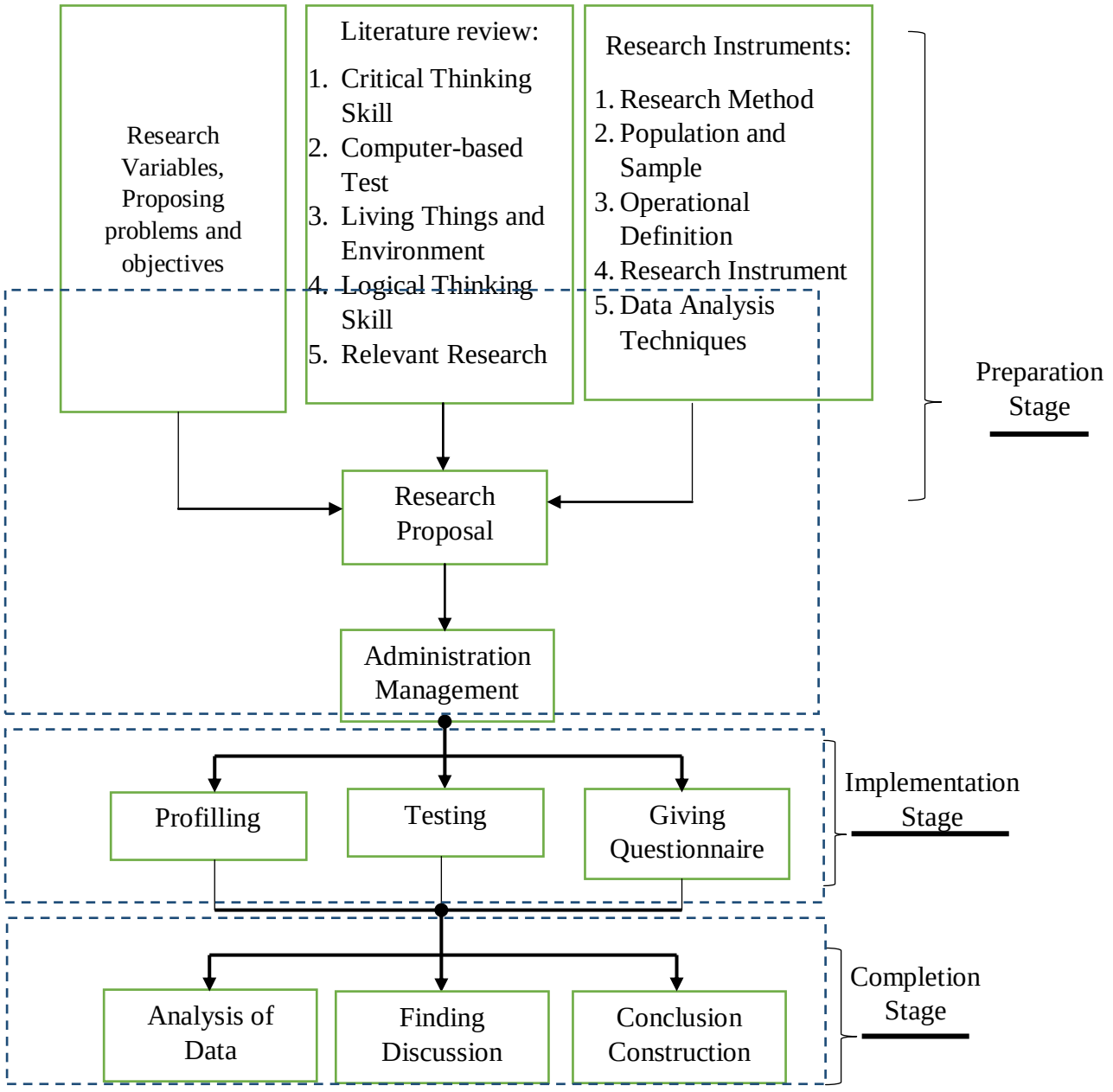

Figure 3.1 The flowchart of research procedure