CHAPTER III
RESEARCH METHODOLOGY

A. Research Method and Research Design

1. Research Method

The research has a purpose to describe the current condition of learning environment and cognitive ability of students when discussion is implemented in teaching learning activities. According to this, then descriptive method is used to fulfill the aim of research itself. In the descriptive, the main objective is to give a very accurate portrayal of characteristics of persons, situations, or groups (Polit & Hungler, 2004). Thus, in this research, the object of research is not given any treatment and natural condition is set without any manipulation. It will provide reasonable answer why something is occured (Arikunto, 2010).

2. Research Design

Non-experimental with natural descriptive design is used in this research. All of students come from two classes of seventh grade are given pre-test and post-test. Those score are captured as the data of cogitive ability of students. After that, Classroom Learning Environment Survey (CLES) is a questionnaire given to the students after the instruction is done. The result of this questionnaire is also taken as the data of learning environment. The last, interview is conducted to clarify all of results which are gained in this research. Based on those results, the profile of learning environment and cognitive ability of students could be identified.

B. Population and Sample

The location of this research is Sekolah Indonesia Kuala Lumpur (SIKL) Malaysia which uses National Curriculum of 2013. The instruction in classes is mainly conducted in Bahasa Indonesia.

The population of this research is all students in SIKL. The sample are 7-1 class which consist of 11 students and 7-2 class which consist of 13 students. So, the number of all students is 24 students. All of students in both classes experience discussion in learning environmental pollution as it is the main focus of this research. The subject of this research is defined under purposed of class which used to implement discussion in teaching learning activities.

C. Operational Definition

In order to avoid misconception, some operational definitions are explained in this research. Those terminologies are explained as follow:

a. Learning activity in both classes is discussion which refers to statement of Discussion is a process whereby two or more people express, clarify and pool their knowledge, experiences, opinions, and feelings to achieve their current purposes (Rahman et al., 2011). In this research, students gather with three until four friends and they try to solve problem about environmental pollution given by the teacher. Discussion is intended as the way to look cognitive ability of students. Therefore, post-test is done in the end of discussion to evaluate this aspect.

b. Cognitive ability of students in this research includes level of remembering (C1), understanding (C2), applying (C3), analyzing (C4), and evaluating (C5) based on Anderson et al. (2001). Data of cognitive ability itself are gained by giving cognitive paper test to students in the form of multiple choice questions.

c. Classroom learning environment in this research refers to Constructivist Learning Environment Survey (CLES) which has been developed by Taylor and Fraser (1991). CLES consists of five aspects such as personal relevance, uncertainty, critical voice, shared control, and student negotiation. In this research, classroom learning environment is obtained

by quistionnaire. Data obtained through questionnaire is adjusted with CLES aspects.

D. Research Instrument

In this research, instrument is necessary to be used for gaining data. There are three types instruments that are used in this research. Those instruments are described below:

a. Questionnaire

Questionnaire is an instrument which is distributed to the students to investigate and describe the classroom learning environment after teacher conducting instruction. Questionnaire used is based on Classroom Learning Environment Survey format which was developed by Taylor and Fraser (1991). This questionnaire results the students' perception about how the teaching learning process going on and finally give the description about classroom learning environment. There are five indicators which is measured in this questionnaire. Questionnaire consists of 30 statements, 28 are positive statements while 2 are negative statements. The blueprint of questionnaire based on CLES is shown below on Table 3.1.

Table 3.1 Blue Print of Questionnaire Based on CLES

Indicators	Question' number
Personal Relevance	1,2,3,4,5,6
Uncertainty	7,8,9,10,11,12
Critical Voice	13,14,15,16,17,18
Shared Control	19,20,21,22,23,24
Student Negotiation	25,26,27,28,29,30

b. Cognitive Paper Test

Cognitive paper test is conducted to describe cognitive ability of students in mastering the concept. Cognitive paper test consists of two sections such as pre-test and post-test. Pre-test is given to students before teacher conduct the instruction in classroom while post-test is given to

the students after teacher conducting instruction in classroom. Pre-test is intended to know students' prior knowledge about the concept of environmental pollution. Post-test is conducted in the end of teaching learning process. It is intended to know whether the improvement of students' cognitive is gained after teacher conducting instruction or not. This cognitive paper test is given in the form of multiple choice question.

Multiple choice question consists cognitive domain from C1 until C5 which is about knowledge, comprehension, application, analysis, and evaluation (Anderson et al., 2001). Cognitive paper test firstly consists of 30 questions after passing judgement by expert. It is used to look students' cognitive starting from C1 until C5. Then, it is distributed to students in grade 8 as a limited test. The blueprint of instrument before passing instrument analysis step is described in Table 3.2 below.

Table 3.2 Blue Print of Cognitive Paper Test Question

Concept	Cognitive Level					Total
	C1	C2	C3	C4	C5	
Interaction between biotic and abiotic factor	3	5	2	3	1	14
Factors that can destruct environment	2	1	-	2		5
Effects that can be resulted by environmental pollution	1	-	3	-	3	7
Solutions that can be done by human to maintain the environment.	-	2	-	1	1	4
Total	6	8	5	6	5	30

The next step after conducting limited test to 8 grade students is analyzing this objective test using ANATES. Based on this analysis, 10 questions are used directly and there are 10 questions which are revised. The new blueprint of objective test is shown below on Table 3.2.

Table 3.3 Blue Print of Objective Test after Passing Instrument Analysis

Concept	Cognitive Level					Total
	C1	C2	C3	C4	C5	
Interaction between biotic and abiotic factor	1	3	2	1	1	8
Factors that can destruct environment	-	1	-	3	-	4
Effects that can be resulted by environmental pollution	-	1	1	1	1	4
Solutions that can be done by human to maintain the environment.	-	2	-	1	1	4
Total	1	7	3	6	3	20

c. Interview Sheet

Interview sheet is an instrument which is used to collect student statement about learning activities that have been conducted in classroom. This interview is given to students after they finish whole activites starting from pre-test until post-test as the end of learning activites. Interview sheet consists of students statement how their feeling was during learning activities. Students are asked about learning style they like the most, the opinion about discussion, their conformity during discussion such as influence of different gender and personal

intelligence, and their interest towards science subject. The blueprint of interview sheet are shown below on Table 3.4.

Table 3.4 Blue Print of Interview Sheet

No	Question	Answer
1	What is your best learning style? State your reason	
2	Do you like discussion method? State your reason	
3	Which one do you like. Doing discussion with similar gender or doing discussion with different gender? State your reason	
4	Which one do you like. Doing discussion with smarter friends or doing discussion with person whose achievement is not too high and not too low? State your reason	
5	What is the thing you do not like when doing discussion?	
6	Do you like science subject? State your reason	
7	Do you like environmental pollution chapter? State your reason	
8	Is your spirit in learning a subject defined first by your interest toward that subject? State your reason	

E. Instrument Analysis

Instrument analysis is done by judgement expert and ANATES V4. Cognitive paper test which is used in limited test firstly is judged by expert. Then, limited test could be conducted. The results of limited test is analyzed by ANATES. Aspects which are analyzed such as validation, reliability, level of difficulty, discriminating power, and distractor which should fulfill the criteria.

1. Validity

Based on Arikunto (2013), evaluation of instrument must be valid in order to get a valid result of the activities conducted. Anderson in Arikunto (2013) said that a test is valid if it measures what it purpose to measure. The validity which is used is content validity. Content validity measures a particular purpose which is still relevant with the material/concept given to the students. The formula to investigate the number of validity is product moment correlation, shown as follow

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

r_{xy} : correlation coefficient between X variable and Y variable

The validity interpretation is represented below on Table 3.5.

Table 3.5 Validity Interpretation

Correlation Coefficient	Validity Criteria
0,00 < r ≤ 0,20	Very Low
0,20 < r ≤ 0,40	Low
0,40 < r ≤ 0,60	Satisfactory
0,60 < r ≤ 0,80	High
0,80 < r ≤ 1,00	Very high

(Arikunto, 2013)

2. Reliability

Reliability is related with trust. A test which has a high level of trust then usually can give a consistent result in repeated trials. It means that the reliability of a test will be very related with the consistency of test results itself (Arikunto, 2013).

The formula which is used to define the reliability of objective test which is multiple question is alpha formula.

$$r_{11} = \left[\frac{n}{n-1}\right]\left[1 - \frac{\sum \sigma_i^2}{\sigma_i^2}\right]$$

r_{11} : Instrument reliability
n : Amount of question
$\sum \sigma_i^2$: Amount of variant score in each item
σ_i^2 : Varian total

The reliability interpretation is represented below on Table 3.6.

Table 3.6 Reliability Interpretation

Reliability Coefficient	Reliability Criteria
0,00 < r ≤ 0,20	Very Low
0,20 < r ≤ 0,40	Low
0,40 < r ≤ 0,60	Satisfactory
0,60 < r ≤ 0,80	High
0,80 < r ≤ 1,00	Very high

(Arikunto, 2013)

3. Level of Difficulty

According to Arikunto (2013), level of difficulty is a term which show the level of question, whether it is easy to solve or hard to solve. Difficulty index is usually used as the number to show the difficulty level of question. The range of level of difficulty is from 0,00 to 1,00. The lower the index, then the more difficult the question and vice versa.

The formula that is used to measure the level of difficulty (difficulty index), shown as follow.

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

P : Difficulty index
B : Number of students who answer the question correctly
JS : Number of all students who join the test

The difficulty index interpretation is represented below on Table 3.7.

Table 3.7. Difficulty Index Interpretation

Reliability Coefficient	Validity Criteria
0,00 < P < 0,30	Difficult
0,30 < P < 0,70	Middle

0,70 < P < 1,00	Easy

(Arikunto, 2013)

4. Discriminating Power

Discriminating power is an ability of question to discriminate between high-achiever students and low-achiever students (Arikunto, 2013). Number that shows discriminating power is called as discriminant index (D). Discriminant index range is about 0,00 to 1,00. Good questions will have discriminant index between 0,4 and 0,7 (Arikunto, 2013).

The formula of discriminant index is

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

D : Discriminating Power (Discriminant Index)
B_A : Number of high-achiever students which answer the question correctly
B_B : Number of low-achiever students which answer the question correctly
J_A : Total of students in upper group
J_B : Total of students in lower group
P_A : Proportion of upper group who answer question correctly
P_B : Proportion of lower group who answer question correctly

P is level difficulty

The discriminant index interpretation is represented below on Table 3.8.

Table 3.8 Discriminant Index Interpretation

Discriminant Index Coefficient	Discriminant Index Criteria
0,00 < D ≤0,20	Poor
0,20 < D ≤0,40	Satisfactory
0,40 < D ≤0,70	Good
0,60 < D ≤1,00	Excellent
D = negative	Question is deleted

(Arikunto, 2013)

5. Distractor

A good distractor can be defined when an option is chosen by almost of students. Students think that the option is the best answer while it is actually the wrong answer. Distractor which even is not chosen by students is actually bad, because it can not attract student' mind to consider the option as the best answer (Arikunto, 2013).

Due to the result of limited test, the reliability of test is 0,81. The average score is 22,41. The number of question which is used directly in research is 10 and the number of question which is revised based on analysis of ANATES is 10. The blue print of limited test analysis result by ANATES is shown below on Table 3.9.

Table 3.9 Blue Print of Limited Test Analysis Result by ANATES

Number of Questions	Discriminating Power	Level of Difficulty	Validity	Correlation Significant	Note
1	Poor	Very easy	Satisfactory	Very significant	Used
2	Satisfactory	Very easy	Satisfactory	Very significant	Used
3	Satisfactory	Medium	Low	-	Revised
4	Excellent	Medium	Satisfactory	Very significant	Used
5	Poor	Very easy	Very Low	-	Revised
6	Good	Medium	Satisfactory	Very significant	Used
7	Good	Very easy	Satisfactory	Significant	Used
8	Poor	Very easy	Satisfactory	Very significant	Used
9	Good	Difficult	Low	Significant	Used
10	Poor	Very easy	Low	-	Revised
11	Satisfactory	Medium	Low	Significant	Used
12	Poor	Easy	Low	-	Revised
13	Satisfactory	Medium	Low	-	Revised
14	Satisfactory	Very easy	Low	-	Dropped
15	Poor	Very easy	Very Low	-	Revised
16	Poor	Very easy	Very Low	-	Revised

Number of Questions	Discriminating Power	Level of Difficulty	Validity	Correlation Significant	Note
17	Poor	Medium	Very Low	-	Dropped
18	Poor	Very easy	Very Low	-	Dropped
19	Good	Medium	Satisfactory	Very significant	Used
20	Good	Easy	Satisfactory	Very significant	Dropped
21	Poor	Very easy	Very Low	-	Revised
22	Poor	Very easy	Not Valid	-	Dropped
23	Satisfactory	Medium	Very Low	-	Dropped
24	Poor	Very easy	Satisfactory	Very significant	Used
25	Satisfactory	Very easy	Satisfactory	Very significant	Dropped
26	Good	Easy	Satisfactory	Very significant	Dropped
27	Satisfactory	Easy	Low	-	Dropped
28	Excellent	Medium	Satisfactory	Very significant	Used
29	Poor	Very easy	Very Low	-	Revised
30	Poor	Easy	Very Low	-	Dropped

F. Data Collecting

Data collecting is done by giving students objective test (pre-test and post-test) and questionnaire based on CLES. The instrument which is used in written test is multiple choice question while the instrument which is used to get the profile of classroom learning environment is based on Constructivist Learning Environment Survey (CLES). The blueprint of data collecting is shown below on Table 3.10.

Table 3.10 The Blue Print of Collecting Data

Dependent Variable	Data Source	Method of Data Collecting	Instrument
Cognitive ability of students in learning environmental pollution	Students who experience discussion in instruction	Cognitive Paper Test	Multiple choice questions
Learning environment	Students who experience	Questionnaire	CLES questionnaire

	discussion in instruction		Students' Interview

G. Data Analysis Technique

Data analysis is done by calculating the score of pre-test and post-test of students. The average of pre-test and post-test score is also calculated. Another aspects that would be described on analysis pre-test and post-test such as the highest and the lowest score, percentage of students who pass the average score and cognitive level achievement that is achieved by students.

Furthermore, questionnaire based on CLES' results is analyzed by using summated rating, which is well-known as Likert Scale. Scoring on each aspect on CLES is based on positive statement and negative statement stated. Scoring for positive statement and negative statement is shown below on Table 3.11.

Table 3.11 Scoring for Positive Statement and Negative Statement on CLES questionnaire

Scale	Scoring	
	Positive statement	**Negative statement**
Almost never	1	5
Seldom	2	4
Sometimes	3	3
Often	4	2
Almost always	5	1

(Sugiono, 2011)

Score of each aspect is gained based on the scoring above and it is analyzed based on the average score of agreement level. The average score of agreement level of each student defines the agreement level of each aspect as a whole in this research. The average of agreement level is based on this scale on Table 3.12 below.

Table 3.12 The Classification of Agreement Level Average Score

Range of Agreement Level Average	Category

0-1	Almost Never
1,01-2	Seldom
2,01-3	Sometimes
3,01-4	Often
4,01-5	Almost Always

(Taylor and Fraser, 1991)

H. Research Procedure

In order to have a good sequence sistematically in this research, the research procedure is arranged in three stages that should be done. Those three stages are preparation stage, implementation stage, and completion stage.

1. Preparation Stage

   Preparation stage of this research includes,

   a. Conducting study on characteristic of school, students, teacher, and teaching method which will be the part of the research later. This is a very initial step to look for the problem and gain the idea which will be taken for the research.
   b. Conducting literature study. It could be taken from various resources such as book, journals, artcles, and etc.
   c. Defining and analyzing a topic for research including variable.
   d. Defining population and sample which will be used in the research.
   e. Contacting the school and science teacher to ask the permission letter for taking data and doing research at that school.
   f. Constructing the instruments.
   g. Judging all instruments such as objective test, questionnaire, and interview sheet to the expert.
   h. Revising the instruments based on expert' suggestions.
   i. Conducting limited test to 8 grade students.
   j. Analyzing the results of limited test by ANATES.
   k. Revising the instruments become a valid instrument which will be used in the data taking process.

2. Implementation Stage

Implementation stage of this research includes,

a. Conducting research by giving pre-test and post-test after conducting instruction using discussion method.
b. Recording current situation of classroom as learning environment in the sample class.
c. Distributing questionnaire of classroom learning environment to the students.
d. Having interview to students who joined discussion about the process of discussion itself.
e. Research data is finally taken.

Data taking timeline which show how the research is implemented is shown below on Table 3.13.

Table 3.13 Data Taking Timeline of Discussion Implementation

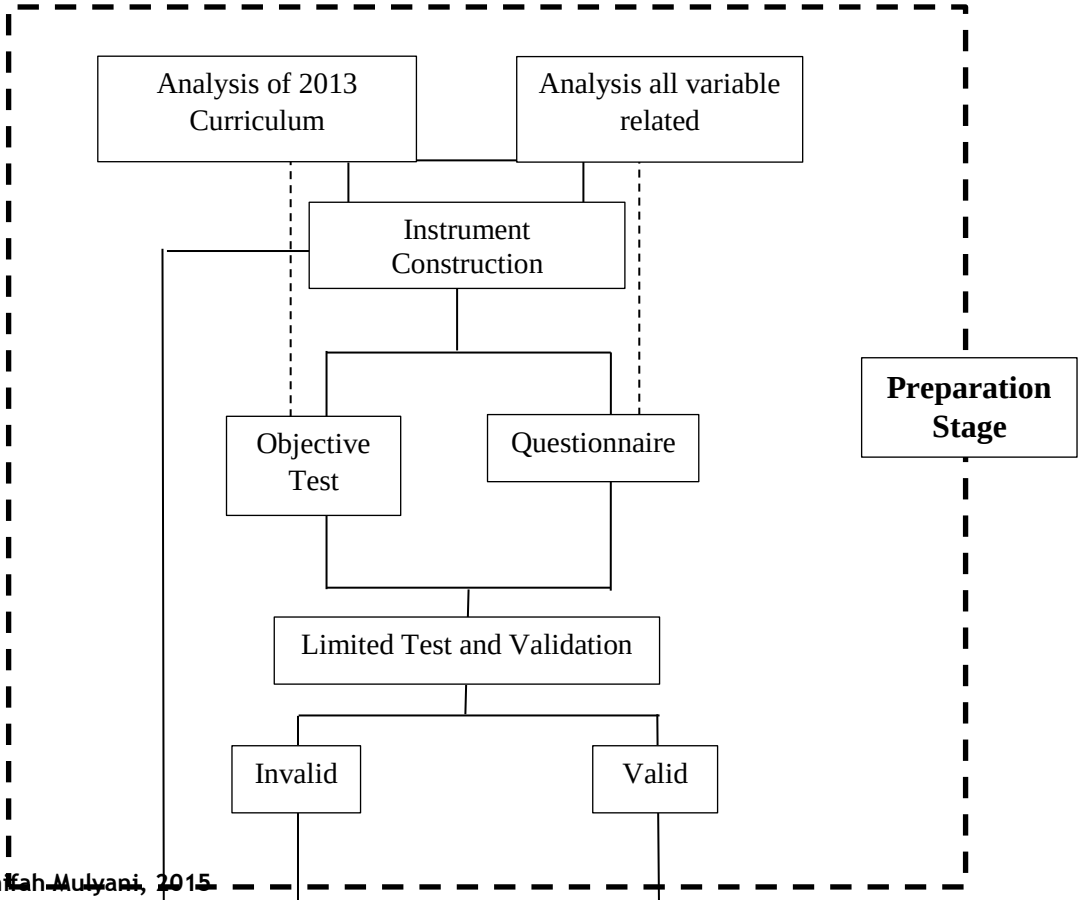
Activity	1st meeting	2nd meeting
Pre-test	30’	
Giving a video about environmental pollution	5’	
Students learn kinds of environmental pollution which are occured nowadays by listening teacher explanation	10’	
Students have a discussion, including make a group poster	45’	
Presenting poster group as students’ discussion result		45’
Post Test		30’
Distributing questionnaire		15’
Having interview about process of discussion	-	-

3. Completion Stage

Completion stage of this research includes,

a. Analyzing research results such as objective test and questionnaire result.
b. Discussing the research results based on related theoritical foundation.
c. Consulting the research result with the lecture regarding to the finishing of this research paper.
d. Drawing conclusion of research based on the research result, discussion, and analysis.
e. Research paper is finally constructed.

4. Research Scheme



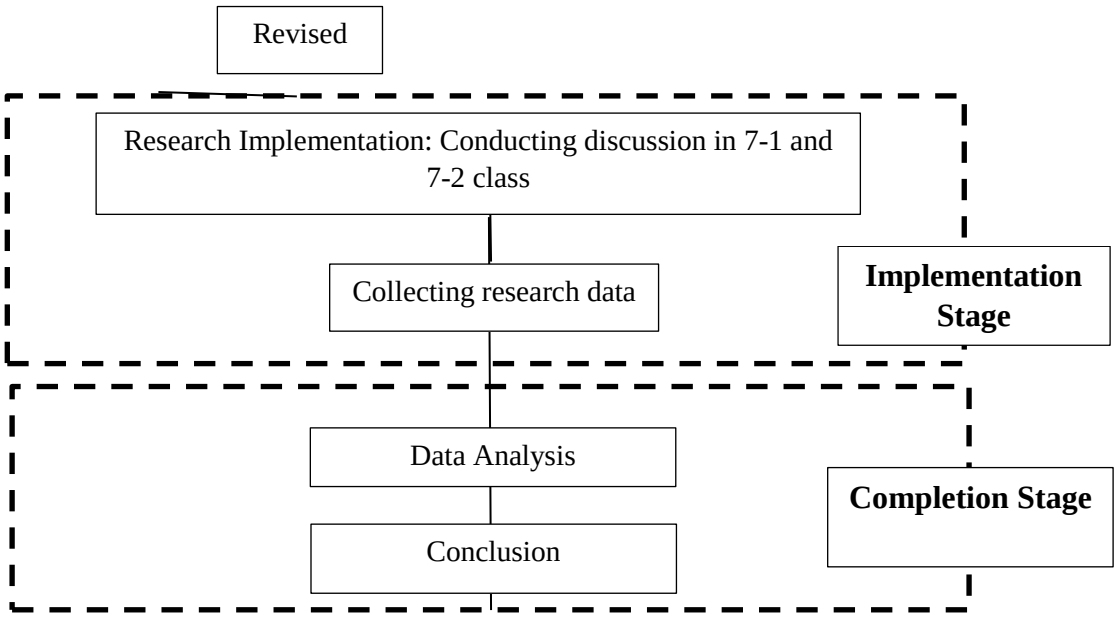


Figure 3.1 Research Scheme