

## CHAPTER III

### METHODOLOGY

#### A. Research Method and Design

##### 1. Research Method

Research methods used in this study is weak-experiment. This study aimed to obtain information are estimates the information that can be obtained by actual experiment in a state that does not allow to control or manipulate all relevant variables.

##### 2. Research Design

The research design used was a one-group pretest-posttest design. Scheme one group pretest-posttest design is shown as follows:

**Table 3.1 Table of Research Design of One Group Pretest and Posttest Design**

Group	Pretest	Treatment	Posttest
Experimental	O <sub>1</sub>	T	O <sub>2</sub>

Note:

O<sub>1</sub>: Pretest

O<sub>2</sub>: Posttest

T: Giving discovery learning treatment

The table explains that the class subject to the pretest ( $O_1$ ) to measure creative thinking skills. Then students are given treatment in the form of learning with discovery learning models. After that, student was given the posttest ( $O_2$ ) with the same instrument with the pretest. Instrument used as a pretest and posttest in this study is an instrument to measure the creative thinking skills in learning integrated science that has been tested and prior judgment.

## **B. Research Subject**

### **1. Research Location**

This research is conducted in one of Public School in Cimahi which applied National Curriculum 2006 in the teaching and learning process. The data collection was done in May 2014.

### **2. Population and sample**

The population in this research was 7<sup>th</sup> Grade Junior High School students in one of the Cimahi Public School year 2013/2014. After observation, the sample was taken one class in the seventh grade, which is VII-2.

## **C. Assumption**

Discovery learning model is a learning model that allows it to be used in efforts to improve creative thinking skills. Solso (1995:453)

describes creativity is defined as a cognitive activity that results in a new way or something in looking at a problem or situation. This result has same expectation in discovery learning, Zemelman, Daniels, and Hyde (1993) in Alfian (2011) stated that learning in all subject areas involves inventing and constructing new ideas. Both expectation results in learning are can produce new idea in thinking.

#### **D. Hypothesis**

The hypotheses in this research are two hypotheses. The explanation is like below:

- H<sub>0</sub> : Through discovery learning strategy, there is no enhancing in students' creative thinking skills in learning integrated science.
- H<sub>1</sub> : Through discovery learning strategy, students can enhance their creative thinking skills in learning integrated science.

#### **E. Research Procedures**

There are several procedures that are conducted in this research. Therefore, the procedure is generally classified into three stages which are preparation stage, implementation stage, and analysis and conclusion stage. Each of stage 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) Discovery learning, 2) Creative Thinking Skills, and 3) Integrated science.
- b) As the result of literature review, research problem is identified and elaborated into several research questions arranged. In order to answering research questions, instruments were arranged as tools to obtain data. Arrangement of instrument arrangement including: 1) Creative thinking in Making Experiment Test, 2) Creative thinking skills essay test, 3) Observation sheet, and 4) Students' questionnaire. Instructional tools which used are lesson plan and worksheet was arranged to help the implementation of Discovery learning.
- c) Judgment of instruments was conducted by experts.
- d) Trial test of creative thinking skill essay test instrument was conducted to identify the quality of instrument.
- e) The result of problem solving test 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:

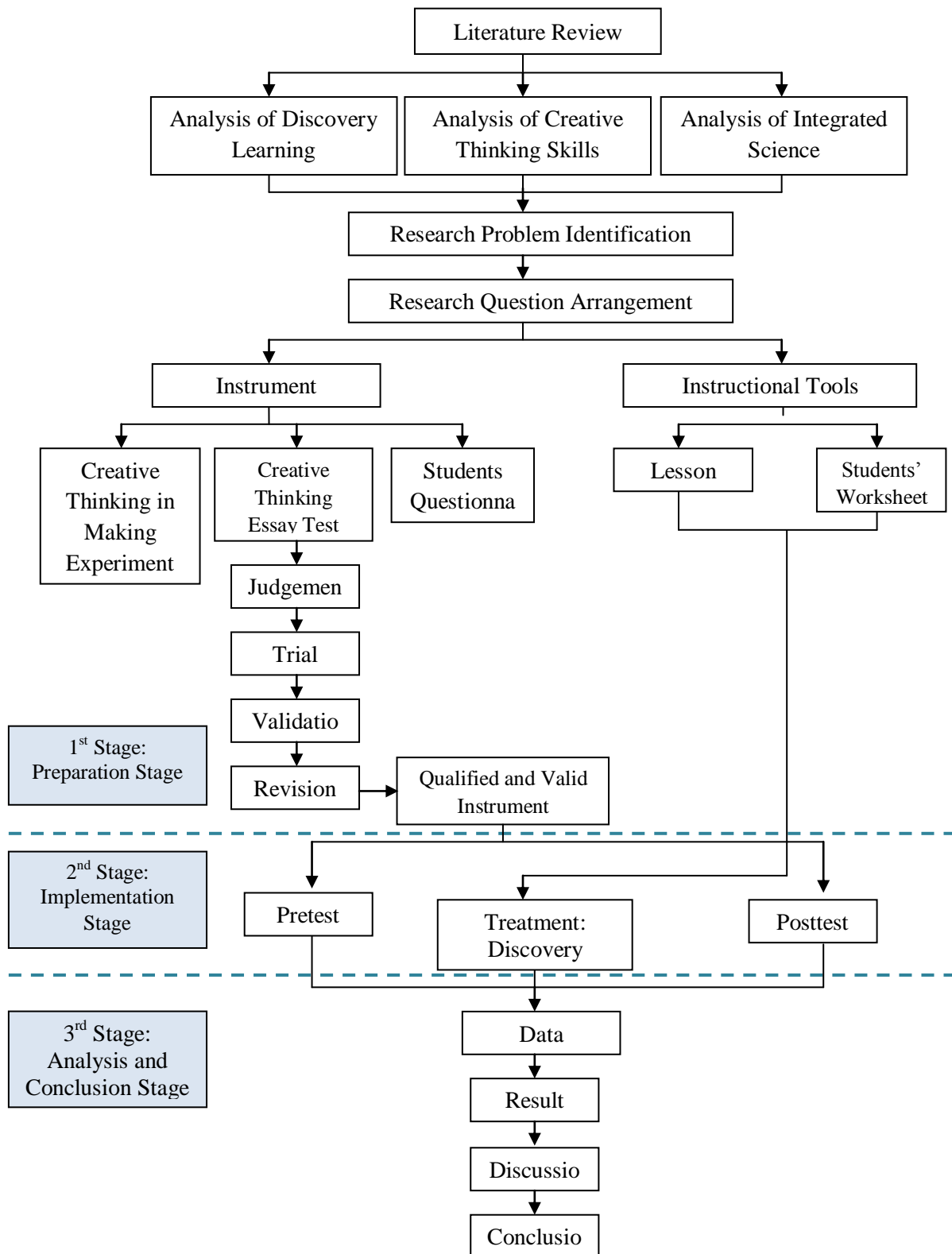
- a) Pre-test was conducted to identify students' preliminary skills
- b) Treatment was conducted in four meetings as follow:
  - 1<sup>st</sup> meeting: Discussion about the topic
  - 2<sup>nd</sup> meeting: Experimental designing
  - 3<sup>rd</sup> meeting: Doing the experiment
  - 4<sup>th</sup> meeting: Presentation, and developing problem
- c) Post-test was conducted

## 3. Analysis and Conclusion Stage

Analysis and conclusion stages consist of four stages, as follows:

- a) All of data which is obtained was calculated
- b) The result of data calculation was analyzed
- c) Discussion was done to elaborate the result of analysis
- d) 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 that is used in the implementation of this research as follows:

### **1. Lesson Plan**

Lesson plan is the design of instructional arrangement that will be used in the class implementation. The arrangement of lesson plan refers to the syntax of Discovery Learning which is proposed by Castronova (2002) in Balim (2009). There are mainly three syntaxes that should be conducted in the implementation of Discovery learning in the class activity which are Discussion, Process, and Developing Problem. However, the implementation of problem based experiments in this research is arranged divided into four meetings.

### **2. Students' Worksheet**

Students' Worksheet is the additional tools that helps the implementation of lesson plan in real activity. Students' worksheet is used as students' guidance during experiments. The module consists of the question and problem that should be solved by students.

Students worksheet consist of both group and individual worksheets which respectively arranged based on syntax of discovery learning and the scope of learning objective in energy concept.

## **G. Research Instruments**

The instrument that is used in this research is test and non-test. Because this research wants to observe the students' creative thinking skills then the test item that be used in essay test.

### **1. Creative Thinking Skills Tests**

Creative thinking is the ability to find some new links, in looking at the subject from a new perspective and create new combinations from several ideas, products, colors, textures, and other things.

Essay tests have been given are pre and posttest individually. The pretest has been given before the treatment and the posttest has been given after the treatment.

There will be such indicators in observation sheet to measure students' creative thinking skills such as Fluently, Flexibility, Originality, and Elaboration. Energy in integrated way is a topic to be raised during designing experiment and having essay test.

In general, the rubric of creative thinking of essay test regarding to the aspect and its behavior is described in the table below:



**Table 3.2 Blueprint of Creative Thinking Test Rubric Scoring**

No.	Creative thinking Indicator	Answer Criteria	Score
1, 2, 3, 4, 5	Fluency	Students cannot determine the solutions	0
		Students can determine 1 solution from solution wants	1
		Students can determine 2 solutions from solutions wants	2
		Students can determine more than 2 solutions from solutions wants	3
	Flexibility	Students cannot giving solution with varied explanation	0
		Students can giving solution with varied explanation but not from the information available	1
		Students can giving solution with varied explanation from the information available but do not applying concept in different way	2
		Students can giving solution with varied explanation from the information available and applying concept in different way	3
	Originality	Students do not giving solution in a new, unique, and unusual	0
		Students can give 1 solution in new, unique and unusual	1
		Students can give 2 solutions in new, unique and unusual	2
		Students can give >2 solutions in new, unique and unusual	3
	Elaboration	Students cannot make an alternative idea	0
		Students can enrich and develop the idea of solution with briefly explanation	1
		Students can enrich and elaborate solution in details of an object, idea, or situation but not attractive	2
		Students can enrich and elaborate solution in details of an object, idea, or situation becomes more attractive	3

## 2. Observation Rubric

The analysis of teacher and students' activity is conducted to identify the quality of implementation which is observed from teacher's activity coherence with the procedure of Discovery learning treatment which has been arranged before. In obtaining data, observation rubrics of students and teacher activity were arranged. The arrangement of observation rubrics is in line with procedure of discovery learning and teaching and learning activities arranged in lesson plan. Observation rubric 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 of discovery learning or not.

## H. Instrument Development

Before giving treatment to the experiment class, another class is used as the trial class to test the instrument should be done first, and then it has to be analyzed. According to Suherman (2003), it is explained that qualified instrument of evaluation requires some criteria. These criteria are to measure the quality of test item and to identified by concerning the following criteria, such as: validity, reliability, objectivity, practicability, difficulty index, discrimination power, option effectivity, and

efficiency. As the form of instrument used is in essay form, thus the calculation is only done to identify validity, reliability, difficulty index, and readability. The more explanation explained below:

1. Validity is the ability of an instrument to measure what is measured. According to Sudjana (2009) in Nugroho (2013), validity test which is used in this research is content validity, which is related to the ability of assessment tool to measure what should be measured. To measure the validity of each test items are using this formula:

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

(Sudjana, 2005; in Nugroho, 2013)

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

n : amount of student

x : total score in test item

y : total score of student

While the interpretation about  $r_{xy}$  will be categorize based on Guilford (Arikunto, 2009).

**Table 3.3 Classification Validity Coefficient**

Value $r_{xy}$	Interpretation
$0,90 \leq r_{xy} \leq 1,00$	Very high validity
$0,70 \leq r_{xy} < 0,90$	High validity
$0,40 \leq r_{xy} < 0,70$	Medium validity
$0,20 \leq r_{xy} < 0,40$	Low validity
$0,00 \leq r_{xy} < 0,20$	Very low validity
$r_{xy} < 0,00$	Invalid

(Arikunto, 2009)

In this research, because the instrument is using essay test, it should be validated by the expert. After judged by the expert, trial test to measure realibility, difficulty index, and discriminating power can be conducted.

## 2. Reliability test

Reliability is the degree of consistency and stability of the instrument. Thus, the concept of reliability has the meaning where the research tools is consistence and stable, and hence predictable and accurate. KR 20 equation is used to calculate reliability of the test and the equation is (Arikunto, 2009):

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum pq}{s^2}\right)$$

(Arikunto, 2009)

$r_{11}$  : Instrument reliability

$k$  : Amount of test item

$\sum pq$  : Multiplication result of  $p$  and  $q$

$s$  : Deviation standard

While the interpretation about  $r_{xy}$  will be categorized based on Guilford (Arikunto, 2009) as follow:

**Table 3.4 Reliability Value of Question**

Reliability coefficient	Criteria
$0.00 < x \leq 0.20$	Very low
$0.20 < x \leq 0.40$	Low
$0.40 < x \leq 0.60$	Satisfactory
$0.60 < x \leq 0.80$	High
$0.80 < x \leq 1.00$	Very high

(Arikunto, 2009)

### 3. Difficulty Level

A good test item is neither too easy nor too difficult. A scale that shows the difficulty level of test item is difficulty index (Arikunto, 2009). The equation which is used to calculate the difficulty level is:

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

(Arikunto, 2009)

$P$  : Difficulty index

B : Amount of student who answer question with the right answer

JS: Total amount of students who undertakes the test

**Table 3.5 Criteria of Difficulty Level**

<b>P Value</b>	<b>Category of test</b>
$P > 0.7$	Very Easy
$0.3 \geq P \geq 0.7$	Medium
$P < 0.3$	Difficult

(Arikunto, 2009)

#### 4. Discriminating power

Discriminating power of test item is the ability of test item to differentiate between high achiever and low achiever (Arikunto, 2009). To determine discriminating power of test item, the equation below is used:

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

(Arikunto, 2009)

D : Discriminating power

JA : Amount of high achiever

JB : Amount of low achiever

BA : Amount of high achiever who answers question with the right answer

BB : Amount of low achiever who answers question with the right answer

$P_A$  : Proportion of high achiever who answers question with the right answer

$P_B$  : Proportion of low achiever who answers question with the right answer

**Table 3.6 Criteria of Test Item Discriminating Power**

<b>Discriminating power interval</b>	<b>Criteria of discriminating power</b>
Negative	Test item is not appropriate
$0.00 < x \leq 0.20$	Poor
$0.21 < x \leq 0.40$	Satisfactory
$0.41 < x \leq 0.70$	Good
$0.71 < x \leq 1.00$	Excellent

(Arikunto, 2009)

In identifying the quality of problem solving test, instrument a trial was conducted by applying the test into 32 samples 7<sup>th</sup> grade of students which already learnt about energy topics. The calculation of item test analysis was helped by using software Anates 4.0. In summary, the result of creative thinking analysis test is presented in the following table below:

**Table 3.7 Recap Data of Instrument Analysis Result**

Item test	Discrimination power		Difficulty Index		Validity		Conclusion
	Value	Category	Value	Category	Value	Category	
1	0.15	Poor	63.43	Medium	0.59	Significant	Revised
2	0.17	Poor	38.43	Medium	0.66	Significant	Revised
3	0.2	Poor	30.56	Easy	0.61	Significant	Revised
4	0.2	Poor	33.33	Medium	0.61	Significant	Revised
5	0.12	Poor	23.15	Difficult	0.56	Not significant	Revised

## I. Data Analysis

### 1) Item Test Data Instrument Analysis

Before the instrument is used in a class about the research sample, at first the researcher has to test the instrument. The aim is to determine the accuracy and feasibility of the instrument in measuring the variables studied.

### 2) Creative Thinking Data Instrument Analysis

Here are the steps to process the instrument to measure students' creative thinking according to Nurmaulana (2010):

- a) Counting the number of correct scores each item on which students have been gotten.



- b) Convert the raw scores obtained by students in the form of a percentage. The following formula is used:

$$NP = \frac{R}{S_m} \times 100\%$$

(Purwanto, 2006: 102; in Nurmaulan, 2010)

Description:

NP: percentage of the expected value

R: crude score gained students

S<sub>m</sub>: ideal maximum score of the test in question

- c) To view the categories used creative thinking ability according Arikunto category (2007). The ability to scale categories can be seen in the following table 3.7:

**Table 3.8 Creative Thinking Skills Category**

Category	Score (%)
Very good	81-100
Good	61-80
Enough	41-60
Deficient	21-40
Very deficient	0-20

(Arikunto, 2007; in Nurmaulana, 2010)

### 3) Improvement test

To know the improvement of the pre-test and post-test result, the determination of normalized gain index was conducted.

Normalized gain or g-factor has been widely used in assessing

students' performance in pre-test and post-test (Saraswati, 2013).

The formula used in measuring the normalized gain such as follow:

$$G = \frac{\text{posttest score} - \text{pretest score}}{\text{Maximum score} - \text{pretest score}}$$

(Saraswati, 2013)

Hake (1998) in Saraswati (2013) argues that normalized gain is divided into several categories; high, medium, and low. For more detail, the table of categories is explained below:

**Table 3.9 The Students' improvement Category**

Normalized gain	Category
< 0.3	Low
0.3 < x < 0.7	Medium
> 0.7	High

(Saraswati, 2013)