CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Method and Research Design

3.1.1 Research Method

The research method that was used in this research was pre-experiment. Pre-experiment a type of research that uses single subject to determine causal relationship between the independent variable and dependent variable without any extraneous variable (Marczyk, DeMatteon & Festinger, 2010). Extraneous variable is a variable that affect the outcome of the research (Cresswell, 2012). This method is appropriate with the purpose of this research that investigates the effect of Video embedded with Guided Inquiry Laboratory Activity with video embedded on students' understanding and motivation in learning light and optics. It can determine the change of independent variable but not due to extraneous factors (Marczyk, DeMatteon& Festinger, 2010). The pre-experimental method may able to approach the true experimental method (Cohen, Manion & Morrison, 2007).

3.1.2 Research Design

The research design that was used in this research was one group pre-test and post-test, which means that the researcher only takes an experimental group to measures the groups' dependent variable (O1), that usually called as a pre-test. The pre-test was given to the subject using an instrument in form of multiple choices. The next step was giving an experimental manipulation (X), by learning with Video embedded with Guided Inquiry Laboratory Activity, before conducting post-test. Moreover, step is giving an experimental manipulation (X), by learning with Video embedded with Guided Inquiry Laboratory activity before conducting post test (O2). The research design is shown in table 3.1 as follows:

Table 3.1

Research Design of One Group Pre-test and Post-test

Pre-test	Treatment	Post-test
O1	X	O2

(Cohen, Manion, & Morrison, 2007)

Where:

O1 = Pre-test

X = Treatment of Guided Inquiry Laboratory Activity with Video embedded

O2 = Post-test

3.2 Research and Sample

The research was taken in private Junior High School in Bandung. The school uses Bahasa Indonesia in their learning activity of Science. The curriculum of the Junior High School is National Curriculum of 2013.

The population in this research was 8th grade students' of the public Junior High school in Bandung. The samples were 8th grade students from one class consist of 20 students. Consist of 12 male and 8 female with the age around 14 years old. The sampling technique that was used was convenience sampling, which is a selection of the subjects that selected by the willingness of the researcher and its available to be studied (Cohen, Manion, & Morrison, 2007).

3.5 Assumption

The assumptions that are used in this study as the foundation are:

1) Video in this research is a media that is not something new in educational process. Video, combination of images and sound, create a powerful medium for explanation of concepts while instructing learners with content that provides multiple senses (Vural, 2013).
2) Laboratory activity is very important in learning science. The purpose of laboratory work is to developing understanding related to the scientific content, problem-solving skill, science processes skills and understanding

the nature of science (Katsampoxaki-Hodgetts, 2015). In guided inquiry laboratory activity, student search for an experiment by the given problem. Commonly Guided Inquiry experiments are based on a discovery,the procedure is predetermined while the outcome is not specified (Gaddis & Schofffstal, 2007).

3.6 Hypothesis

The hypothesis that is tested in this research are as follow:

H0 : There is no significant difference between students' understanding before and after the implement of Guided Inquiry Laboratory with Video Embedded

H1 : There is a significant difference between students' understanding before and after the implement of Guided Inquiry Laboratory with Video Embedded

3.5 Validation of Research Instrument using Ana Test

In order to validate the instrument before conducting pretest and posttest, the researcher checked the reliability, validity, discriminating power, and difficulty level using Ana Test Program. From 30 samples in 9th grade Junior High School in Bandung. The recapitulation of Validation checked by ANATES Program shows on Table 3.8

Table 3.8
Recapitulation of Test Item for Students' Concept Mastery

Question Number	Discriminating Power	Difficulty Level	Correlation (Validity)	Decision
1	12.50	16.6	0.275	Revised
2	12.50	96.67	0.131	Revised
3	12.50	86.67	0.147	Revised
4	37.50	63.33	0.322	Revised
5	25.00	46.67	0.106	Revised
6	0.00	40.00	-0.006	Rejected
7	12.50	6.67	0.106	Revised
8	25.00	10.00	0.449	Accepted
9	50.00	50.00	0.440	Accepted
10	12.50	30.00	0.019	Revised
11	-12.50	20.00	-0.132	Rejected
12	12.50	40.00	0.084	Revised

Question Number	Discriminating Power	Difficulty Level	Correlation (Validity)	Decision
13	62.50	30.00	0.467	Accepted
14	37.50	20.00	0.198	Revised
15	37.50	33.33	0.280	Revised
16	25.00	66.67	0.342	Revised
17	62.50	60.00	0.574	Accepted
18	-25.00	26.67	-0.093	Rejected
19	12.50	36.67	0.164	Revised
20	0.00	6.67	0.165	Revised
21	0.00	0.00	Nan	Rejected
22	25.00	33.33	0.218	Revised
23	0.00	33.33	0.093	Revised
24	50.00	33.33	0.342	Revised
25	62.50	53.33	0.394	Accepted
26	12.50	20.00	0.161	Revised

3.7 Research instrument

Research instrument is a tool to measure, observe, or collect data quantitatively (Cresswell,2012).The research instrument that was used in this research consisted of two types, which are shown in Table 3.2 as follow

Table 3.2

Research Instrument

Data Needed	Instrument
Test to measure students' understanding	Objective test
Students' Motivation	Questionnaire of students' motivation

3.7.1 Objective Test

Objective test was developed to measure students' understanding in Light and Optics. This test was given to the students in pre-test that was before any implementation of Guided Inquiry Laboratory with Video Embedded , and post-test that was after the treatment given the students. The purpose of post-test was given to measure students' understanding after the treatment.

The type of question that was given in the pre-test and post-test are multiple choice, contained 25 questions. All test items were judged by the experts and tested to the students' that have learned about light and optics, then after that the students' answer was analyzed using a statistical software, namely ANATES. The result of ANATES was to analyze the eligibility of the questions. The analysis of objective test also conducted to determine the reliability, discriminant power, and the difficulty of the test.

3.7.1.1 Validity of TheTest

Validity is the degree to which the test scores are seen as relevant to proposed purpose (Creswell, 2012). The test can be determined by this formula:

$$R^2 = \frac{(\Sigma XY - n\bar{X}\bar{Y})}{(\Sigma X^2 - n\bar{X}^2)(\Sigma Y^2 - n\bar{Y}^2)}$$

Where

R : items correlation coefficient

X : items score

N : the amount of subject

(Source: Ott and Longnecker, 2010)

The interpretation of validity of the items shown in Table 3.3 as follows:

Table 3.3

Validity Interpretation of Items

Correlation Coefficient	Criteria
$0.90 \leq r \leq 1.00$	Very High
$0.70 \leq r < 0.90$	High
$0.40 \leq r < 0.70$	Enough
$0.20 \leq r < 0.40$	Low
$0.00 \leq r < 0.20$	Very Low
$r < 0.20$	Invalid

(Source: Cohen, Manion, & Morrison, 2007)

3.7.1.2 Reliability of The Test

The reliability of the test is used to determine the consistency and stability of items measurement (Creswell, 2012). The formula is shown below:

$$Kr = \frac{K}{K-1}\left[1 - \frac{M(K-M)}{SD^2}\right]$$

Where:

Kr : reliability coefficient of the test

M : mean of the set of the test scores

SD :standard deviation of the test scores

K : number of items on the test

(source: Fraenkel and wallen, 2009)

The interpretation of reliability test is shown in Table 3.4 as follow:

Table 3.4

Reliability Interpretation

Reliability Coefficient	Criteria
$0.80 < Kr \leq 1.00$	Very High
$0.60 < Kr \leq 0.80$	High
$0.40 < Kr \leq 0.60$	Enough
$0.20 < Kr \leq 0.40$	Low
$0.00 \leq Kr \leq 0.20$	Very Low

(source: Fraenkel and Wallen, 2009)

3.7.1.3 Discriminant Power

The discriminant power of an item is a potential of the items to be answered by upper group correctly and cannot be answered by lower group (Cohen et al., 2007). The formula is shown as follows:

$$D = \frac{A-B}{0{,}5N}$$

Where:

D : discriminant power

A: number of correct students in the upper group

B: number of correct students in the lower group

N: total number of students

(source: Cohen, Manion, & Morrison, 2007)

The interpretation of discriminant power is shown in Table 3.5 as follows:

Table 3.5

Discriminant Power of Items Criteria

Discriminant Power	Criteria
$0.71 \leq D \leq 1.00$	Excellent
$0.41 \leq D \leq 0.70$	Good
$0.21 \leq D \leq 0.40$	Statisfactory
$0.00 \leq D \leq 0.20$	Poor
Negatives	Not Appropriate

(Source: Fraennkel and Wallen, 2009)

3.7.1.4 Level of Difficulty

The difficulty of the items are determined by the formula as follows:

$$Df = \frac{A}{N} X100$$

Where:

Df : difficulty level of the item

A : number of students that answer correctly

N : total number of students attempt the best

(source: Cohen, Manion, & Morrison, 2007)

The interpretation of the item is shown in Table 3.6 as follow:

Table 3.6

Difficulty Level of Items Criteria

Difficulty Level	Criteria
Df > 7.00	Very Easy
0.30 < Df ≤ 0.70	Medium
Df ≤ 0.30	Difficult

(Source: Cohen, Manion, & Morrison, 2007)

3.7.2 Observation Sheet

Observation sheet was used to investigate the compatibility of the aspect of Guided Inquiry Laboratory Activity, lesson plan and the real learning activity conducted by the researcher. Observation sheetcontain several statement and fulfilled by observers that have the obligation to observe and analyze the whole implementation and to judge whether the implementation was in line with procedure or not by giving checklist if the activity that stated in the lesson plan is done.

3.7.3 Questionnaire of Students' Motivation

To determine students' motivation in learning light and optics with Video Embedded with Guided Inquiry Laboratory Activity that is used in this research, a questionnaire is developed by using 4 point Likert-scale (Strongly agree, agree, disagree, strongly disagree). The Students' Motivation Toward Science Learning (SMTSL) was used to assess students' motivation in learning light and optics and the students' answer was analyze by statistical software, namely RASCH model.

3.8 Research Procedure

3.8.1 Preparation stage

1. Formulating the problem and objective of the research that will be determined
2. Literature review of Video Embedded, Guided Inquiry Laboratory Activity and Light and Optics .
3. Constructing Instrument of objective sheet

4. Validating objective sheet (expert judgment)
5. Conducting limited test of objective test instrument
6. Analyzing the validity, reliability, difficulty level, discriminating power of objective test
7. Revising the instrument

3.8.2 Implementation stage

1. Conducting pre-test of students' understanding
2. Implementing Video Embedded with Guided Inquiry Laboratory Activity as a treatment for three meeting
3. Post-test of students' understanding after treatment
4. Analysing the data

3.8.3 Completion stage

1. Constructing result and discussion of the research
2. Drawn the conclusion of the research
3. Reporting the result

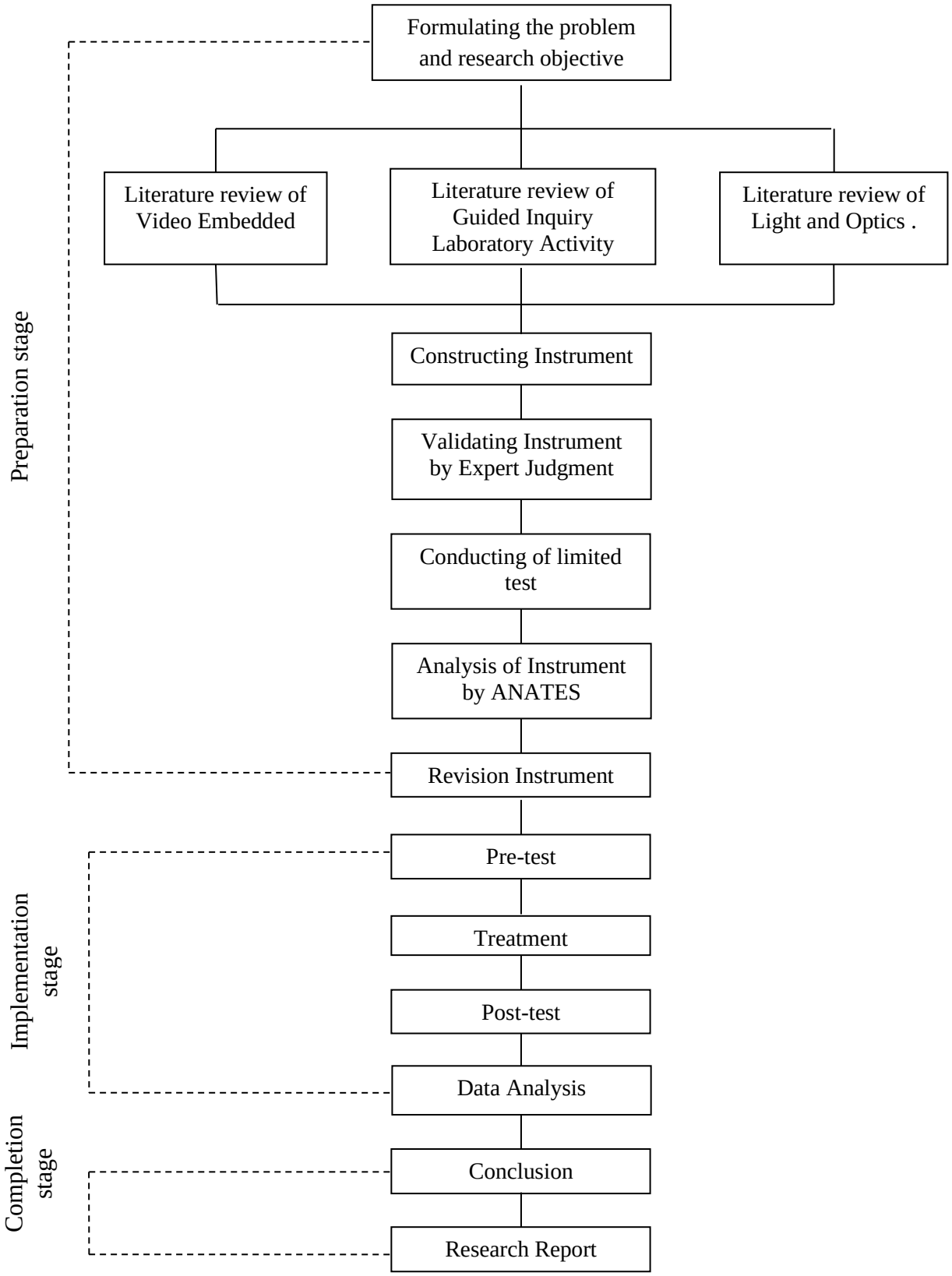

Figure 3.1
Research Flowchart

3.9 Data Processing Technique

In this research, there are two types of dataquantitative that are data of students understanding and data of students motivation. The data processing techniques that will be used are explained bellow:

3.9.1 Data Processing of Students Understanding

3.9.1.1. Gain Score and Normalized Gain

In order to determine the improvement, gain score are calculated by post-test scores minus pre-test scores.

$$G = \frac{Po - Pr}{Pmax - Pr}$$

When:

G : normalized gain

Po : Post-test score

Pr : Pre-test Score

Pmax : maximum Score

(Source: Cohen, Manion, & Morrison, 2007)

After the value of normalized gain determined, it should be interpreted as shown in Table 3.7 as follow:

Table 3.7

Interpretation of Normalized Gain

Normalized Gain (G)	Criteria
$G \geq 0.7$	High
$0.7 \geq G \geq 0.3$	Medium
$G < 0.30$	Low

(Source: Cohen, Manion, & Morrison, 2007)

3.9.1.2. Normality

Normality testis used to determine the population comes from a normally distributed group or not (Fraenkel and Wallen, 2009). The data is determined using the Shapiro-Wilk method in SPSSas it is reliable for a small number of

sample (Hidayat, 2013). The data shows normal distribution if the p-value >Signficance level of (α) 0.50.

3.9.1.3. T-Test Paired Sample

To test the hypothesis, the t-test can be used to determine the difference betweenaveragepre-test and post-test. The T-test Paired Sample is can be analyzed if the data were conducted normality test first.After the data has been analyzed, the conclusion can be drawn. If the sig. 2 – tailed < 0.50 (α), H_0 will be rejected, which mean there is a significant difference between pre-test and post-test. If sig. 2 – tail > 0.50 (α), H_0 will be accepted, which mean there is no significant difference. There is a hypothesis to investigate the average between pre-test and post-test.

H_0: There are no significant difference the average score of pre-test and post-test

H_1: There is a significant difference the average score of pre-test and post-test

3.9.2 Data Processing of Students Motivation

Qualitative data in this research was obtained from the questionnaire of students' motivation. The scoring of instruments is calculated using software ministeps by RASCH model. The model shows what should be expected in responses to items if measurement (at the metric level) is to be achieved (Pallant & Tennant, 2007). The model assumes that the probability of a given respondent affirming an item is a logistic function of the relative distance between the item location and the respondent location on a linear scale. In other words, the probability that a person will affirm an item is a logistic function of the difference between the person's levels of.

One of the differences with classical theoretical models is that besides paying attention to items, they also pay attention to the aspects of the respondents. The output of the analysis of the Ministeps program shown is

3.9.2.1 Variable Map

Variable Map is a visual representation that able to show where is the exact location of a question item is as well as the respondent in terms of measured dimensions.Variable maps aim to explain the person map and items tested.

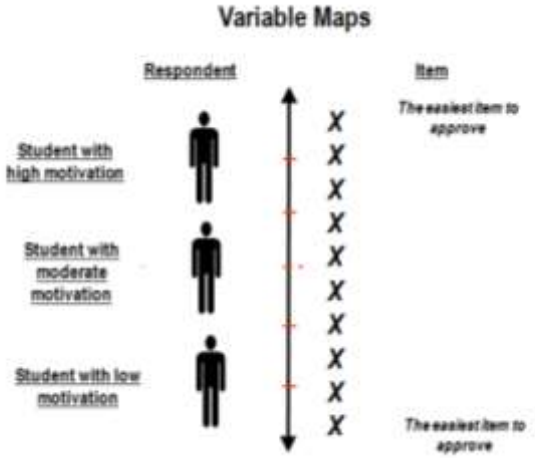

Figure 3.2
Variable Maps

3.9.2.2 Scalogram

Is a tool that shows a systematic response pattern between respondents and items. Scalogram aims to see the results of the analysis in the form of a scalogram.

```
GUTTMAN SCALOGRAM OF RESPONSES:
Person |Item
       |212 12 1  22 12   11 1111
       |09210135284415697235 4867
       |-------------------------
     9 +43443443444444444433444333  09L
     4 +33434334333333333333332343  04P
     8 +43333333333433433333333333  08P
    16 +33333343333333333334333333  16L
    17 +44433434333423433223342222  17L
     1 +44344333343333333343222322  01P
     2 +44334333333333333334232322  02L
    10 +43333433333343333333231333  10L
    20 +33433343433333333332323332  20L
     3 +43333333333333333333333322  03L
     5 +33343333333333333333333232  05P
     7 +33333333333333332333333333  07P
    11 +44433434333333242324323111  11P
    18 +23333333333333333323323333  18L
    14 +33343333334333333333132231  14L
    12 +33333333333233333323232222  12L
    13 +33333333333333333333132231  13L
    15 +33333333333333232222323222  15P
     6 +33233233333333223323221111  06P
    19 +33323322222223222222323222  19L
       |-------------------------
       |212 12 1  22 12   11 1111
       |09210135284415697235 4867
```

Figure 3.3
Scalogram