CHAPTER III

METHODOLOGY

A. Research Method and Design

1. Research method

The reasearch method which was applied in this research was experimental research. In experimental research, the reserachers look at the effect of least one independendent variable on one or more dependent variable (Fraenkel *et al.,* 2009). The type of experimental research that is used in this study is weak experimental design, "weak" here means that there is no control for threats to internal validity. The dependent variable in this research are cognitive achievement and creativity, while the independent variable is learning style. According to the Frankael *et al* (2009) state that experimental study is the best type to testing hypothesis. That statement as one consideration of using this method is to testing hypothesis whether learning style has an impact in cognitive achievement or not.

2. Research design

Type of weak experimental design that is used in this research is one-group Pretest-Posttest Design. In this research design, a single group is measured or observed not only after being exposed to treatment of some sort but also before (Frankael *et al.,* 2009). A table of this design is as follows:

Tabel 3.1 The One Group Pretest-Posttest Design

O	X	O
Pretest	Treatment	Posttest

B. Research Location and Subject

1. Research Location

This research was held in one of Boarding School in Subang which is use KTSP curriculum in teaching-learning process. The data collection was done in July 2014.

2. Subject

Population of this research is all of student's ability in concept mastery and creativity that belongs to all 8 (eight) grade in the middle school. The sample of this research is one class of students' ability in concept comprehension and creativity on optic instrument. The simple random sampling is used as sampling technique. Simple random sampling is one of the population has an equal and independent chance of being selected (Frankel *et.al.*, 2011)

C. **Operational Definition**

In order to conduct the research in accordance with the expected aims and avoid misunderstanding, therefore an operational definition need to be describe as follows:

1. Learning Style is a student's preference of how student catch, organize and then processed the information by their sensory (visual, aural, read/write, and kinesthetics) based on Fleming. Student were given a learning style questionnaire that was developed by Fleming, then student were grouped based on their prefference learning style.

2. Cognitive Achievement is a student cognitive accomplishment which is taken by pre and post test. The learning achievement that conduct in this research is achieved by cognitive aspect from revised taxonomy Bloom by Anderson (2011) which covers C1 until C4 in learning optics instrument.

3. Creativity is a product of creative thinking from group or individual perceive and create new combinations. Students' creativity is assesed through rubric as an instrument. The are four aspects that measure

creativity based on Munandar. There are Fluently, Flexibility, Originality, and Elaboration. Optic instrument is a topic that is chosen to make a product. Class will divided into several group based on their learning style.

D. Research Instrument

Research instrumen is a tool that is used to collect research data. Instrumen used in this research are, rubric for creativity product (Scientific Poster, Artistic Representation, writen article, and drama presentation) and multiple choice related to the creativity product made by students.

The instruments used in this research are illustrated in table, as follows:

Table 3.2 Instrument Research Used

No.	Type of Instrument	Aspect that Assessed	Data Collected
1	©VARK Questionnaire	Student preference learning style	The highest score of preference learning style from answer sheet of questionnaire
2	Assesment of product	Level of creativity which is assessed based on novelty, resolution, elaboration and syhthesis.	Product of artistic representation/ drama performences/ scientific poster/writing article.
3	Multiple choices related to the optics instrument	Cognitive achievement that should be mastery by student	Pre-test and post-test

1. Pre test

Pre test were conducted in the beginning of learning. It was intended to know the students; prior knowledge toward optics intrument concept. In this pre test consist of 20 multiple-choice questions. Those questions only elaborated to the students' cognitive domain. Learning outcome that would

be conducted in this research is about cognitive aspect; there were C1 (remembering), C2 (understanding), C3 (applying), C4 (analyzing) according to Revised Taxonomy Bloom.

Table 3.3 Details of Cognitive Domain Type

No	Indicator	Cognitive Domain				Total	Precentage (%)
		C1	C2	C3	C4		
1	Explain the function of eyes as an optics instrument	1, 3	2, 4			4	20
2	Describe the image formation of objects on the retina.	8	5,6	7		5	25
3	Investigate the characteristics of optical instruments (Camera, telescope, lup, and microscope).	9	10, 11,15 19,20	13,14 16,18	12	11	55
	Total	4	9	5	1		
	Precentage (%)	20	45	30	5	20	100

2. Post Test

   Posttest was conducted at the end of learning. All questions were same with pre test questions. Post tes was given intention of knowing the development of student cognitive achievement towards optics instrument concept.

3. Rubric Scale of Product as a product creativity

Assesment rubric was used to asses the creativity based on the product that has been made by student. Rubric was made by adapted the existing rubric and developed subsequently based on the needed and objective of the research. Level of students' creativity classified into categories, very high, high, medium, low, and very low. As illustrated table below :

Table 3.4 blueprint of Student Creativity Product

No.	Indicator of Creativity	Value Aspect of Product			
		Scientific Poster	Writing Assignment	Presentation	Artistic Representation
1	Fluency	Graphics	Theme	Performances	Variation of material
2	Flexibility	Elements	Elements	Elements	Elements
3	Originality	Attractiveness	Attractiveness	Attractiveness	Attractiveness
4	Elaboration	Answering problem a with explanation	Answering problem a with explanation	Answering problem a with explanation	Answering problem a with explanation

There are 4 types of rubric scale of product. First, rubric scale product of poster, presentation, writting scenario, and last, rubric scale product for artistic representation.

E. Instruments Development

The instruments that would be judged consist of questions of pretest and postest, the rubric sclae of product, rubric scale of creativity. The whole instruments were judged by 3 experts. Two of them are lectures of university and one of them is the official scence teachers of SMP Al-Azhar Syifa Budi Parahyangan.

Number of quetions that was related to the concept were tested to find out the feasibility as an instrument of the research. Form of product assesment onl tested and validated by teacher or lecturer. While for cognitive test, after being revised by judges the questions were tested to the

student. Further analysisi were needed to find out good or bad some test, covers validity, realibility, discriminating power, level of difficulty, and distractor by using dsoftware *Anates ver.4.*

1. Validity

The validity test is used to measure the validity of item test that will be used to measure students concept comprehension. Based on Arikunto, validity test is a measurement that confirm the instrument whether it is valid or not and can measure that will be measured (Arikunto, 2010).

Because of that, the validity test was implemented by compared the content of the subject matter which is students taught. To determine the appropriateness of the instrument with the material, it was done with the product moment correlation formula are given:

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

Where,

r_{xy} = items correlation coefficient.

X = items scores

N = amount of subject

(Arikunto, 2010)

The table of interpretation of validity criteria compare to the result, are given:

Table 3.5 Validity Interpretation

Correlation Coefficients	Validity Criteria
$0,80 < r \leq 1,00$	Very high
$0,60 < r \leq 0,80$	High
$0,40 < r \leq 0,60$	Enough
$0,20 < r \leq 0,40$	Low
$0,00 \leq r \leq 0,20$	Very low

(Arikunto, 2010)

Based on the criteria above, the item test are validated and classify it whether it belongs to very high, high, enough, low and very low. According to the calculation by using *Anates ver.4* it was obtained 20 question of multiple choices which have criteria very high, high, enough , low, and very low. that will be used as a instrument

Table. 3.6 Recapitulation of Validity Testing

in Multiple Choices

Number Question	Coefisien Correlation	Criteria
1	0,617	High
2	0,611	High
3	0,369	Low
4	0,145	Very Low
5	0,304	Low
6	0,925	Very High
7	0,330	Low
8	0,559	Enough
9	0,159	Very Low
10	0,304	Low
11	0,651	High
12	0,559	Enough
13	0,482	Enough
14	0,149	Very Low
15	0,146	Very Low
16	0,159	Very Low
17	0,482	Enough
18	0,718	High
19	0,391	Low
20	0,475	Enough

2. Reliability

Reliability is used to measure the consistency of instrument to measure that was used. Based on Arikunto (2010) reliability tends to tool that is used to data collection instrument whether it has been good or yet. The formula that was used in this research is use Alpha Cronbrach, because this formula

could be used to answer which has the scales dichotomy as such true (1), false ()). Split-half method formula given:

$$r_{11} = (\frac{n}{n-1})(1 - \frac{\sum \sigma_i^2}{\sigma_i^2})$$

Where,

r11   = Instrument reliability

n   = Amount of question

$\sum \sigma_i^2$ = Amount of Varian score in each item

σ_i^2 = Varian total

(Arikunto,2010)

The instrument can be called reliable if the reliability coefficient (R11)> 0.6, or can be compared with r table (product moment). The table to interpret reliability is given:

Table 3.7 Reliability Interpretation

Correlation Coefficient	Reliability Criteria
$0,80 < r \leq 1,00$	Very high
$0,60 < r \leq 0,80$	High
$0,40 < r \leq 0,60$	Enough
$0,20 < r \leq 0,40$	Low
$0,00 \leq r \leq 0,20$	Very low

(Arikunto, 2010)

Based on the calculation by using software *Anates ver.4*, the reliabiity of the test was 0,62. Hence , it can be conclude that the test have a high criteria . means that the test was acceptable.

3.   Discriminating Power

The discriminating power is used to measure whether the student belongs to higher or lower achiever category through item test. the question or problem which have a good discrimination power will have higher result , so if it is given to the high achiever student rather than it is given to the low achiever student (Arikunto, 2010). Means that the problem can be determine which student belongs to. The formula that is use to discriminating power of an item test are given:

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

Where,

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

(Arikunto, 2012)

To classify it then the criteria are given below:

Table 3.8 Classification of Discriminating Power

Discriminating Power	Classification
0,00 – 0,20	Poor
0,21 – 0,40	Satisfactory
0,41 – 0,70	Good
0,71 – 1,00	Excellent

(Arikunto, 2010)

Based on the calculation was done by *software anatest ver.4*. the analysis of the discrimination power was obtained and criteria were given based on the table 3.8. as follows:

Table 3.9 The Classification Result of Discriminating Power

No. Question	Discriminating Power (%)	Criteria
1	85,71	Excellent
2	83,33	Excellent
3	33,33	Satisfactory
4	42,86	Good
5	33,33	Satisfactory
6	100	Excellent
7	0,00	Poor
8	57,14	Good
9	85,71	Excellent
10	16,67	Poor
11	0,00	Poor
12	83,33	Excellent
13	0,00	Poor
14	16,67	Poor
15	14,29	Poor
16	16,67	Poor
17	33,33	Satisfactory
18	66,67	Good
19	16,67	Poor
20	50,00	Good

Generally, question was good enough to use as instrument. But for a few question that belongs to poor criteria are revised, so it can be used.

4. Level of Difficulty

The good item test it should be not too easy or difficult of item test, but it should be balance. Students' capability in answered difficult question is not determine by teacher perspective, but there are some requirements that should be consider determining the difficulty level of item test. the first requirement is balancing, means that the amount of

easy, medium and difficult of item test should be same. The second is the approximately three categories based on the proportion of the normal curve. Means that most of the problems are in the medium category, some are include in the easy category and difficult category with balanced proportions (Arikunto, 2010). The formula is given to determine it:

Where,

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

P = Difficulty level

B = Number of students who answer correctly

N= Total number of students

(Arikunto, 2010)

Table of each criteria are given as below:

Table 3.10 Difficulty Level

Index of Difficulty Level	Criteria
0 – 0,29	Difficult
0,30- 0,69	Middle
0,70 - 1,00	Easy

(Arikunto, 2010)

Based on the calculation was done by *software anatest ver.4*. the analysis of the discrimination power was obtained and criteria are given based on the Table 3.10. as follows:

Table 3.11 Result of Difficulty Level

No. Question	Index Level of Difficulty	Criteria
1	80,95	Easy
2	61,90	Middle
3	90,48	Easy
4	68,00	Middle
5	80,95	Easy
6	57,14	Middle
7	66,67	Middle
8	36,00	Middle
9	44,00	Middle

No. Question	Index Level of Difficulty	Criteria
10	95,24	Easy
11	28,00	Difficult
12	61,90	Middle
13	84,00	Easy
14	95,24	Easy
15	52,00	Middle
16	92,00	Easy
17	52,00	Middle
18	71,43	Easy
19	95,24	Easy
20	76,19	Middle

F. Technique Data Collection and Analysis

Data was collected using creativity rubric scoring for product, pretest and posttest that covers concept of optics instrument. Each data processed and analyzed by following way:

1. Data Processed and Analyzed of Creative Product

Data collected using rubric scale. Furthermore data is processed by calculating each score then convert to the form scale value from 1 – 100

$$NP = \frac{R}{SM} \ X \ 100\%$$

Where,

NP   = value look for (%)

R   = Raw score obtained by students

SM   = Maximum ideal score

100   = Fixed number

(Purwanto, 2008)

To determine level of students' creativity, obtained value is interpreted in percentage form. Based on Purwanto (2008), the precentage value result can be grouped into crirtia such as very high, high, medium, low, and very low.

Table 3. 12 Category of Creativity Level based on Product

Value (%)	Criteria
86 – 100	Very High
76 – 85	High
60 – 75	Medium
55 – 59	Low
≤ 54	Very Low

2. Data Processing and Analysis of Pretes and PostTest

Data was collected from pretest and post was obtained from student, which covered material about optics instrumen then being rocessed by calculating score of students' pretest and posttest that formed in multiple choice. Each correct answer was given a score one, while a wrong answer was given a score zero. Then, to find out final score with scale 100 from multiple choice done by using formulation, as given:

$$FS = \frac{SS}{SM} \; x \; 100\%$$

Where,

SS = Score obtained by student

SM = Maximum Score

FS = Final Score

After getting the final score, pretest and posttest being analyzed for the effectiveness of their instruction by finding the value of N-Gain. The value of N-gain were categorized as high, medium and low. As follows :

a. Average Normalized Gain

in obtaining the average normalized gain score in this research was done by ©*Microsoft Office Excel 2007*. Average normalized gain is a method to assess the effectiveness of instruction. The average normalized gain is commonly used to assess students' performance in pre- and post-test. the average or normalized could be calculated by using average scores of the class or individual student's score. Generally, both of calculation has

different product. The properties of two result were explored for several ideallized situations. The results indicated that it might be able to utilize the the difference between the two results to extract information about how population may have changed as a result of instruction. Average normalized gain (g) describe as the ratio of the average improvement in participantscores from pre-test to the post-test rescpectly to the maximum possible improvement. G can be calculated, as follows :

$$g = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

Hake (1998) noted that the normalized gain has a significant measurement of how well a course though topics of physics to students. Hake regarded normalized gain in the category of high, medium and low. As illustrated in table below :

Table 3.12 Category of Average Normalized Gain

Normalized Gain	Category
< 0.3	Low
0.3 < X< 0.7	Medium
> 0.7	High

(Hake, 1998)

3. Research Scheme

    Research scheme is a view of how the research is conducted. Starting from the preparation stage, following by implementation stage until a conclusion is made based on the formulation issued raised. Detailed the plot of this research is set out in several step as shown below:
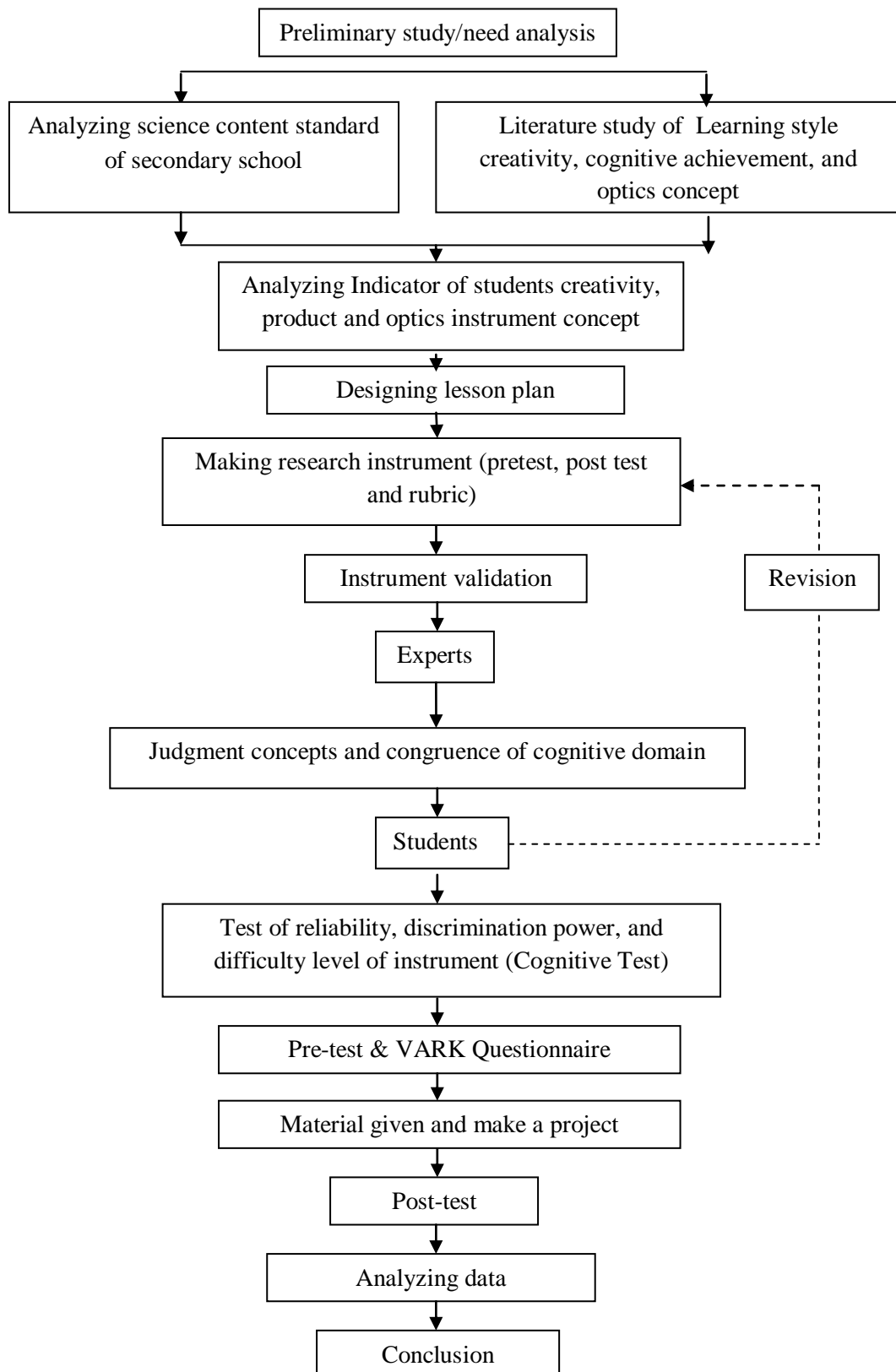
Figure 3.2 Research Scheme