

### CHAPTER III

#### DESIGN OF THE STUDY

##### A. Method

One purpose of this study was to determine the differences in improvement of Learning Achievement and Graph Interpretation Skills between male students and female students. So there are two classes with different gender given the same treatment. Then be measured with the same instrument. This research method is called pre-experimental design with the design of the study is one group Pre-test/post-test Design with one kind of treatment.

Group	Pre	Treatment	Post
Male	O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>
Female	O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>

Table 3.1. The Research Design.

Observation was done before treatment (O<sub>1</sub>) which is called pre - test and observation after treatment (O<sub>2</sub>) which is called post - test. Treatment was done in three meetings. A test instrument that are used as a pre-test and post-test in this study is instrument to measure students' Learning Achievement and students' Graph Interpretation Skills. The instruments used were judged and tested. Learning Achievement Test was used to measure student learning outcomes on cognitive domain on Kinematics of Linear Motion. Test of

Understanding graph (TUGK) was used to find students' Graph Interpretation Skills. Both instruments are given to students before and after treatment.

## **B. Population and Sample**

The population in this study is one of the classes X bilingual high school in Bandung. By random cluster sampling technique, there were taken three classes from four X grade in the school. The number of students involved in this study, there are 34 male students and 22 female students, divided into two classes. Thus, the total number of students involved in the study was 56 students.

## **C. Research Procedure**

In this study, researcher took five stages, namely: a preliminary study, literature review, preparation, implementation, and ended with an analysis results and writing the report.

### **1. Preliminary studies**

Preliminary study intended to find out the problems that arise in the process of learning physics, issue that arise from students. This preliminary study is also useful in getting an overview of students' learning achievement and the result of practical exam in high school. The results of practical exam are used as a basis to find solutions to the problems.

## **2. A Literature Review**

Literature review is carried out to obtain the theory and concepts of the selected material after adjusting for standard of competence (SK) and basic competencies (KD) that have been determined. In the literature reviews also studied a variety of learning methods and then choose which method will be the subject of research. The study of literature and then used as a basis in designing the study and its instrumentalities.

## **3. Instruments, Lesson Plan and Learning Media**

The next stage of research is designing the instrument, lesson plans and research media. The design refers to the SK, KD, and indicators that are determined. Instrument is in the form of multiple-choice learning outcomes in accordance with the indicators to be achieved. Instrument to determine the Graph Interpretation Skills is Test of Understanding Graph Kinematics (TUGK). Lesson plan and media were designed based on Video-Based Laboratory Learning Cycle 5E Model.

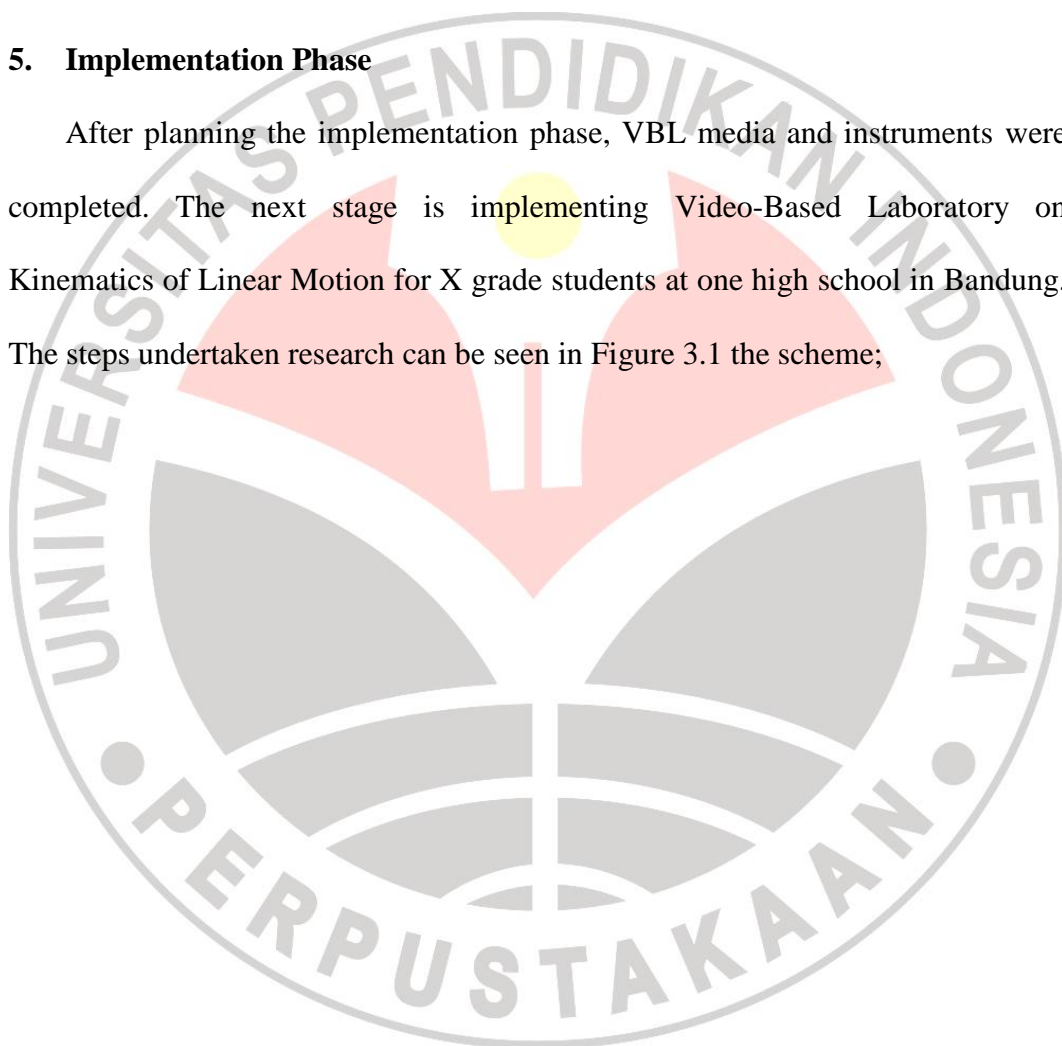
## **4. Trial of Research Instruments**

Instruments were given to different students as a test to determine the validity, reliability, and difficulty factor and discrimination index of research instruments. Research instruments were delivered in one of five class XII grade in the same school, the materials to be used by researchers have been taught in this

class. From the test results, about which items are not eligible discarded or revised. Revised result of the instrument was tested again in another class XII, after the context of the sentence was revised, analysed and repaired. No questions are removed. All question items were generally qualified.

## 5. Implementation Phase

After planning the implementation phase, VBL media and instruments were completed. The next stage is implementing Video-Based Laboratory on Kinematics of Linear Motion for X grade students at one high school in Bandung. The steps undertaken research can be seen in Figure 3.1 the scheme;



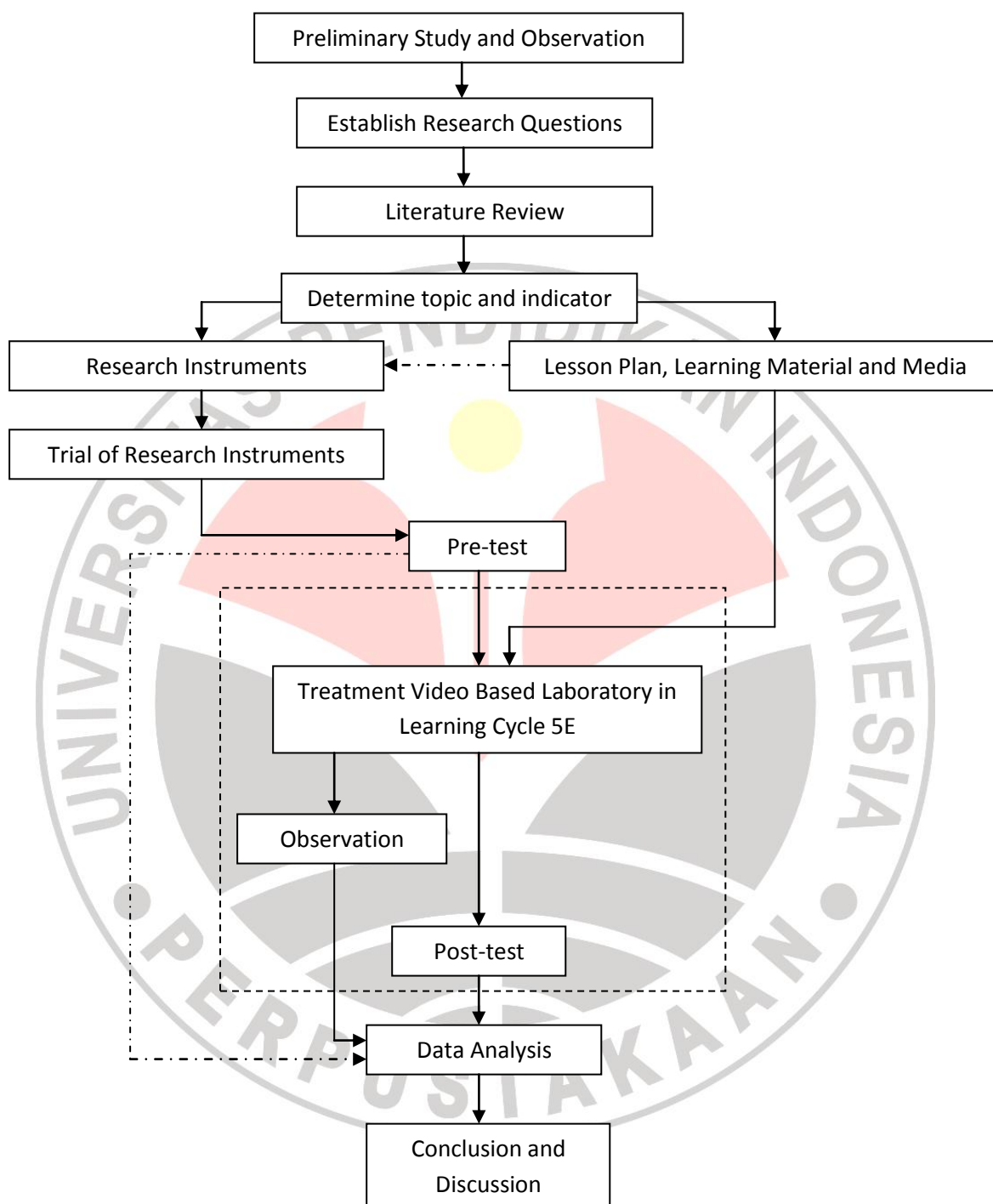


Figure 3.1. Research Scheme

## **D. The Research Instruments**

### **1. Type Of Research Instrument**

Research instrument designed and used in this study consists of two types of tests:

#### **a. Teacher and Students' Activity Observation Form**

Teacher and students' activity is observed by observer. This observation form is to know the accomplishment of learning phases of 5E learning cycle model. The accomplishment of learning phases is counted in per centation. This observation form is made in accordance with lesson plan and all learning stages that have been prepared before lesson.

#### **b. Learning Achievement Test**

The test result of multiple-choice questions is used to determine the kinematics of linear motion learning achievement. Students get the test twice, the pre-test (initial test) and post-test (final test). From these test results will be counted normalized gain (N-gain) of male class and female class. N-Gain score of male and female class is compared to see which one has higher improvement.

#### **c. Test of Understanding Graph – Kinematics**

Test of understanding kinematics graphs entirely in the form of multiple choices. The test is a standardized test. Students get the test twice, the pre-test (initial test) and post-test (final test). From these test results will be counted normalized gain (N-gain)N-Gain score of male and female class is compared to

see which one has higher improvement on graph interpretation skills in both classes.

## 2. Analysis of Instruments and Data Processing

### a. Learning Achievement Test Analysis Technique

Analytical instruments include validity, reliability, level of ease, and distinguishing features. Explanation in full is as follows:

#### 1) Validity of Instruments (question item)

The validity of the test is a measure that states the validity of instruments so as to measure what is to be measured (Arikunto, 2009: 65). Test the validity of the tests used are the logical validity (i.e. including content validity and the validity of construction) and empirical validity. To find out logical validity of the tests, it is carried out judgments against the points made about by two lecturers and a teacher of physics subjects. To know the empirical validity, it is done some statistically test. After conducted trials that test and the results incorporated into the statistical tests, the Pearson Product Moment correlation technique is expressed in equation 3.1(Arikunto, 2009: 73), namely:

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{(N \sum X^2 - (\sum X)^2)(N \sum Y^2 - (\sum Y)^2)}} \dots \dots \dots (3.1)$$

Description:

$r_{xy}$  = correlation coefficient between variables X and Y,  
two variables are correlated.

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X = score of each item questions.

Y = total score of each question item.

N = number of students.

The following table 3.1 (Arikunto, 2009: 73) who interpret validity:

Table 3.1 Interpretation of Validity

Correlation Coefficient	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
$0.00 < r \leq 0.20$	Very Low

## 2) Reliability of Instruments

In this study, there is only one instrument package and tested twice. Reliability analysis is used to determine the accuracy of the evaluation tools in measuring the accuracy of the students answer the questions. The formula used is halved reliability of the formula C - R 20 (Arikunto, 2005) as follows:

$$r_{11} = \left( \frac{n}{n-1} \right) \left( \frac{S^2 - \sum pq}{S^2} \right) \dots \dots \dots (3.2)$$

Description:

$r_{11}$  = reliability of the instrument.

p = proportion of subjects who answered the item correctly.

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q = proportion of subjects who answered the item with the wrong  
( $q = 1 - p$ ).

$\sum pq$  = sum of the multiplication between p and q.

n = number of items.

S = standard deviation of the test (standard deviation is the root variance).

To interpret the value obtained from the reliability test above calculation is used criteria such as reliability tests are shown in Table 3.3.

Table 3.3. Interpretation of Reliability

Correlation Coefficient	Reliability Criteria
$0.81 \leq r \leq 1.00$	Very High
$0.61 \leq r \leq 0.80$	High
$0.41 \leq r \leq 0.60$	Enough
$0.21 \leq r \leq 0.40$	Low
$0.00 \leq r \leq 0.20$	Very Low

(Arikunto, 2008: 93)

### 3) Difficulty Factor of a question

Level of difficulty is the ability of the test (each question item) in capturing the many subjects that test takers can do (about) correctly. The magnitude difficulty level of the index can be calculated by the formula: (Arikunto, 2010)

$$P = \frac{B}{J} \dots \dots \dots (3.3)$$

Description:

P = the level of difficulty

B = Number of subjects who answered correctly

J = Number of subjects who take the test

The criteria for interpreting the level of difficulty of items about obtained to use the following Table 3.4:

Table 3.4. Interpretation of Difficulty Factor

Difficulty Factor Value	Criteria
0.00 – 0.20	Very Difficult
0.21 – 0.40	Hard
0.41 – 0.60	Medium
0.61 – 0.80	Easy
0.81 – 1.00	Very Easy

(Arikunto, 2008:210)

#### 4) The Discrimination Index

Test distinguishing features is the ability of the test (each item instrument) in a split between subjects who are good with the less intelligent subjects. Calculations about the distinguishing features of each item using the following formula: (Arikunto, 2010)

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} \dots \dots \dots (3.4)$$

Description:

$D$  = Discrimination Index

$J_A$  = the number of upper-class subjects

$J_B$  = number of lower-class subjects

$B_A$  = number of subjects who answered the correct class

$B_B$  = number of lower-class subjects answered correctly

To interpret the value of distinguishing obtained from the above calculation is used as distinguishing criteria is shown on Table 3.5

Table 3.5. Interpretation of Discrimination Index

Discrimination Index	Criteria
Negative	Very Bad
0.00 – 0.20	Bad
0.20 – 0.40	Enough
0.40 – 0.70	Good
0.70 – 1.00	Excellent

(Arikunto, 2008: 218)

## b. Data Processing Techniques

### 1) Learning Effectiveness Analysis

#### a) Normalized Gain

From the raw pre-test and post-test each class that have been obtained searched normalized gain value (N-gain). Of the data and test results of initial tests incorporated into the final with a normalized gain equation (N-gain) will be obtained N-Gain for experimental and control groups. N-gain  $\langle g \rangle$  factor calculated by the formula developed by Hake (1999) by the formula:

$$\langle g \rangle = \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{S_{maks} - \langle S_{pre} \rangle} \dots\dots (3.5)$$

Hake (1999)

Description:

$S_{post}$  = final test scores

$S_{pre}$  = initial test scores

$S_{maks}$  = maximum score

To interpret the normalized gain value obtained from the above calculation, the criteria used normalized gain as shown in Table 3.6

Table 3.6. Normalized Gain Criteria

$\langle g \rangle$	Criteria
$\langle g \rangle \geq 0,7$	High
$0,3 < \langle g \rangle \leq 0,7$	Moderate
$\langle g \rangle \leq 0,3$	Low

Hake (1999)

## E. Results from Instrument Trial

From the test instrument is then performed analyses to determine the criteria point to know the proper questions about whether or not to be used. it includes items about the validity of the analysis, discrimination index, difficulty factor, and reliability of the test.

### 1. Validity, Difficulty Factor and Discrimination Index

Discrimination index and question validity analysis is using Microsoft Excel software. Here's the recap;

Table 3.7. Recap of Discrimination Index and Question of LAT.

No.	Discrimination Index	Criteria	Validity	Criteria	Note
1	0.47	Good	0.65	High	
2	0.12	Low	0.37	Low	
3	0.18	Low	0.10	Very Low	
4	0.35	Medium	0.64	High	
5	0.35	Medium	0.38	Low	
6	0.24	Medium	0.44	Medium	
7	0.41	Good	0.81	Very High	
8	0.47	Good	0.75	High	
9	0.35	Medium	0.35	Low	
10	0.29	Medium	0.56	Medium	
11	0.59	Good	0.75	High	
12	0.24	Medium	0.67	High	
13	0.18	Low	0.31	Low	
14	0.59	Good	0.72	High	
15	0.18	Low	0.27	Low	
16	0.29	Medium	0.47	Medium	
17	0.29	Medium	0.62	High	
18	0.18	Low	0.40	Low	
19	0.18	Low	0.31	Low	
20	0.12	Low	0.31	Low	
21	0.53	Good	0.67	High	

No.	Discrimination Index	Criteria	Validity	Criteria	Note
22	0.35	Medium	0.44	Medium	
23	0.41	Good	0.45	Medium	
24	0.35	Medium	0.38	Low	Fixed
25	0.29	Medium	0.40	Low	Fixed
26	0.24	Medium	0.48	Medium	
27	0.41	Good	0.57	Medium	
28	0.35	Medium	0.50	Medium	
29	0.18	Low	0.35	Low	Fixed
30	0.12	Low	0.23	Low	Fixed
31	0.12	Low	0.25	Low	Fixed
32	0.41	Good	0.45	Medium	
33	0.29	Medium	0.59	Medium	
34	0.29	Medium	0.45	Medium	

## 2. Reliability of the Instrument

Based on calculations using the formula with KR-20, the obtained reliability of TUGK was 0.84 with very high criteria. LAT reliability was 0.59 with enough criteria. It can be concluded that the instrument is reliable.