CHAPTER III

RESEARCH METHODOLOGY

A. Operational Definition

To avoid differences in perception, it would explain a few terms as follows:

1. Hands on Activity is defined as a learning model of physics that are in the real world context of students' lives by engaging students in exploring and asking information, activities, and discover, collect and analyze the data and make your own conclusions (Amin, 2007). Students doing hands on activity based experiment in laboratories.
2. Learning Achievement are the patterns of actions, values, understandings, attitudes, appreciation, abilitas, and skills (Hamalik, 2005:31). This is meant form of cognitive scores of students above the standard of >80. Student achievement is the result of learning achieved by students after school activity or following the term used to express the degree of learning success that has been achieved by the students after participating in learning activities. Success rate of learning is seen by comparing the scores obtained by student's prior knowledge using a model of hands-on learning activity (pretest) and determine student achievement after learning by using hands on activity model (posttest). Learning achievement in this study is shown by the figures obtained from the provision of learning achievement tests as an evaluation of the teaching and learning activities. Tests are given in this study will measure the cognitive aspects of students, in the form of remembering aspects (C1), Understanding (C2) and applying (C3).

3. Light is one of the subs of science subjects and part of physics subjects. Light in a medium will propagate in a straight line. Light Reflection is one of the properties of light when light rays fall on the surface of the object and then turned back. In the light reflection will be discussed on the law of reflection, the nature of the image formed by a plane mirror, and the nature of the image formed by a concave mirror.

B. Method and Research Design

This study aims to determine the possibility of a causal relationship between the variables in the study, other than that this study uses only one class. Based on this, the method used in this study is *weak experimental design*. So called because this method is not yet a truly experimental, as there is external variables that also affected the results to be achieved. So the experiment is not solely influenced by the independent variable, this can occur in the absence of variable control and the sample was not chosen at random (Sugiyono, 2011:74)

The form of the *pre-experimental design* methods used were single *pretest-posttest design*, providing pretest and then provide treatment in a deliberate and systematic review of the treatment groups in the form of learning through *hands on activity*, and after treatment completion then administered posttest using the same instrument pretest. The design can be described as follows

Quantitative method through *weak experiment/pra-experiment*

Table 3.1

One group pretest posttest design

O_1	X_1	O_2
Pretest	*Treatment*	*Posttest*

O_1 : Pre-test (first test) before conducting treatment

O_2 : Post-test (final test) after conducting treatment

X : Data research taken (implementing *hands on activity*)

C. Population and Research Sample

The population in this study is one class of eight (8^{th}) grades of junior high school students in the 2^{nd} semester. The sample had studied the subject "Light Reflection" in the second semester.

The sample is using one class of eight (8^{th}) grades of junior high school students in the 2^{nd} semester using purposive sampling technique**.** Purposive sampling technique is used for the selection of the sample. A purposive sample is a non-representative subset of some larger population, and is constructed to serve a very specific need or purpose. Purposive sampling starts with a purpose in mind and the sample is thus selected to include people of interest and exclude those who do not suit the purpose. Identify selected based on the knowledge of a population and the purpose of the study. The subjects are selected because of some characteristic.

D. Research Instrument

1. Test item (post test and pre test)

   The questions used in the form of multiple choice of light reflection concept. All of instrument refers to cognitive domain on the aspect of remembering (C1), understanding (C2), and applying (C3).

   a. Pre-test

      First step is students given pre test to know the prior study of in the concept of light reflection before teaching using hands on activity.

b. Post-tes

Students is given post test to know the improvement of students achievement of light reflection after teaching by using hands on activity. The result of pre test and post test will be compared with KKM >80 physics minimum standard.

2. Questionnaire

Questionnaire is given to the students to know the respond about the learning process is it good and need to be improved or it is bad and need to be stopped.

E. Learning Materials

1. Guidelines for Learning Implementation Plan

The implementation plan is the preparation of teachers to teach lessons to each meeting.

2. Worksheet

Worksheet used as teaching materials which eventually collected and examined to determine the extent of a student's ability to understand the material they have learned.

F. Research Procedure

Generally, this research consists of some steps which are divided into three stages as follow:

1. Preparation stage

In this stage, activities done are:

a. Conducting literature study because conducting literature study is important to gain accurate theory and any related information to research problem. Those information can be gained from latest journals, books, articles and other resources.

b. Choose the topic for implementing research

c. Determine the school as the place to implement the study

d. Contact the school and science teacher.

e. Make permission letter.

f. Conducting prior study

It can be done by examining schools' archived files about students' achievement in science and observing how the lesson conducted in that school. The results will be very useful for consideration in implementing the research.

g. Determine the research sample

The samples of this study are one class of junior high school level students.

h. Prepare lesson plan and consult about it with lecturer and teacher in school.

The lesson plan describes what students and teacher do during the lesson.

i. Construct and justify the instruments

The instruments used in this study are test item (including pre-test and post test) experiment module

2. Implementation steps

a. Give pre-test to know the prior knowledge of students about light reflection

b. Conducting a treatment by using hands on activity to students in the concept light reflection (implement the lesson)

c. Conducting Post-test

Students give a post test to know the achievement of students after using hands on activity is improved or not

d. Conducting questionnaire to know the respond of students after teaching by using hands on activity in the concept light reflection is effective or not

3. Final steps

a. Make data collection and analysis

The data from sample instrument will analyzed by using SPSS for Windows.

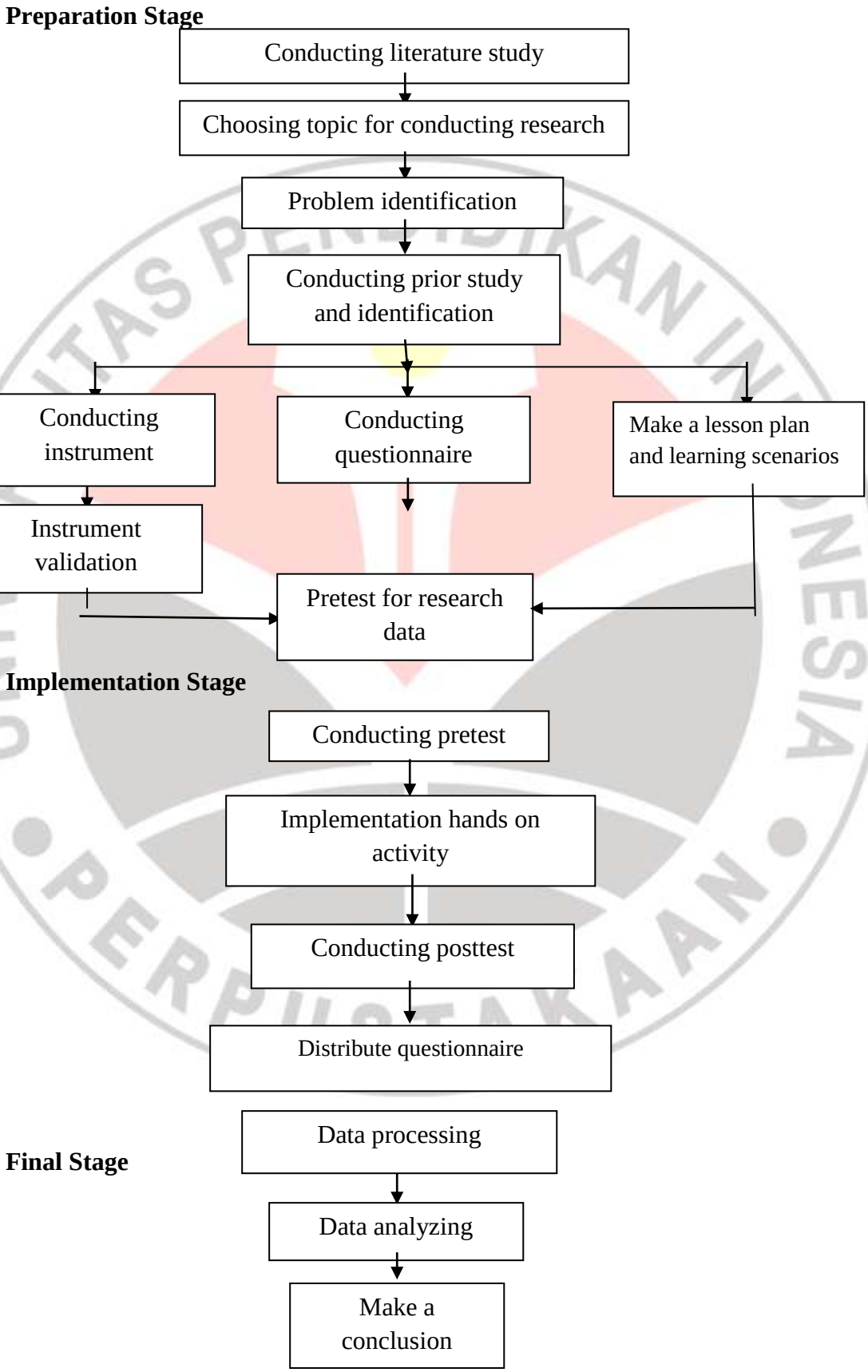
b. Make conclusion

c. Give suggestion for further research

d. Consult with lecture

G. Research Plot

Figure 3.1 Research Design



H. Data Analyzing Technique

Data from this study is quantitative data that will be analyzed with descriptive percentage measures as follows:

1. Instrument validation

a. Validity content of test item

Validity which is used in this research is content validity, the content of cognitive test item which is related to the ability of assessment tool to measure what should be measured (Sudjana, 2009). In this research, instruments are validating and judgments by research expert supervisor.

b. Validity of the instrument

Arikunto (2002:169) states that "to test the validity of each item so the scores on the items should be correlated with the total score." validity technique through analyze an item by using correlation product moment formula by Pearson. An evaluation called valid (valid or invalid) if it is able to evaluate what should be evaluated (Suherman, 2003). The validity or legality of evaluation tools rely on the accuracy of the evaluation tool in carrying out its functions. To calculate the validity of each question using the formula Karl Pearson Product Moment Correlation are:

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

n: total students

x: total score in test item

y: students total score

Based on Guilford (Suherman, 2003) there are some classification that describe the validity in table below

Table 3.2

Validity coefficient classification

Score 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	Not valid

c. Reliability

Reliability of an instrument is intended as a tool that gives the same results if the measurement is given on the same subject although done by different people, at different times and different places (Suherman, 2003). Not affected by the behavior, circumstances, and conditions. High reliability measurement tool called a reliable gauge. Reliability was determined from the value of the reliability coefficient obtained by using alpha formula as follows:

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

With:

r_{11} = instrument reliability

n = amount of test item

p = subject proportion who answers question with the right answer

q = subject proportion who answers question with the wrong

∑pq= multiplication result of p and q

s = deviation standard

Then, the reliability coefficient obtained interpreted in classification reliability coefficient according to (Arikunto, 2008: 75) are presented in below:

Table 3.3

Classification Reliability Coefficient

Correlation coefficient	Interpretation
0,81 - 1,00	Very high
0,61 - 0,80	High
0,41 - 0,60	Medium
0,21 - 0,40	Low
0,00 - 0,20	Very low

d. 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, 2008). The equation which is used to calculate the difficulty level is:

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

With:

P = difficulty level

B = amount of student who answer question with the right answer

JS = total amount of students who undertakes the test

Then, Classification of difficulty level according to (Arikunto, 2008: 75) is presented in below:

Table 3.4

Classification of Difficulty Level

Difficulty index	Category of test
0,0 – 0,3	Difficult
0,3 – 0,7	Medium
0,7 – 1,0	Easy

e. Discriminating Power

Discriminating power of test item is the ability of test item to differentiate between high achiever and low achiever (Arikunto, 2008). To determine discriminating power of test item, the equation below is used:

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

With:

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

Then, criteria of test item discriminating power according to (Arikunto, 2008: 75) are presented in below:

Table 3.5

Criteria of test item discriminating power

Discriminating power interval	**Criteria of discriminating power**
Negative	Test item is not appropriate
0,0 – 0,2	Poor
0,2 – 0,4	Satisfactory
0,4 – 0,7	Good
0,7 – 1,0	Excellent

Calculation of multiple-choice test trials conducted using application of Anates version 4.0. Recapitulation of the difficulty level for each instrument of multiple choice questionsof is as follows:

Table 3.6 validity of multiple-choice questions

Number of Questions	Correlation	Significant
1	0.654	Highly Significant
2	0.841	Highly Significant
3	0.862	Highly Significant
4	0.862	Highly Significant
5	0.861	Highly significant
6	0.758	Highly Significant

7	0.755	Highly Significant
8	0.559	Highly Significant
9	0.740	Highly Significant
10	0.555	Highly Significant
11	0.506	Highly Significant
12	0.344	-
13	0.268	-
14	0.268	-
15	0.437	Significant
16	0.177	-
17	0.842	Highly Significant
18	0.862	Highly Significant
19	0.669	Highly Significant
20	0.777	Highly Significant
21	0.742	Highly Significant
22	0.742	Highly Significant
23	0.708	Highly Significant
24	0.511	Highly Significant
25	0.672	Highly Significant

Based on acquisition of the data processing multiple choice test results can be composed overall recapitulation in the table below:

Table 3.7 Recapitulation Analysis of Multiple Choice Tests

No Questions	**Validity**	**Difficulty Level**	**Discriminating Power**	**Reliability**	**Judgment**
1	Valid	Medium	Excellent	0,99 (very high)	Use
2	Valid	Medium	Excellent	0,99 (very high)	Use
3	Valid	Medium	Excellent	0,99 (very high)	Use
4	Valid	Medium	Excellent	0,99 (very high)	Use
5	Valid	Medium	Excellent	0,99 (very high)	Use
6	Valid	Medium	Excellent	0,99 (very high)	Use

7	Valid	Medium	Excellent	0,99 (very high)	Use
8	Valid	Medium	Good	0,99 (very high)	Use
9	Valid	Medium	Excellent	0,99 (very high)	Use
10	Valid	Medium	Excellent	0,99 (very high)	Use
11	Valid	Medium	Good	0,99 (very high)	Use
12	Not Valid	Medium	Good	0,99 (very high)	Revised
13	Not Valid	Medium	Good	0,99 (very high)	Revised
14	Not Valid	Medium	Good	0,99 (very high)	Revised
15	Valid	Difficult	Excellent	0,99 (very high)	Use
16	Not Valid	Very Easy	Poor	0,99 (very high)	Revised
17	Valid	Medium	Excellent	0,99 (very high)	Use
18	Valid	Medium	Excellent	0,99 (very high)	Use
19	Valid	Medium	Excellent	0,99 (very high)	Use
20	Valid	Medium	Excellent	0,99 (very high)	Use
21	Valid	Medium	Excellent	0,99 (very high)	Use
22	Valid	Medium	Excellent	0,99 (very high)	Use
23	Valid	Medium	Excellent	0,99 (very high)	Use
24	Valid	Difficult	Excellent	0,99 (very high)	Use
25	Valid	Difficult	Excellent	0,99 (very high)	Use

2. Quantitative data processing

From the total score obtained from the data collection activities then analyzed to determine the value of learning achievement results obtained by converting it to standard 100 values.

Furthermore descriptive statistical analysis, aimed to describe the results obtained by students studying physics, achievement results are then compared using a categorization according Arikunto (2005) as follows:

Table 3.8

Guidelines for the categorization results of student achievement (Arikunto, 2005)

Interval Value	Category
80-100	Strongly Good
66-79	Good
56-65	Enough
40-55	Less
≤39	Failed

a. Analysis score pre-test for each students

   Analysis was conducted to determine students' prior learning and student learning achievement before given treatment.

b. Analysis score post-test for each students

   Analysis was conducted to determine students learning achievement after given a treatment

c. Analysis score pretest and posttest and compared with KKM physics minimum standards

d. Analysis of criteria N-*gain score*

   Analysis of the criteria used to determine the N-gain obtained gain criterion. N-gain score derived from data pre test and post test are processed to calculate the average N-gain normalization. Average normalized N-gain was calculated using the formula based on (Hake, 1998) there are:

$$< g > = \frac{\% < G >}{\% < G > maks} = \frac{(\% < Sf > - \% < Si >)}{(100 - \% < Si >}$$

Where:

Sf : the final score posttest

Si pretest : the initial score of pretest

Max Score : maximal score

The rate of N-gain normalized scores is categorized into three categories, as follows:

Table 3.9 N-Gain Category based on Hake (1998)

N-Gain	Category
$g \geq 0,7$	High
$0,3 \leq g < 0,7$	Medium
$g < 0,3$	Low

e. Testing hypothesis

1. Testing Normality using *kolmogorov-smirnov* and *Shapiro-wilk*
2. Testing Homogeneity

   If the significance obtained >α, then the variance of each sample are same (homogeneous). If the significance obtained <α, then the variance of each sample are not the same (not homogeneous)
3. Testing Hypothesis using t-test SPSS

   H_0: $\mu_1 = 80$

   The differences average pretest with the value 80 insignificant

   H_a: $\mu_1 \neq 80$

   The differences average pretest with the value 80 is significant

   Error rate (α) are tolerated in this study was 5%.

3. Questionnaire data processing

Qualitative data analysis consisted of analysis of data from questionnaires. Questionnaire is conducted at the end of meeting and filled by students. The scale used is a Likert's model response scale. Likert's scale is a bipolar scale method that measure either positive or negative response to a statement. This questionnaire contains four selections of answers: Strongly Agree (SA), Agree (A), Netral (N), Disagree (DA), and Strongly Disagree (SDA). Questionnaire is filled by students as the respondent by a fixing a check mark (√) in the space provided.

In analyzing the results of questionnaires, qualitative scale above transferred into a quantitative scale. For positive statements (favorable) SA category was given the highest score, further into the SDA scores gradually decreased. In contrast to the negative statement (unfavorable) for the category of the SA was given the lowest score, the more into the SDA scores given gradually higher.

Table 3.10 Questionnaire Response Categories

Type of statement	**Score**				
	SA	**A**	**N**	**DA**	**SDA**
Positive	5	4	3	2	1
Negative	1	2	3	4	5

After each statement was scored, each student calculated the average total score. Classification calculation of the percentage of each category of interpretation according Kunjaraningrat (Suherman, 2001:6) is as follows:

Table 3.11

Classification of interpretation percentage questionnaire

Percentage of Answer (%)	Criteria
0%	No improvement
0 %- 25%	Just a little
26%-40%	Almost half of total
41%-50%	Half of total
51% - 75%	Most of
76% - 99%	Almost all
100%	Total improvement