

CHAPTER III RESEARCH METHODOLOGY

A. Research Method

The research method applied in this research was the weak experimental method or usually known as pre-experimental research. It is a type of research design which involves a within-group or within-individual procedure in which a single group or single individuals are studied (Creswell, 2008).

B. Research Design

Based on the research method which has been adjusted to the research objective and because of the number of classes which were given the treatment, therefore the research design which was implemented in this research is one group Pre-test and Post-test design. Only one group is involved and two tests were given, which are before and after the treatment is given without any control group to be compared (Mertler & Charles, 2008).

Table 3.1 One group Pre-test and Post-test Design

Pre-test	Treatment	Post test
O ₁	X	O ₂

(Source: Mertler & Charles, 2008)

O₁: Pre-test of students' achievement test

X: Implementation of Multiple-Intelligence Based Learning on Matter

O₂: Post-test of students' achievement test

In this research, students were given a pre-test in the form of achievement test consisting of 25 multiple choice questions. Then the matter concept were being taught to students using the multiple intelligence - based learning which took three meetings, finally students were then given a post-test at the fifth meeting.

C. Population and Sample

Wida Nur Wahyu Pratiwi, 2017

THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY AND INTERES IN MATTER

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu

The population in this research was the concept mastery and interest of the students in learning matter. The sample of this research was the grade 7, consisting of 13 students in Nusa Laila Puteri School, an english medium school which uses both Brunei Curriculum (SPN21) for lower secondary levels and Cambridge International Curriculum (GCSE) for the upper secondary level.

D. Operational Definition

In order to prevent misconceptions on this research, the following are some operational definition for further clarifications:

1. Multiple Intelligence – Based Learning is a learning approach which is designed by making it in line with the students' intelligence area. In this research, there were four dominant intelligences present in the students which are mathematical-logical, visual-spatial, verbal-linguistic and interpersonal (social) intelligence. In the implementation of Multiple Intelligence, students with logical-mathematical intelligence were facilitated to learn matter by doing a simple experiment; students with visual-spatial intelligence were facilitated to learn by observing 3D model of matter and making a mind-map; verbal - linguistic students were facilitated to learn through presentations and watching videos on matter; interpersonal-social intelligence students were facilitated to learn though group discussion. The implementation of Multiple Intelligence-Based Learning was observed using an observation sheet.
2. Interest is a stable, long-term predisposition (Renninger and Hidi, 2011). The interest which was concentrated in this research was the students' individual interest in learning the concepts of matter using the Multiple Intelligence-Based Learning. The interest in this research was measured using an Interest Scale in the form of Likert Scale, a type of scaled questionnaire to measure students' interest level. The interest scale consists of five questions of which includes interest aspects to calculate the students' interest level after being taught using Multiple Intelligence-Based Learning in Matter.

3. Concept mastery is where students accomplish a task which accurately represents the meaning of the concept learned. In this research, concept mastery was measured using an achievement test consisting of 25 Multiple Choice Questions covering the cognitive domains from C1 to C3, which includes 7 questions of C1 (remembering), 11 questions of C2 (understanding) and 8 questions of C3 (applying).
4. Matter is anything which occupies space and has mass. In this research, matter was the concept which was taught to the students using multiple intelligence-based learning.

E. Assumption

The assumptions which were used as the foundations of this research were as follows:

1. Multiple intelligence based learning will increase students' concept mastery (Abdi, Laei & Ahmadyan 2013).
2. Interest is one of the most important motivational variables and has significant impact on achievement (Blankenburg & Hoffer, 2015).

F. Hypotheses

H_0 : Multiple Intelligence based learning has no significant effect towards students' concept mastery in learning matter.

H_1 : Multiple Intelligence based learning has a significant effect towards students' concept mastery in learning matter

H_0 : Multiple Intelligence based learning has no significant effect towards students' interest in learning matter.

H_1 : Multiple Intelligence based learning has a significant effect towards students' interest in learning matter.

G. Research Instrument

In this research, the instruments were used in order to obtain the research data. Table 3.2 states the instruments which were used in this research:

Table 3.2 Research Instruments

No.	Instrument	Data Obtained
1.	Observation Sheet	Implementation of Multiple Intelligence-Based Learning
2.	Achievement Test	Students' Concept Mastery
3.	Interest Scale	Students' Interest Level

Further description of the above research instruments are described as follows:

1. Observation Sheet

The observation sheet in this research contains the Multiple Intelligence-Based Learning activities which has to be done by the researcher in implementing the Multiple Intelligence- Based Learning adopted from Activities to Develop the Eight Intelligences (Palmberg,2011), which was then developed into multiple intelligence - based activities related with the concepts of matter . The function of the observation sheet used in this research was as a guideline to make sure that the researcher follows the appropriate activities while implimenting the Multiple Intelligence-Based Learning during the research implementation. The observation sheet was filled by the observer who was the science teacher of the school. The table below shows the blueprint of the observation sheet used in this research:

Table 3.3 Observation Sheet Blueprint

No	Concept	Intelligence/ Activity			
		Visual-Spatial	Logical-Matthe-matical	Inter-personal	Verbal-Linguistic
1.	a. Matter around us b. States of matter : Solid, liquid and gas	1. Mind mapping	1. Learning scientific models	1.Group work	1. Listening to teacher's instructions and explanation

No	Concept	Intelligence/ Activity			
		Visual-Spatial	Logical-Mathematical	Inter-personal	Verbal-Linguistic
2.	The movement of matter particles	1. Looking at teacher's demonstration 2. Card Game	1.Simple experiments on diffusion in liquid	1.Group Discussion .	1. watching a video.
3.	The classification of matter	1.Cross-word puzzle game.	1.Predicting and classifying.	1. Sharing.	Presentation .

2. Achievement Test

In this research, the achievement test was used to measure students' concept mastery which consists of 25 Multiple Choice Questions which includes the first three student cognitive dimensions: remembering (C1), understanding (C2) and applying (C3), based on Bloom's Taxonomy (Anderson and Krathwohl, 2001). In this research, the achievement test were given in the pretest and posttest. Table 3.3 below shows a blueprint of the achievement test in matter.

Table 3.4 Achievement Test Blueprint

No	Concept	C1	C2	C3	Total
1.	Definition and example of matter around us.	2,3	1	4	4
2.	States of matter: Solid, liquid and gas	6,10,11	5,7,8, 12,13	9,14	10
3.	The movement of matter particles	17	15,16,19	18	5
4.	The classification of matter: elements, compounds and mixtures.	20	21,22	23,24 25	6
Total Number of Questions		7	11	8	25

The achievement test was distributed to the students for pre-test and post-test. The purpose of giving a pre-test was to find out students existing or prior knowledge on matter. Meanwhile the post-test was given to investigate the improvement of students' concept mastery in matter after being taught using the Multiple Intelligence-Based Learning.

In order for the test items of the research instruments to be appropriate for this research, the test items were firstly checked for its validity as follows:

a. Validity

Validity is the appropriateness, meaningfulness, correctness and usefulness of an implication made by a researcher. It is the evidence gathering and analyzing process to support inferences (Fraenkel and Wallen 2009). The type of validity which will be used in this research is the content validity, it refers to the instrument content and format.

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

Where,

r_{xy} = items correlation coefficient

X = items scores

N = number of subjects

(Minium et al., 1993)

The above formula can be used to determine test item validity. The following table can be used to interpret the validity of each item.

Table 3.5 Interpretation of r value (Correlation)

Gained r value	Interpretation
0.80 – 1.00	Very high

Gained r value	Interpretation
0.60 – 0.79	High
0.40 – 0.59	Prosperous
0.20 – 0.39	Low
0.00 – 0.19	Very low

(Jacobs and Chase, 1992)

b. Reliability

Reliability is defined as the consistency of the obtained scores, it is the consistency of every individual from one instrument administration to another and from one item set to another which focus on accuracy and preciseness.(Kaplan and Saccuzzo, 2012).Therefore, reability will be calculated using the following formula:

$$\alpha = \frac{K}{K - 1} \left(1 - \frac{\sum_{i=1}^K \sigma_{Yi}^2}{\sigma_x^2} \right)$$

Where,

K = number of items

σ_x^2 = the variance (square of standard deviation)

σ_{Yi}^2 = observed variance from item i

(Cronbach, 1951)

Table 3.6 Interpretation Reability Coefficient

Gained r value	Interpretation
0.80 – 1.00	Very high
0.60 – 0.79	High
0.40 – 0.59	Prosperous
0.20 – 0.39	Low
0.00 – 0.19	Very low

(Jacobs and Chase, 1992)

c. Difficulty Level

Difficulty level in this research refers to the degree of difficulty for students to answer the questions which is not from teacher's perspective. The higher the degree of difficulty of the item, the lower the difficulty level (Wood, 1960). In order to obtain the difficulty level of an item, the number of students or respondents with correct answer is divided by the total number of students or respondents. Below is the formula that will be used to find the difficulty level :

$$P_i = \frac{A_i}{N_i}$$

Where:

P_i = Difficulty Level

A_i = Number of students who answers correctly

N_i = Total number of student

Table 3.7 Categories of Difficulty Index

Difficulty Index Value (P _i)	Category
0.00 – 0.30	Difficult
0.31 – 0.70	Moderate
0.71 – 1.00	Easy

(Arikunto, 2010)

d. Discriminating Power

Discriminating power is defined as the level to which a score differs with trait level, it is also the effectiveness of this score to compare between high trait respondents and low traits respondents (Backhoff, Larrazolo and Rosas, 2000). The formula to be used in order to obtain the discriminating power is :

$$D_i = \frac{GA \text{ correct answers} - GB \text{ correct answers}}{N \text{ largest group}}$$

Where:

Di = Discrimination index of item i

GA _{correct answers} = Number of correct answers to item i among 27% of highest score achiever.

GB _{correct answers} = Number of correct answers to item i among 27% of lowest score achiever.

N _{largest group} = Number of person in the largest group (GA or GB)

Table 3.8 Discriminating power of the answers according to their D value

D =	Quality	Recommendations
>0.39	Excellent	Retain
0.30 – 0.39	Good	Possibilities for improvement
0.20 – 0.29	Mediocre	Need to check / review
0.00 – 0.28	Poor	Discard or review in depth
< -0.01	Worst	Definitely discard

(Backhoff, Larrazolo, & Rosas, 2000)

e. Distractor

Distractors are the incorrect option which is provided in a multiple choice question and students are to choose the correct option. Usually there are four choices provided in each multiple choice question.

$$\text{corrected score} = R - \frac{W}{n - 1}$$

Where,

R = number of right answers

W = number of wrong answers

n = number of choice in each item

(Kaplan and Saccuzo, 2012)

3. Student Interest Scale

Student Interest Scale in the form of likert scale survey was used to measure the level of interest of each student as a response after

Wida Nur Wahyu Pratiwi, 2017

THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY AND INTERES IN MATTER

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu

experiencing learning matter through Multiple Intelligence Based Learning. In this research, the Student Interest Scale was distributed after the implementation of the Multiple Intelligence - Based Learning. The student interest scale in this research was adopted from Glynn and Koballa (2006), which was then developed and validated by three experts from the lecturers.

H. Instrument Analysis Result

1. Recapitulation of Achievement Test Instrument

Table 3.8 shows the instrument analysis result which was analysed after being tested to the year 8 and year 9 students of the same school, who have learnt about matter concepts when they were in year 7. The test results were then tested for its validity, reability, discriminating power and difficulty level. The recapitulation of each test items are shown in the following :

Realibility Level: 0.86 (Very High Realibility Level)

Table 3.9 Recapitulation of Achievement Test Items

No	DP	Category	DL	Category	Validity	Cate gory	Decision
1	77.78	Excellent	50.00	Medium	0.570	V.High	Used
2	55.56	Excellent	70.59	V. Easy	0.530	V.High	Used
3	11.11	Poor	79.41	Easy	0.297	V.Low	Revised
4	55.56	Excellent	76.47	Easy	0.504	V.High	Used
5	33.33	Good	17.65	Difficult	0.350	V.Low	Used
6	33.33	Good	91.18	V. Easy	0.500	V.High	Used
7	22.22	Medicore	51.88	Medium	0.351	V.Low	Used
8	77.78	Excellent	58.82	Medium	0.503	V.High	Used
9	66.67	V Poor	47.06	Medium	0.410	High	Used
10	0.00	V Poor	14.71	VD	-0.125	V.Low	Revised
11	33.33	Good	61.76	Medium	0.417	High	Used
12	66.67	Excellent	73.53	Easy	0.650	V.High	Used
13	22.22	Medicore	94.12	V. Easy	0.323	V.Low	Revised
14	0.00	V Poor	94.12	V. Easy	0.057	V.Low	Revised

Wida Nur Wahyu Pratiwi, 2017

THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY AND INTERES IN MATTER

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu

No	DP	Category	DL	Category	Validity	Category	Decision
15	77.78	Excellent	67.65	Medium	0.612	V.High	Used
16	44.44	Excellent	79.41	Easy	0.452	High	Used
17	66.67	Excellent	73.53	Easy	0.445	High	Used
18	44.44	Excellent	61.76	Medium	0.431	High	Used
19	55.56	Excellent	82.35	Easy	0.544	V.High	Used
20	22.22	Medicore	41.18	Medium	0.189	V.Low	Used
21	44.44	Excellent	70.59	V. Easy	0.453	High	Revised
22	0.00	V.Poor	41.18	Medium	0.105	V.Low	Revised
23	55.56	Excellent	58.82	Medium	0.474	High	Used
24	44.44	Excellent	67.65	Medium	0.344	V.Low	Used
25	33.33	Excellent	17.65	Difficult	0.277	V.Low	Used

2. Instrument Non-Test Requirement

There were two instruments of non-test requirements in this research, which were Students' Interest Scale and observation sheet. The Students' Interest Scale adopted from Glynn and Koballa (2006), was developed and then validated by three experts. The Students' Interest Scale was distributed to students after they were taught the matter concepts using the Multiple Intelligence-Based Learning, it consists of questions which triggers their respond towards the Multiple Intelligence - Based Learning when they learn the topic Matter. The observation sheet which consists of the Multiple Intelligence Based activities which has been aligned with Activities to Develop the Eight Intelligences (Palmberg,2011) is filled by the observer during the implementation of Multiple Intelligence-Based Learning. The observer place a tick mark on the last column after an activity was done by the researcher.

I. Data Processing Technique

In this research, the researcher gathered only one type of data which was quantitative data . The data which were gathered in the research were gained from the students'pre-test and post-test achievement tests which

Wida Nur Wahyu Pratiwi, 2017

THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY AND INTERES IN MATTER

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu

will then describe the whether there is an improvement in students concept mastery or not, and the other data was gathered from the students interest scale to describe the level of interest of each student after being taught using Multiple Intelligence – Based Learning. Further explanation on data processing techniques are explained as follows:

1. Quantitative Data Processing

Quantitative data analysis was calculated using Microsoft Excel, in order to determine the score of pre-test and post-test. The process of data calculation is explained as follows:

a. Scoring of Test Item

The first step to process data was by scoring the test item which consists of 25 test questions.

b. Calculation of Gain Score and Normalized Gain

After scoring the test items, the data was then processed to find the gain and Normalized Gain scores. Gain score is obtained from the difference between pretest and posttest. It is also an assumption the effect from the given treatment. It was assumed as the effect of the treatment given (Hake, 1998). He suggested the following formula in determining the Gain Score:

$$G = S_f - S_i$$

Description:

G = Gain Score
 S_f = Post test Score
 S_i = Pre test Score

(Hake, 1998)

The effect of Multiple Intelligence Based Learning approach towards students' concept mastery in learning matter was determined from the result of normalized gain which was achieved by students during learning process. The formula which was used to calculate normalized gain regarding to Hake (1998) is:

Normalized gain of each student $\langle g \rangle$ was determined by this formula:

$$\langle g \rangle = \frac{\%G}{\%G_{max}} = \frac{\%S_f - \%S_i}{100 - \%S_i}$$

Description:

$\langle g \rangle$ = Normalized gain
 G = Actual gain
 G_{max} = Maximum gain possible
 S_f = Post - test score
 S_i = Pre - test score

Average of normalized gain ($\langle g \rangle$) which is formulated as:

$$\langle g \rangle = \frac{\% \langle G \rangle}{\% \langle G \rangle_{max}} = \frac{(\% \langle S_f \rangle - \% \langle S_i \rangle)}{(100 - \% \langle S_i \rangle)}$$

Description:

$\langle g \rangle$ = Normalized gain
 $\langle G \rangle$ = Actual gain
 $\langle G \rangle_{max}$ = Maximum gain possible
 $\langle S_f \rangle$ = Average of post test score
 $\langle S_i \rangle$ = Average of pre test score

The value of Normalized gain that has been gained is interpreted using interpretation table as follows:

Table 3.10 Interpretation of Normalized Gain

Value	Classification
$\langle g \rangle \geq 0.7$	High
$0.7 > \langle g \rangle \geq 0.3$	Medium
$\langle g \rangle < 0.3$	Low

(Hake, 1998)

c. Normality and Homogeneity Test

According to the parametric statistic which assumes that each variable in this research will only be analysed from a normal distribution. Which means that the data has to be normalised in order to be tested for homogeneity variance. Normality test is used to see whether the sample is distributed normally. In this research, SPSS 17 was used to obtain the normality test.

The normal distribution is determined by referring to the significant value of *Shapiro-Wilk* which has been approved for its effectiveness in measuring normality even for a small size sample ($n < 20$) (Shapiro and Wilk, 1965). Once it achieves significance level (α) > 0.05 , then H_0 is accepted while H_1 is rejected. If the significance level < 0.05 , so the H_0 is rejected. The hypotheses are:

H_0 : Sample comes from population that has normal distribution.

H_1 : Sample comes from population that has not normal distribution.

Homogeneity test was also gained from the SPSS result. The data is considered as homogeneous once the significance value is ≥ 0.05 .

d. Paired Sample T-Test

In this research, in order to determine whether the students have achieved the standard score after being treated with Multiple Intelligence Based Learning, a Paired sample T-Test was done post-test score. Data was then normalised and homogenised first. In order to do the T-Test in SPSS 17, H_0 is accepted if the significance level is ≤ 0.05 while it will be rejected if its significance level ≥ 0.05 .

2. Qualitative Data Processing

The qualitative data in this research were obtained from the observation sheet and student interest scale. The analysis of the

observation sheet was done by converting the raw score into percentage using the following equation:

$$P = \frac{R}{MS} \times 100\%$$

(Arikunto, 2010)

Where:

P = Percentage

R = raw score

MS = maximum score

The percentage calculated from the observation sheet of multiple intelligence based learning was then categorized according to Arikunto (2010) shown in Table 3.11 :

Table 3.11 Interpretation of Multiple Intelligence Based Learning Implementation

No	Percentage (%)	Interest Level
1.	80 – 100	Very Good
2.	66 – 79	Good
3.	56 – 65	Enough
4.	40 – 55	Lack
5.	< 40	Very lack/ Failed

(Arikunto, 2010)

Percentages of Students' Interest Scale was obtained using the following formula:

$$P = \frac{f}{n} \times 100\%$$

Where:

P = Percentage

F = Frequency of answer

N = Total of response

(Sugiyono, 2011)

The result of the above percentage is then categorised into the following level of interest in table 3.12 :

Table 3.12 Interest Level Rubric

No	Percentage	Interest Level
1.	< 21%	Very Low
2.	21% - 40 %	Low
3.	41% - 60%	Medium
4.	61% - 80%	High
5.	81% - 100%	Very High

J. Research Procedure

There were three main stages in the research procedures in order for this study to be done. The stages were preparation; implementation; and completion stages. Those three stages are explained as follows:

1. Preparation Stage

There were several steps that were done in the preparation stage as follows:

- a. Formulate the problem which was to be investigated.
- b. Determine the focus of variable research.
- c. Conduct literature review of Multiple Intelligence Based Learning towards students' interest and concept mastery in matter.
- d. Arrange the research proposal to be presented in the proposal seminar.
- e. Consultation with experts.
- f. Present the research proposal in the proposal seminar.
- g. Suggestions and comments from lecturers and experts.
- h. Revision of research proposal.

- i. Arrange research instrument and ask for expert judgment.
- j. Revision of research instruments.
- k. Testing revised research instrument.
- l. Revision of tested instruments

2. Implementation Stage

This stage consist of the data gathering process which includes several steps as follows:

- a. Conduct pre-test in order to find out the initial condition.
- b. Analyze pre-test results.
- c. Conduct post-test to class in order to find out the effect made by the treatment.
- d. Hand out questionnaire in order to find out students' respond towards the Multiple Intelligence Based Learning.

3. Completion Stage

This step is where researcher analyse the collected data gained during the implementation stage. This stage has also several steps :

- a. Analyze the results of the overall research.
- b. Discuss and conclude for the data analysis result.
- c. Arrange the report of the research.

4. Research flowchart

In order to have a clear overview on the research procedures, Figure 3.1 below shows the simplified research flowchart of this research.

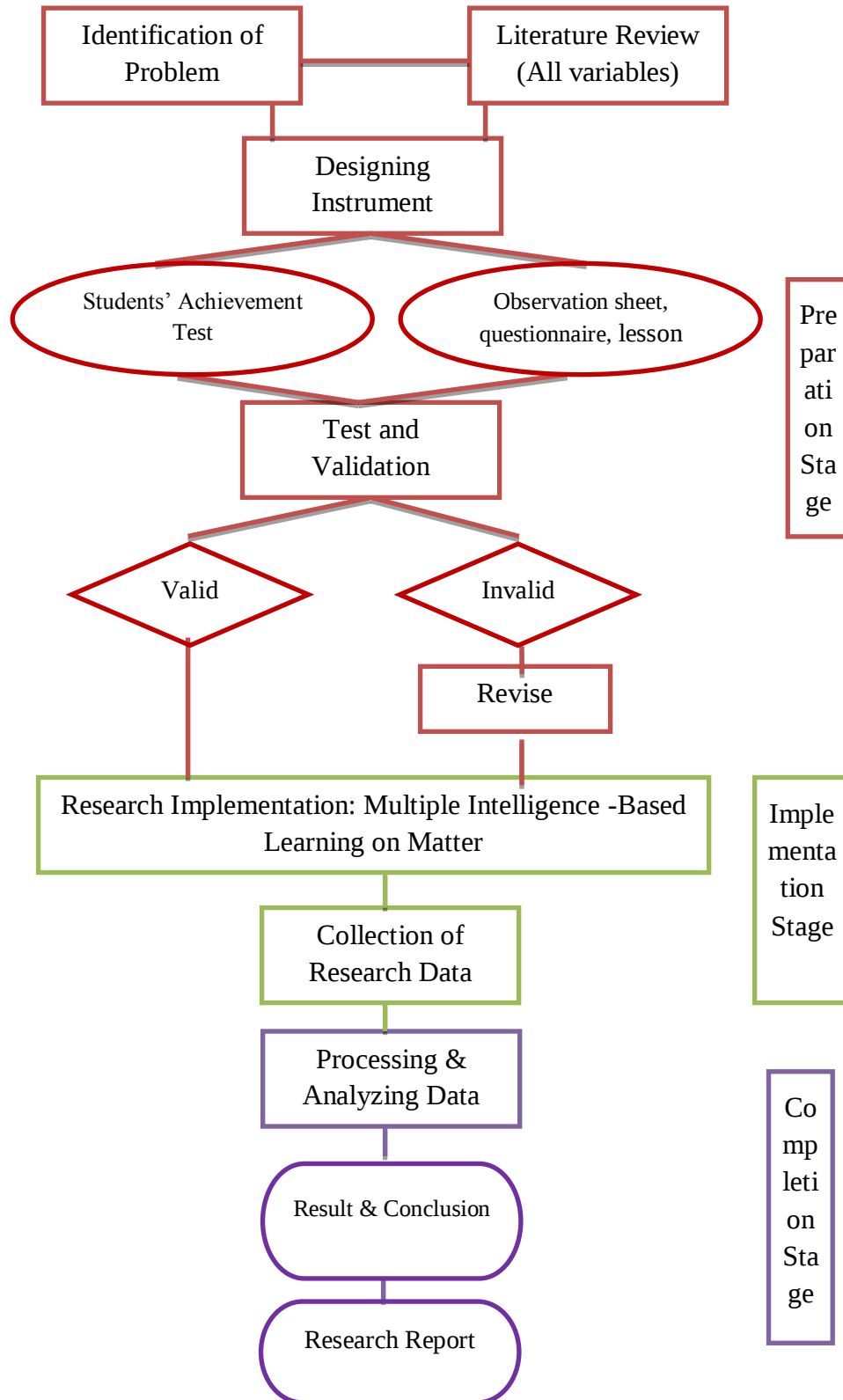


Figure 3.1 Research Flowchart

Wida Nur Wahyu Pratiwi, 201

THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY AND INTERES IN MATTER

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu

Wida Nur Wahyu Pratiwi, 2017

***THE EFFECT OF MULTIPLE INTELLIGENCE - BASED LEARNING TOWARDS STUDENTS' CONCEPT MASTERY
AND INTERES IN MATTER***

Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu