

CHAPTER III

METHODOLOGY

A. Population and Sample

Population of this study comprises of 7th grade in one of public junior high school located in Bandung, Indonesia. One class was chosen as sample of this study, it consisted of 28 students enrolled in even semester which is chosen by purposive sampling.

B. Time and Location

1. Time

Research was conducted from February 2013 until June 2013. Preparation stage was conducted from February 2013 until April 2013, implementation stage was conducted in May 2013 and final stage was conducted in June 2013.

2. Location

Research was conducted in one of public junior high school located in Bandung, Indonesia.

C. Research Method

Quantitative method was used in this research. Quantitative research method is explaining phenomena by collecting numerical data that are analysed using mathematically based methods (Aliaga and Gunderson, 2000). Research method used in this research is pre experiment method as the purpose of the research is appropriate with this method.

D. Research Design

One group pretest-posttest group design is research design that is used in this research. Design determination is considered based on purpose of research to investigate the implementation of grouping type. Hence, the characteristic of design is eventually

compatible with the purpose of research. In this design, one experimental group is arranged to be investigated by given pre-test before the implementation of treatment. The purpose of this step is to investigate student prior skills. Further, the group is given some treatment of grouping type, as the effort to improve student' achievement. Finally, the step is ended by giving posttest in a way to analyze the result of implementation. For further description, research design is illustrated in the following table.



Figure 3.1 Design Illustration of one group Pretest-Posttest

Note :

T₁ = Pre test

T₂ = Post test

X = Treatment by using Grouping type

This research took one class that treated by using two grouping type in the same chapter about pollution and environmental damage concept. The one sub-topic about water pollution has treated by using a homogeneous group and the next sub-chapter about air pollution has treated by using heterogeneous group. Every group in homogeneous and heterogeneous is consisted of 4-5 students. During the learning activity, each group investigated patterns of interaction by an observer using observation sheet that has been judgment. Besides observation sheets, there is also a questionnaire given to the students to find out students' responses to the grouping type.

1. Determine the level of student' ability

This research used results of pre-test to determine student ability level and categorized them into low, medium and high. According Arikunto (2006), to determine the position of a group of students at a high, medium or low, can be done by using the standard deviation.

2. Design of grouping in classroom

After determine student's ability level, class is designed into homogeneous group. This means that each member of the group has the same ability. In first meeting, class is designed for water pollution.

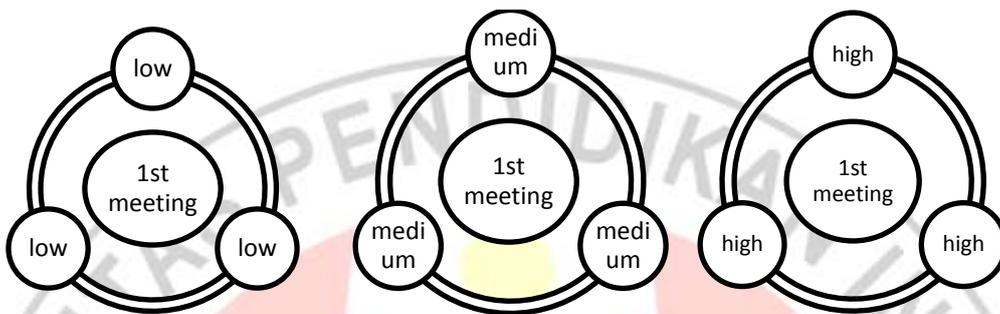


Figure 3.2 Design of grouping in classroom at first meeting

After teaching and learning activities in first meeting is completed, students are grouped into heterogeneous group for air pollution topic. It means that each member of the group has mixed-ability.

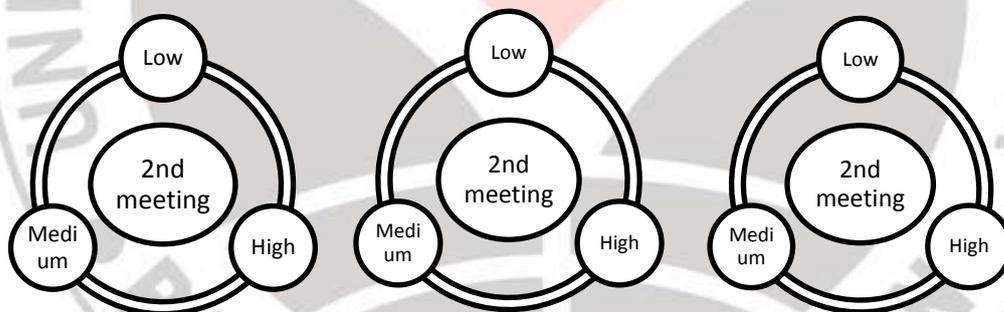


Figure 3.3 Design of Grouping in Classroom at Second Meeting

3. Data collection

Data is collected by using the results of the pretest and post-test, observation sheets and questionnaires. The first pretest and post-test conducted on water pollution topic with homogeneous grouping type and the second pretest and post-test conducted on air pollution topic with heterogeneous grouping type. The result of pretest and posttest are performed statistical tests to notice the significance difference both of groups and

improvement of student achievement for each grouping type. Observation sheet used to look the patterns of interaction that occur during group discussions and questionnaires are used to investigate the response of students and teachers to the grouping strategy based on student ability.

E. Operational Definition

In order to avoid different interpretations of the definition used in this research, it is needed for clarification of the definition of these operations.

1. Grouping type used in this study based on the level of student 'ability. Determination of student ability based on the results of pretest that given at the beginning of learning. Student ability differentiated into low, medium and high. According Arikunto (2006), to determine the position of high, medium or low groups, can be done by using the standard deviation. There are two types of groupings, namely, homogeneous and heterogeneous. Homogeneous group composed of all members of the groups have same ability. Meanwhile, heterogeneous group composed of members of groups that have different abilities. Test given in this study was composed of 4 essay questions about water pollution in homogeneous group and 5 essay questions about air pollution in heterogeneous group.
2. Capability of students' achievement is according to Bloom Taxonomy Revised (Anderson, 2001), this study measured only cognitive domains and more concern to Understanding (C_2) that relate to water pollution and air pollution concepts.
3. Variety of interaction patterns are shown students during the discussion activity. Determination patterns of interaction refers to the interaction patterns proposed by Royhounhury and Roth (1996) which consists of patterns of interaction symmetric, asymmetric, and shifting asymmetric. Patterns of interaction observed during the discussion by using the observation sheet.

F. Research Instrument

This research observed through test and non test instruments. Test instrument consist of pre-test and post test, meanwhile another non test instrument is arranged in the form of observation sheet, student and teacher questionnaires. The instruments will be elaborated as the following explanation.

1. Test

Test consists of pretest and posttest. Pretest is given at the beginning of the meeting before the learning activity. Pretest is used to determine the level of student understanding, and structure of the group formed by the students' ability levels, low, medium and high. Post-test is given at the end of the discussion; post test is used to measure students' achievement of the concept after learning activity. The type of question used is essay question about water and air pollutions. Blueprint of pretest and posttest of water pollution in homogeneous group in the following Table 3.1.

Table 3.1 Blueprint of pretest and post-test of water pollution (homogenous group)

Indicator	Question	Test item number
Identify characteristic of contaminated water	Besides the above quoted article, how do you know the characteristics that Cisadane river polluted?	1
Explain impact of water pollution	According to you, what is the impact of pollution in the river Cisadane on living things and the surrounding environment?	2
	Make the design of experiments to prove that the pollution in the river Cisadane affect living thing which is live in that river?	3
Explain efforts to prevent and solve the problem of water pollution in environment	What efforts should be made to prevent and reduce the impact of water pollution? At least 3 efforts	4

Meanwhile, blueprint of pretest and posttest of air pollution in heterogeneous group in the following Table 3.2.

Table 3.2 Blueprint of pretest and post-test of air pollution (heterogeneous group)

Indicator	Question	Test item number
Mention cause of air pollution	Based on article above, what causes air quality in the city of Bandung decreased?	1
Mention cause of air pollution	Mention substances (pollutants) that can cause air pollution?	2
Explain impact of air pollution	Make the design of experiments to prove that air pollution in your community.	3
	What is the impact caused by the air quality in the city decreased?	4
Explain efforts to prevent and solve the problem of air pollution in environment	What efforts should be made to prevent and reduce the impact of air pollution? Minimum of 3 efforts.	5

Before the instrument used in the research, the instrument must be tested first for validity, and then analyzed whether the instrument is valid to be used as an instrument to take the data.

a. Analysis of test instruments

Test is tested on class VII-F which already learned materials about water pollution and air pollution at the same school with the number of students 30. The following test instrument test analysis included:

1) Reliability

Reliability is the degree of consistency and stability of the instrument .Thus, the concept of reliability has the meaning where the research tools is consistence and stable, and hence predictable and accurate (Kumar ,2005). In other words, reliable

instrument is decipherable and the tool that gives same result when the measurement is given into the same subject whenever, wherever, and whoever it is implemented (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.

Then, the reliability coefficient obtained interpreted in classification reliability coefficient according to Suherman (2003) are presented on the Table 3.3 below:

Table 3.3 Classification of 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

According to result's test trial obtained the correlation coefficient of instrument of water pollution topic is shown on the Table 3.4 below:

Table 3.4 Result of reliability of water pollution topic

Correlation coefficient	Interpretation
0.65	High

From the Table 3.12 above, it is seen clearly that result's test trial obtained the correlation coefficient of instrument as much as 0.65. It means that reliability of instrument is high. Meanwhile, according to result's test trial obtained the correlation coefficient of instrument of air pollution topic is shown on the Table 3.5 below:

Table 3.5 Result of reliability of air pollution topic

Correlation coefficient	Interpretation
0.51	Medium

From the Table 3.13 above, it is seen clearly that result's test trial obtained the correlation coefficient of instrument as much as 0.51. It means that reliability of instrument is medium.

2) Validity

In the term of measurement procedure, validity is the ability of an instrument to measure what is measured (Kumar, 2005). The validity of the instrument itself is depended on the effectiveness of its function in measuring data that is supposed to be collected for the needs of research.

There is various type of validity measurement. In this research, constructive validity is used in evaluating instrument. Meanwhile, to calculate the validity of test item, it is proposed to use the formula of correlation of Pearson Product-Moment Correlation. Moreover, the interpretation of r_{xy} is classified into some categories. The categories are arranged based on Guilford (Suherman, 2003) and described as the following Table.

Table 3.6 Validity coefficient classifications

r_{xy} Value	Interpretation
$0,90 \leq r_{xy} \leq 1,00$	Very high
$0,70 \leq r_{xy} < 0,90$	High
$0,40 \leq r_{xy} < 0,70$	Average
$0,20 \leq r_{xy} < 0,40$	Low
$0,00 \leq r_{xy} < 0,20$	Very low
$r_{xy} < 0,00$	Invalid

3) Difficulty index

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 (Suherman, 2003) is presented on the Table 3.7 below:

Tabel 3.7 Classification of difficulty index

Di Value	Level of difficulty
Di=0,00	Very hard
0,00 < Di ≤ 0,30	Hard
0,30 < Di ≤ 0,70	Average
0,70 < Di < 1,00	Easy
Di= 1,00	Very Easy

4) Discrimination Power

Discrimination Power of item test represent how strong the test item in differentiating between the sample that able to proposed right answer and wrong answer/ blank answer (Suherman,2003). If the test and an item measure the same ability or competence, we would expect that those having a high overall test score would have a high probability of being able to answer the item. We would also expect the opposite, which is to say that those having low test scores would have a low probability of answering the item correctly. Thus, a good item should discriminate between those who score high on the test and those who score low.

Indeed, discrimination power is supposed to give verification that the test item can be used to differentiate between high achiever and low achiever. The formula to determine discrimination power is formulated as :

$$DP = \frac{\sum \bar{X}_{ha} - \sum \bar{X}_{la}}{MS}$$

Note :

DP : discrimination Power

$\sum \bar{X}_{ha}$: Average score of high achiever group

$\sum \bar{X}_{la}$: Average score of low achiever group

MSI : Maximum Score

Likewise, the classification of DP coefficient is described as the following Table 3.8 (Suherman , 2003)

Table 3.8 Classification of Discrimination Power Coefficient

DP score	Interpretation
$DP \leq 0,00$	Very low
$0,00 < DP \leq 0,20$	Low
$0,20 < DP \leq 0,40$	Average
$0,40 < DP \leq 0,70$	Good
$0,70 < DP \leq 1,00$	Very good

Recapitulations of validity test item about uniformly accelerated motion concept inform of multiple choice question that shown on the Table 3.9 below:

Table 3.9 Recapitulation of validity test item of water pollution topic

Question number	Discriminating power	Interpretation	Difficulty level	Validity		Conclusion
				Value	Interpretation	
1	0.32	Average	Easy	0.600	Average	Valid
2	0.21	Average	Medium	0.627	Average	Valid
3	0.38	Average	Easy	0.794	High	Valid
4	0.42	Good	Easy	0.726	High	Valid

According to the Table 3.9, it can be seen that from 4 questions is taken all of questions to be instrument for determine students' achievement.

Table 3.10 Recapitulation of validity test item of air pollution topic

Question number	Discriminating power	Interpretation	Difficulty level	Validity		Conclusion
				Value	Interpretation	
1	0.1	Low	Very Easy	0.23	Low	Valid
2	0.15	Low	Very easy	0.27	Low	Valid
3	0.54	Good	Easy	0.86	High	Valid
4	0.25	Average	Very easy	0.64	Average	Valid
5	0.31	Average	Easy	0.57	Average	Valid

According to the Table 3.10, it can be seen that from 5 questions is taken all of questions to be instrument for determine students' achievement.

2. Observation Sheet

Observation sheet aims to observe patterns of interaction that occur in students during the learning takes place, the instrument used is the observation sheet based on criteria that have been set. Determination of interaction patterns refers to Roychondhury research and Roth (1996). Every statement made on the observation sheet representing interaction patterns that occur in groups of students.

Every question on the observation sheets is representing interaction patterns that occur in groups of students. Observation sheets made into two, they are observation sheet for homogeneous groups at the first meeting and observation sheet for heterogeneous groups in the second meeting. Blueprint of interaction pattern can be seen in Table 3.11 and Table of observation sheet for homogeneous group has been appended to C.10

Table 3.11 Patterns of interaction on observation sheet for homogeneous group

No.	Patterns of interaction	Number of statement
1.	Symmetric	1a, 1b, 2a, 3a, 4a, 5a, 6a
2.	Shifting Asymmetric	1a, 1b, 2b, 3b, 4a, 5b, 6b
3.	Asymmetric	1c, 1d, 2c, 3c, 4b, 5c, 6c, 6d

In Table 3.11 above characteristics of student group interaction patterns obtained through observation sheet. Any statement describing the observation sheet group interaction patterns that occur during the learning takes place. Statement on 1a, 1b, 2a, 3a, 4a, 5a, 6a illustrates symmetrical pattern of interaction. Statement on 1a, 1b, 2b, 3b, 4a, 5b, 6b illustrates Asymmetric Shifting patterns. Statement on 1c, 1d, 2c, 3c, 4b, 5c, 6c, 6d illustrates the pattern Asymmetric.

Meanwhile, blueprint of interaction pattern for heterogeneous group can be seen in Table 3.12 and Table of observation sheet for heterogeneous group has been appended to C.11

Table 3.12 Patterns of Interaction on observation sheet for heterogeneous group

No.	Patterns of interaction	Number of statement
1.	Symmetric	1a, 2a, 3a, 4a, 5a, 6a
2.	Shifting Asymmetric	1b, 1c, 1d, 2b, 3b, 4a, 5b, 6b
3.	Asymmetric	1e, 2c, 3c, 4b, 5c, 6c ,6d

In Table 3.12 above characteristics of student group interaction patterns obtained through observation sheet. Any statement describing the observation sheet group interaction patterns that occur during the learning takes place. Statement on 1a, 1b, 1c, 1d, 2a, 3a, 4a, 5a, 6a illustrates a symmetrical pattern of interaction. Statement on 1a, 1b, 1c, 1d, 2b, 3b, 4a, 5b, 6b illustrates Asymmetric Shifting patterns. Statement on 1e, 2c, 3c, 4b, 5c, 6c, and 6d illustrates the pattern Asymmetric.

3. Questionnaire

A questionnaire is written test of questions, the answer to which are recorded (Kumar, R. 2005). In questionnaire respondents read the questions, interpret what is expected and the write down the answer. Questionnaires are used to determine the response of students and teacher towards methods of grouping type. Questionnaire is given to the students after the completion of learning activities. Blue print of student questionnaire can be seen in Table 3.13.

Table 3.13 Blue print of questionnaire for student

No.	Aspect will be observe	Objective	Item test
1.	Experience of student to grouping type based on student ability	To find out of student experience to group which is formed by teacher	3 item tests
2.	Interest of student in the division of the grouping type	To find out of student interest in the division of grouping type.	4 item tests
3.	Effect of heterogenous to discussion	To find out of difficulties and interaction of student in grouping type.	14 item tests
4.	Improved learning outcomes	To find out of student improvement in learning outcomes.	4 item tests

Meanwhile, blueprint of teacher questionnaire can be seen in Table 3.14

Table 3.14 Blue print of questionnaire for teacher

No.	Aspect will be observe	Objective	Item test
1.	Experience of teacher about type of grouping based on student ability	To find out of teacher' experience about grouping type based on student ability	2 item tests
2.	Satisfaction of using grouping type based on student ability	To find out of teacher' satisfaction of grouping type based on student ability	1 item tests
3.	Improvement of student achievement by using grouping type based on student ability	To find out of teacher' opinion about improvement of student achievement by using grouping type	2 item tests
4.	Student interaction using grouping type based on student ability	To find out of teacher opinion about interaction using grouping type based on student ability.	8 item tests

G. Research Procedures

In general, the research to be conducted has three stages, namely:

1. Preparation

- a. Analyze problems, conduct literature by reading a few journals about grouping type (homogeneous and heterogeneous group) or other sources such as book regarding grouping type by Slavin (2005), patterns of interaction, student' achievement and pollution concept for secondary student.
- b. Doing observation to get information about class condition, grouping commonly used by teachers, students characteristic, experiment equipment in laboratory and prepare a research permit.
- c. Prepare instructional tools, such as design lesson plan about water and air pollution and module for experiment activity about water and air pollution.
- d. Instruments designing, the instrument is divided into two; they are test and non test. Test used in this study are 4 essay questions of water pollution and 5 essay questions of air pollution to measure student 'achievement, meanwhile non test is observation sheet to observe interaction among group members that occur during discussions and questionnaires to know response of students and teacher towards methods of methods of distribution groups conducted by the teacher based student 'ability.
- e. Conduct judgment instrument such as test, observation sheet and questionnaire by 3 lectures and make revision. After getting a judgment instrument, whether the instrument will be used decent or not.
- f. After the judgment from lecturers, the instrument is tested to students who already learned material about environmental pollution especially water and air pollution to determine the validity, reliability, level of difficulty and discrimination power of each question and conduct revision. Meanwhile observation sheet and questionnaire are only from lecturer' judgment. Observation sheet that will be use to observe student interaction pattern has been calibrated by six observers.

- g. Determine class VII-F as the subject of research with number of students 28.
- h. Distributing first pretest to determine students' ability by using an essay that consists of 4 questions of water pollution topic before learning activity.
- i. Formation the groups are designed to homogeneous group which is each member of group has same ability.

2. Implementation

- a. Learning process at the first meeting conducted by a simple experiment to identify the effects of water pollution to living thing in each group. There are 6 observers who conducted observation for each group.
- b. The end of learning activity in first meeting, student given posttest of water pollution and in next meeting teacher distributed second pretest to determine students' ability by using an essay test that consists of 5 questions for air pollution for second meeting.
- c. Formation of the group at the second meeting is designed to heterogeneous group which is each member of the group has mixed-ability.
- d. Learning process at the second meeting conducted by a simple experiment to investigate air pollution by dust in the classroom. There are 6 observers who conducted observation for each group and has been informed about procedure how to use observation sheet.
- e. The end of learning activity in second meeting, student given second posttest of air pollution to measure student 'achievement and also given questionnaire to know the response of students and response from professional teacher towards methods of distribution groups conducted by the teacher based student 'ability.

3. Data analyzing

a. Test

Processing data was conducted from tests which is given to students. Test consists of pretest and post-test. The test results matched to scoring rubrics for pretest and posttest, then obtained a total score of student's pretest and post-test. Then, data is

processed with statistical test to find descriptive statistic analysis, the significant differences with t-test using SPSS 17 software and calculate increasing student' achievement using the normalized gain manually.

b. Observation Sheet

Observation sheet used to investigates the interaction among group members in homogeneous and heterogeneous groups. The data obtained in the observation sheet prepared by using checklist (✓) sign on the available column accordance to aspects that were observed during the discussion activity. Every cheklist in interval coloum equals to 10 score, then every aspect is calculated and processed by following the occurrence relatively formula, number of aspects that obtained divided by the total expected time interval and then multiplied by 100% and percentages. (Arikunto, 2001).

c. Questionnaire

Questionnaire is aimed to find out students 'and teachers' responses to learning that has been implemented using two different types of grouping, there are homogeneous group for water pollution topics and heterogeneous group for air pollution topic, which contains twenty-five questions. Each question in questionnaire has two options, there are "yes "and" no ". Processing is done by scoring questionnaire to all of options in question on the questionnaire. Each option was given score 1 for "yes" and 0 for "no", then summed for each question and calculated its percentage and interpreted in reference Table values interpretation questionnaire. For more details, research plot which conducted can be used in the following Figure 3.3:

H. Research Plot

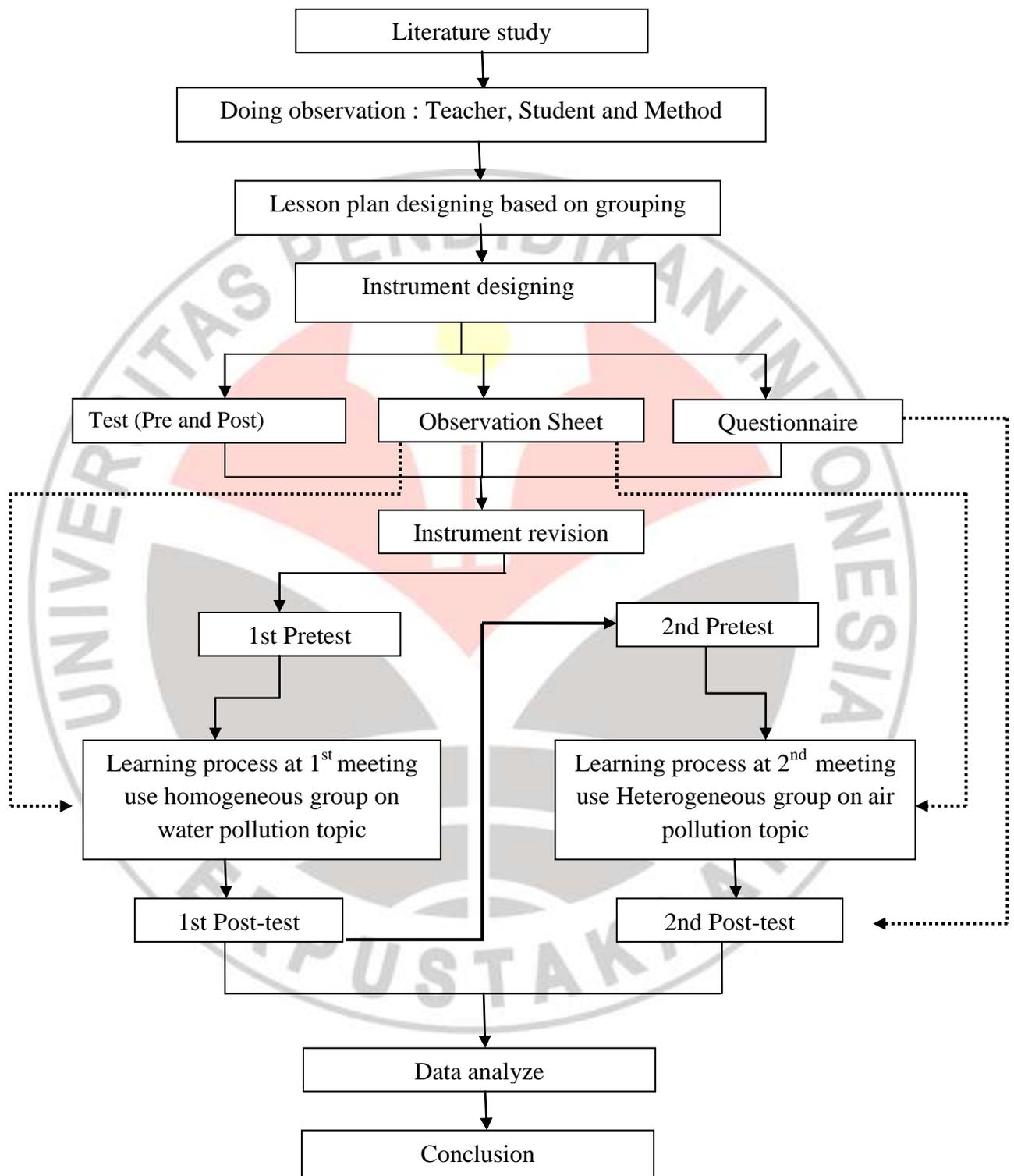


Figure 3. 4 Research Plot

Wulannita Andika, 2013

Pengaruh Dari Implementasi Tipe Pengelompokan Untuk Meningkatkan Hasil Belajar Dan Interaksi Siswa Pada Topik Pencemaran Lingkungan Pada Siswa Sekolah Menengah Pertama
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I. Data Collection Technique

Techniques of data collection in this study are:

1. Test

Test consists of pretest and posttest. Pre test is conducted twice, in homogeneous and heterogeneous groups. Pretest is given at the beginning of meeting before the lesson. Pre test is used to determine the level of student understanding, and structure of the group formed by the students' ability levels, low, medium and high and classifies students into homogeneous and heterogeneous groups. There are 28 students as research subjects to be grouped in three categories namely the high, medium or low. According Arikunto (2006), to determine the position of high, medium or low groups, can be done by using the standard deviation. The first pretest in this research is four essay questions of water pollution. The high group consists of students with scores equal to or greater than the average score of students plus the overall standard deviation. The low group is determined by students who have an average score of students minus standard deviation. While for medium group consists of students with scores between high and low groups.

In the first learning activity, the group was made homogeneous group or each member of the group has the same ability level. Based on the statement Arikunto (2006), the high group with pretest score ≥ 72.10 (4 students or only 1 group), the medium group with pretest score between 43.10 and 72.10 (20 students or 4 groups) and low group with pretest score ≤ 43.10 (4 students or 1 group).

The second pretest in this research is five essay questions of air pollution. In the second learning activity, the group was made a heterogeneous group or each member of the group was made mixed-ability. The data used for grouping students is pretest that given before conduct learning activity. Based on the statement Arikunto (2008), the high group with pretest score ≥ 64.50 (6 students), the medium level with pretest score between 46.90 and 64.50 (16 students) and low level with pretest score ≤ 46.90 (6 students). Students are divided into six groups with each group of 4-5 students. Each group consisting of 1 student with a low level, 2 – 3 students with medium and 1 student with a high level.

Post-test is conducted twice in homogeneous and heterogeneous groups. Posttest is given at the end of the lesson. Post-test used to measure students' achievement of the concept after discussion. The type of question is 4 essay questions about water pollution in homogeneous group and five essay questions of air pollution in heterogeneous group.

2. Observation sheet

Observation sheet aims to observe patterns of interaction that occur in students during the learning takes place, the instrument used is the observation sheet based on criteria that have been set. Every question on the observation sheets made representing interaction patterns that occur in groups of students, there are symmetric, shifting asymmetric and asymmetric. Observation sheets made into two, they are observation sheet for homogeneous groups at the first meeting and observation sheet for heterogeneous groups in the second meeting. The data obtained in the observation sheet prepared by using checklist (✓) sign on the available column accordance to aspects that were observed during the discussion activity. Observation conducted by the observer during the discussion activity. Every one observer observed one group of students. Observation is conducted about 40 minutes divided into 5-minute intervals as much as 8 times.

3. Questionnaire

Questionnaires are used to determine the response students and teacher towards methods of distribution grouping type, homogeneous and heterogeneous. Questionnaire is done by students after the completion of learning activities. Questionnaire is given in form of a sheet and students have to fill it by a fixing a check mark (✓) in the space provided.

J. Data analyzing techniques

Data obtained from the study such as quantitative data and qualitative data. Quantitative data obtained from pretest and post-test and data increase students' achievement, while the qualitative data obtained from the observation sheet of interaction among group members in homogeneous and heterogeneous group and questionnaire for student and teacher to know their respond towards methods of grouping type based student 'ability. Data processing techniques described below are based on the purpose of this research.

1. Test

Test consists of pretest and posttest. Pre test is conducted twice, in homogeneous and heterogeneous groups. In this research, pretest has two functions. First function is used to determine the initial conditions of water pollution and air pollution topics. The results of pretest were determined students' prior knowledge about material that will be taught. Second, the result of the pretest is used to determine the grouping of students based on student 'ability. The result of pretest is used to determine high, medium and low levels. The pretest is given at the beginning of lesson and the ends of the lesson students were given the posttest to determine the increase of student' achievement after learning activity using homogeneous and heterogeneous grouping. The process of data analysis is enlisted in the following explanation.

a. Scoring process

Scoring process is performed on both of pretest and posttest in homogeneous and heterogeneous groups. Scoring process is initiated by analyzing right answer based on scoring rubrics stated in blue print. Each of questions is given score from the interval between 0-100. After all of the question analyzed, and then obtained total score. After the data is obtained, the next step is to analyze and process the data by using statistical test. It is done by using software SPSS (Statistical Product and Service Solution) 17.0 for windows which is operated by using a laptop.

b. Descriptive statistic analyze

From data obtained, the further step is descriptive statistic analyze. Data processing is performed on the pretest and posttest scores. This is done to determine the maximum

value, minimum value, mean, standard deviation, and variance of the data that has been obtained.

c. Normality test

Normality test conducted to determine whether data obtained normally distribute or not. *Kolmogorov-smirnov* statistic test with 5% signification level in SPSS 17 software were used to determined normality. Normality test conducted to pretest and post test score from two different group (homogeneous and heterogeneous). If both data distribute normally, we can continue the data processing to homogeneity test. If the data show that the distribution from one or all the data not normally distribute, the data processing can continue using *non parametric* statistic it is using *Wilcoxon test*.

d. Homogeneity test

If the data normally distributed, then further testing is testing homogeneity of variance. Homogeneity test is used to determine whether both groups have homogenous variances or not. To count homogeneity we can use *Leven's* test with 5% signification level.

e. Compare mean test

Compare mean test uses to notice any significant difference or not between the pretest and post-test of homogeneous and heterogeneous groups. If the data obtained normally distribute and has homogenous variances, the next test will be *t-test* (less than 30 students). If the data normally distribute and did not have homogenous variances will be tested by using *t'-test*. Meanwhile if the data obtained did not distribute normally, the test will be used is non-parametric test.

For more detail, steps of test processing data shown in Figure 3.4 below:

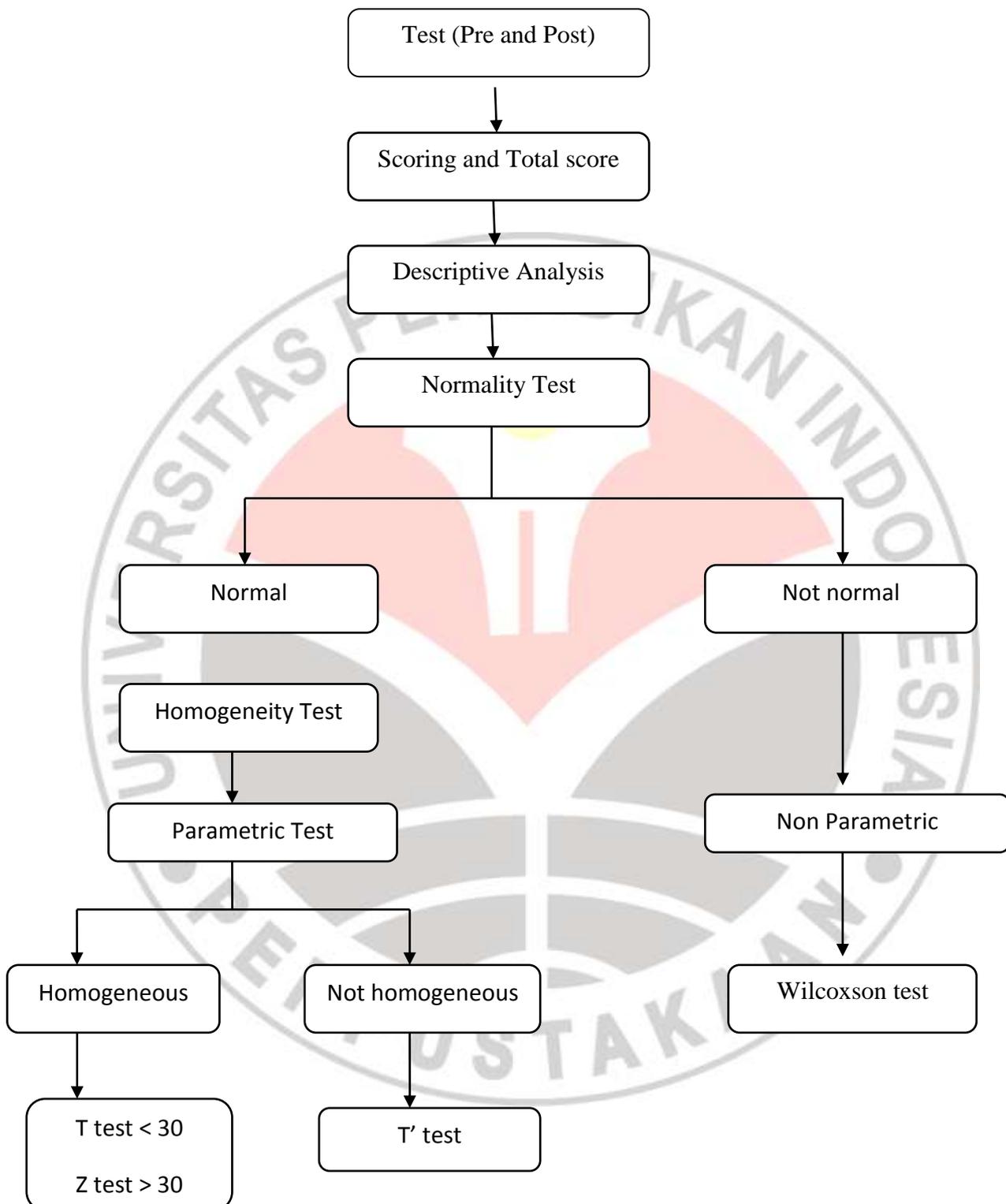


Figure 3.5 Steps of processing data

The further data analysis is measure normalized gain. It was use to determine increase of student' achievement of homogeneous and heterogeneous groups. The pretest and post-test data from each student in homogeneous and heterogeneous group will be calculated to find normalized gain value. Normalized gain is calculated by formula from Meltzer (2003):

$$\text{Normalized Gain} = \frac{\text{skor postes} - \text{skor pretes}}{\text{skor maksimum ideal} - \text{skor pretes}}$$

To determine the quality increase students' achievement of concepts does normalize gain data interpretation. The criteria used by Hake (1999) are presented in Table 3.15 below:

Table 3.15 Gain Criteria

<g>	Interprets
G > 0,7	High
0,3 < g < 0,7	Medium
G < 0,3	Low

2. Observation sheet

Observation sheet used to investigate the interaction among group members in homogeneous class and heterogeneous class used observation sheet. The data obtained in the observation sheet prepared by using check (✓) sign on the available column accordance to aspects that were observed during the discussion activity. Every cheklist in interval coloum equals to 10 score, then every aspect is calculated and processed by following the occurrence relatively formula by Arikunto (2002).

$$\% \text{ occurrence relatively} = \frac{\text{Events were encountered and observed}}{\text{number of group}} \times 100\%$$

3. Questionnaire

Questionnaire was conducted to find out students and teachers' responses to learning that has been implemented using two different types of grouping, namely homogeneous

groups for water pollution topics and heterogeneous group for air pollution topic, which is contained twenty five questions with two options "yes "and" no ". Processing is done by scoring all of options on the questionnaire. Each option was given score 1 for "yes" and 0 for "no", then data is interpreted in reference Table values interpretation questionnaire. The data processed by using a Likert scale with the formula below (Arikunto, 2001):

$$P = \frac{R}{R_{max}} 100 \%$$

Description:

P = percentage of responses

R = response observed

R_{max} = maximal response observed

Classification calculation of the percentage of each category of interpretation (Koentjaraningrat, 1990) is as follows:

Table 3.16 Percentages of questionnaire classification

Percentage of answer (%)	Criteria
0%	None
1 %- 25%	Small
26%- 49%	Almost half
50%	Half
51% - 75%	Majority
76% - 99%	Generally
100%	Overall