CHAPTER III
RESEARCH METHODOLOGY

3.1. Research Method and Research Design
3.1.1. Research Method

Quantitative study was used in this studies. Creswell (2012) states that the collection of numerical information from a wide range of individuals by using a predetermined question tool is one of the features of quantitative studies. This technique was almost experimental. This quantitative method. The investigator can hardly artificially generate groups for the experiments in a quasi-experiment, so the investigator uses the group (class) the college has arranged to collect information (Frankel, Wallen & Hyun, 2012). The dependent factors of this study are the mastery and science of concept learners, while collaborative learning is an autonomous variable.

3.1.2. Research Design

The study was conducted with a non-randomized pretest and post-test group. Creswell (2012) states that pretest and post-test design was used for the studies when a quasi-experiment was used as the technique. The courses were allocated randomly to the testing and testing group. The control group and the experimental group had pretest and post tests with this design, but the only experimental group with the Round Table and control group will not have only lecture-method .

Table 3.1

Pretest and Post test Design

Pre and Post Test Design		Time		
Select Control Group	Pretest	No Treatment	Post test
Select Experiment Group	Pretest	Treatment	Post test

(Source: Creswell, 2012)

3.2. Population and Sample

All values that are complicating the results of counting and measuring are limited by certain criteria or constraints, while the population of the sample is a

part of the population by all the values, quantitative and qualitative properties of certain objects (Kumar, 2005).

The population for this research was 7th Grade of Junior High School in Bandung where implemented 2013 Curriculum in their Science lesson. For the sample, it selected two from three classes. The first class was a control group (not get a treatment) and the second class was an experiment group (get a treatment).

The sampling technique used purposive sampling. Purposive sampling is defined where the researcher use their judgement to select a sample that they believe based on prior knowledge (Fraenkel, 2012). Both group generally consisted of the students with the age between 13 until 14 years old. There were 24 students in experimental group and 26 students in control group.

3.3. Assumption

The assumption as the foundation of this study as follow

1. Students trained in cooperative learning achieved significantly higher performance scores and post test knowledge retention than students trained in lecture-based education.

2. Consistent with the literature in terms of strategies for reducing science anxiety, cooperative learning and utilizing a constructivist approach worked best.

3. Comparison of cooperative and non cooperative group results did not indicate any statistical significance between the two groups in concept mastery.

3.4. Research Instrument

In this research, the instruments used objective test, science anxiety questionnaire, and observation sheet.

3.4.1. Objective Test

The test used to evaluate the conceptual mastery in learning global warming, especially in explaining the understanding of greenhouse effect, explaining the process of greenhouse effect, describing the definition of global warming describing the causes of global warming, describing the effect of global warming for life on Earth, and describe several efforts to tackle the global warming.

Conceptual test will be 25 multiple choices questions which have 4 options to be selected with the cognitive levels C1 (Remembering), C2 (Understanding), C3 (Applying) and C4 (Analyzing). Blueprint of objective questions before doing instrument analysis item test is shown in Table 3.2.

Table 3.2

Blueprint of Objective Questions Before Doing Instrument Analysis Item Test

Number	Concept Themes	Cognitive Level			
		C1	C2	C3	C4
1	Explain the understanding of greenhouse effect	1	7		
2	Explain the process of greenhouse effect	12, 16, 20	2, 8		
3	Describe the definition of global warming	3			
4	Describe the causes of global warming	9, 13, 21	4, 17	24	
5	Describe the effect of global warming for life on Earth		22	18	5, 10, 14
6	Describe several efforts to tackle the global warming	11	15, 19, 23, 25		6
	Total	9	10	2	4

1. Validity

Validity, it is expected to be measured, is described as a consensus between test results or size and quality (Kaplan 2009). Validity relates to the researchers ' correctness, significance and usefulness. The researcher would like data to fulfill its aims by using a tool. Validation is the method by which proof to support inference is analyzed and collected (Fraenkel, 2011). The validity of the tool is through the application of ANATES software. The formula is described:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (XY)^2)}}$$

r   = Correlation coefficient between x and y variable

N   = Amount of students

X   = total score in test item

Y   = total score of student

(Source: Fraenkel, 2011)

Table 3.3

Validity Criteria

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

(Source: Minium et al., 1993)

2. Reliability

Reliability relates to the uniformity of results or reactions between devices and items (Fraenkel, 2011). Reliable implies that a test must be performed on a number of dimensions. The formula is described.

$$r_{11} = \left(\frac{n}{n-1}\right)\left(\frac{1 - \sum\sigma_1{}^2}{\sigma_1{}^2}\right)$$

Where:

r11   = test of reliability

$\sum\sigma_1{}^2$ = number of variant of each item test

$\sigma_1{}^2$ = test items' variant

N   = total of test items

(Source: Minium, 1993)

Table 3.4

Reliability Interpretation

Value r	Interpretation
0.80<r≤ 1.00	Very high
0.60<r≤ 0.79	High
0.40<r≤ 0.59	Enough
0.20<r≤ 0.39	Low
0.00<r≤ 0.19	Very Low

(Source: Minium, 1993)

3. Difficulty Level

The mean item score correspond to the proportion of examines who answer the item correctly is called difficulty. It describes a test's proficiency in terms of the achievement. The formula is described

$$Pi = \frac{Ai}{Ni}$$

Where:

Pi   = Difficulty level

Ai   = Number of students who answers correctly

Ni   = Total number of students

(Source: Cohen, 2007)

Table 3.5

Difficulty Level Interpretation

Difficulty Value	Interpretation
0 - 0,29	Difficult
0,30 - 0,69	Medium
0,70 - 1,00	Easy

(Source: Cohen, Manion & Morrison, 2007)

4. Discriminating Power

A test item's capacity to discriminate between weak and powerful organizations is discriminatory (Jandaghi, 2010).

$$ID = \frac{B_A}{J_A} - \frac{B_B}{J_B}$$

Where:

ID   = item discrimination (Discriminating Power)

BA   = number of high achieving group that have correct answer

BB   = number of low achieving group that have correct answer

JA   = total participant of high achieving test-takers

JB   = total participant of bottom test takers

(Source: Brown, 2004)

Table 3.6

Discriminating Power Interpretation

Discriminating Power Values	Interpretation
0 - 0,20	Poor
0,21 - 0,40	Satisfactory
0,41 - 0,70	Good
0,71 - 1,00	Excellent

(Source: Arikunto, 2006)

5. Distractor

Multiple choice option is distraction, offering one alternative and the right alternative response must be selected by learners. If learners choose it worked efficiently many times, and if it was rarely or never, it worked not efficiently (Cohen, 2007).

3.4.2. Questionnaire of Science Anxiety

The questionnaire of Science Anxiety is used to measure the level of Science Anxiety of the students. The questionnaire that was used in this research is adopted from by Diana K. May (2009) which also analyzed Science Anxiety of students in each category. Permission to use and adapt it was obtained. The questionnaire consists of 28 statements to measure students' Science Anxiety based on their self efficacy, grade anxiety, future, and in class and assignment. It used some scales from 1 until 5 (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always). The category of Science Anxiety and its statements are shown in the table below.

Table 3.7

Category of Science Anxiety

Category	Statements
Self efficacy	1, 2, 3, 4, 5, 6, 7
Grade anxiety	8, 9, 10, 11, 12, 13, 14, 15
Future	16, 17, 18, 19, 20, 21, 22, 23
In class and assignment	24, 25, 26, 27, 28

(Source: Diana K. May, 2009)

3.4.3. Observation Sheet

Observation sheet is made to identify the teaching and learning process that conducted by the researcher in this research relates with the lesson plan. The observation sheet used consists of the steps in Round Table and lecturing method and there are "yes" and "no" checklist column that should be filled by the observer.

Table 3.8

Observation Sheet for Experiment Group

Subtopic	Activity	Observer			
		1		2	
		Yes	No	Yes	No
Definition and process of greenhouse effect	Grouping The teacher asks the students to sit in a group of four students Preparing The teacher gives the groups similar themes Brainstorming The teacher asks the member of the groups to write word or phrases related to the theme Writing The group writes a text using the word or phrases written Presenting Each group presents their writing Evaluating The teacher asks each group to make correction				

Subtopic	Activity	Observer			
		1		2	
		Yes	No	Yes	No
Definition and causes of global warming	Revising Each group revises their work or writing Grouping The teacher asks the students to sit in a group of four students Preparing The teacher gives the groups similar themes Brainstorming The teacher asks the member of the groups to write word or phrases related to the theme Writing The group writes a text using the word or phrases written Presenting Each group presents their writing Evaluating The teacher asks each group to make correction				
The effect and solution of global warming	Revising Each group revises their work or writing Grouping The teacher asks the students to sit in a group of four students Preparing The teacher gives the groups similar themes Brainstorming The teacher asks the member of the groups to write word or phrases related to the theme Writing The group writes a text using the word or phrases written Presenting				

Subtopic	Activity	Observer			
		1		2	
		Yes	No	Yes	No
	Each group presents their writing				
	Evaluating				
	The teacher asks each group to make correction				
	Revising				
	Each group revises their work or writing				

Table 3.9

Observation Sheet for Control Group

Subtopic	Activity	Observer			
		1		2	
		Yes	No	Yes	No
Definition and process of greenhouse effect	Opening				
	State the purpose of the meeting				
	Presentation				
	Elaborate with multimedia resources				
	Learner Instructor two ways Interaction				
	Encourage active learning multimedia streaming				
	Conclusion				
	Consolidate the concepts				
Definition and causes of global warming	Opening				
	State the purpose of the meeting				
	Presentation				
	Elaborate with multimedia resources				
	Learner Instructor two ways Interaction				
	Encourage active learning multimedia streaming				
	Conclusion				
	Consolidate the concepts				
The effect and solution of global warming	Opening				
	State the purpose of the meeting				
	Presentation				
	Elaborate with				

Subtopic	Activity	Observer			
		1		2	
		Yes	No	Yes	No
	multimedia resources				
	Learner Instructor two ways Interaction				
	Encourage active learning				
	multimedia streaming				
	Conclusion				
	Consolidate the concepts				

3.5. Instrument and Validation Result

Before given to the students, the objective test was validated first by the expert judgement and tested to the students in 8th grade. Based on the reliability calculation, the test items obtained 0,86 which is established as reliable. The recapitulation of objective test for each question is shown below.

Table 3.10

Analysis of Test Item by ANATES

No	Discriminating Power	Difficulty Level	Correlation	Option				Acceptance
				A	B	C	D	
1	0,4545 (Good)	Easy	0,395 (Moderate)	4 (10%)	30 (75%)	2 (5%)	4 (10%)	Accept
2	0,6364 (Good)	Medium	0,405 (Moderate)	20 (50%)	7 (17,5 %)	8 (20%)	5 (12,5 %)	Accept
3	0,6364 (Good)	Easy	0,588 (Medium)	4 (10%)	5 (12,5 %)	29 (27,5 %)	2 (5%)	Accept
4	0,5455 (Good)	Medium	0,479 (Moderate)	7 (17,5 %)	5 (12,5 %)	23 (57,5 %)	5 (12,5 %)	Accept
5	0,8182 (Excellent)	Medium	0,665 (Medium)	6 (15%)	26 (65%)	4 (10%)	4 (10%)	Accept
6	0,5455 (Good)	Hard	0,665 (Medium)	12 (30%)	9 (22,5 %)	7 (17,5 %)	12 (30%)	Accept
7	0,6364 (Good)	Medium	0,540 (Medium)	9 (22,5 %)	20 (50%)	5 (12,5 %)	6 (15%)	Accept
8	0,6364 (Good)	Easy	0,606 (Medium)	5 (12,5 %)	4 (10%)	29 (72,5 %)	2 (5%)	Accept
9	0,4545 (Good)	Hard	0,407	12	8	6	14	Accept

No	Discriminating Power	Difficulty Level	Correlation	Option				Acceptance
				A	B	C	D	
			(Moderate)	(30%)	(20%)	(15%)	(35%)	
10	0,4545 (Good)	Medium	0,403 (Moderate)	4 (10%)	28 (70%)	3 (7,5%)	5 (12,5%)	Accept
11	0,5455 (Good)	Hard	0,426 (Moderate)	13 (32,5%)	6 (15%)	9 (22,5%)	12 (30%)	Accept
12	0,7273 (Excellent)	Medium	0,512 (Medium)	4 (10%)	17 (42,5%)	9 (22,5%)	10 (25%)	Accept
13	0,5455 (Good)	Hard	0,406 (Moderate)	10 (25%)	9 (22,5%)	12 (30%)	9 (22,5%)	Accept
14	0,5455 (Good)	Medium	0,460 (Moderate)	24 (60%)	5 (12,5%)	5 (12,5%)	6 (15%)	Accept
15	0,7273 (Excellent)	Medium	0,581 (Medium)	4 (10%)	24 (60%)	5 (12,5%)	6 (15%)	Accept
16	0,6364 (Good)	Medium	0,521 (Medium)	25 (62,5%)	7 (17,5%)	4 (10%)	4 (10%)	Accept
17	0,5455 (Good)	Medium	0,410 (Moderate)	18 (45%)	7 (17,5%)	7 (17,5%)	8 (20%)	Accept
18	0,8182 (Excellent)	Easy	0,786 (Strong)	4 (10%)	29 (72,%)	4 (10%)	3 (7,5%)	Accept
19	0,7273 (Excellent)	Easy	0,658 (Medium)	3 (7,5%)	4 (10%)	30 (75%)	3 (7,5%)	Accept
20	0,6364 (Good)	Medium	0,473 (Moderate)	7 (17,5%)	12 (30%)	15 (37,5%)	6 (15%)	Accept
21	0,5455 (Good)	Medium	0,461 (Moderate)	5 (12,5%)	5 (12,5%)	4 (10%)	26 (65%)	Accept
22	0,6364 (Good)	Medium	0,594 (Moderate)	5 (12,5%)	26 (65%)	5 (12,5%)	5 (12,5%)	Accept
23	0,6364 (Good)	Medium	0,417 (Moderate)	4 (10%)	26 (65%)	5 (12,5%)	5 (12,5%)	Accept
24	0,6364 (Good)	Medium	0,486 (Moderate)	6 (15%)	5 (12,5	25 (62,5	4 (10%)	Accept

No	Discriminating Power	Difficulty Level	Correlation	Option				Acceptance
				A	B	C	D	
25	0,5455 (Good)	Hard	0,481 (Moderate)	13 (32,5 %)	10 %) (25%)	11 %) (27,5 %)	6 (15%)	Accept

The objective test for measuring students' concept mastery in form of 25 questions has been tested in term of validity, reliability, discriminating power, and difficulty level. The questions are given to 40 students of 8th grade who already gained the material of global warming before.

3.6. Research Procedure

In this research procedure, it will be divided into 3 stages which are preparation stage, implementation stage, and completion stage.
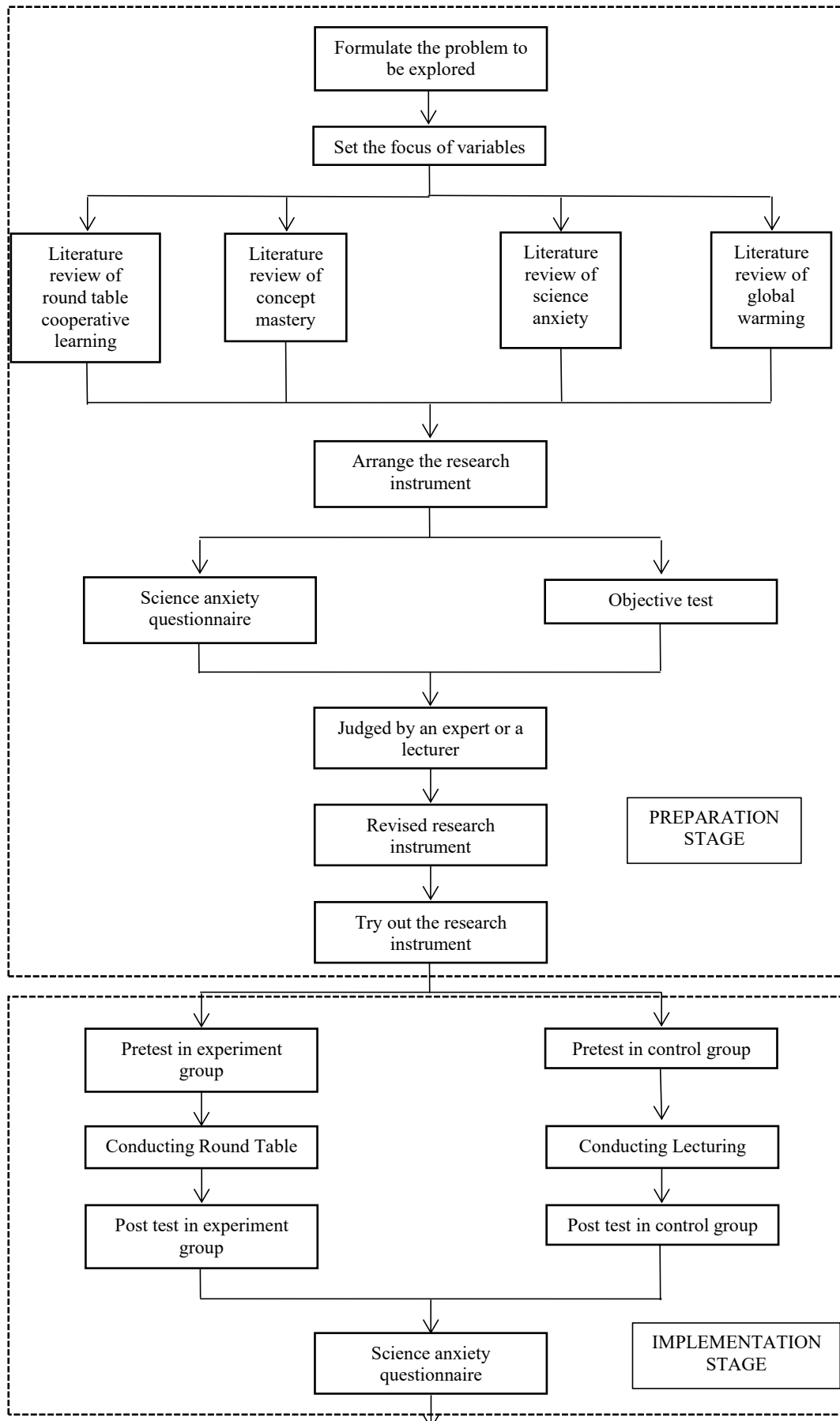
3.6.1. Preparation Stage

1. Formulate the problem to be explored

2. Set the focus of variable research

3. Review the literature on round table cooperative learning, concept mastery, science anxiety and global warming

4. Arrange the research instrument and be judged by an expert or a lecturer

5. Revised research instrument after suggestions

6. Try out the research instrument

7. Revised instrument based research instrument to analyze results

3.6.2. Implementation Stage

1. Setting up the experimental class

2. Prove the sample class to recognize the student's initial condition

3. Pretest result processing

4. Conduct research by implementing round table cooperative learning

5. Give the sample class post test to recognize the improvement of the mastery concept of students in the sample class

6. Give science anxiety questionnaire to measure students' science anxiety

3.6.3. Completion Stage

1. Analyze the result of the whole research from based on the instrument result

2. Discuss and conclude for the data analysis result

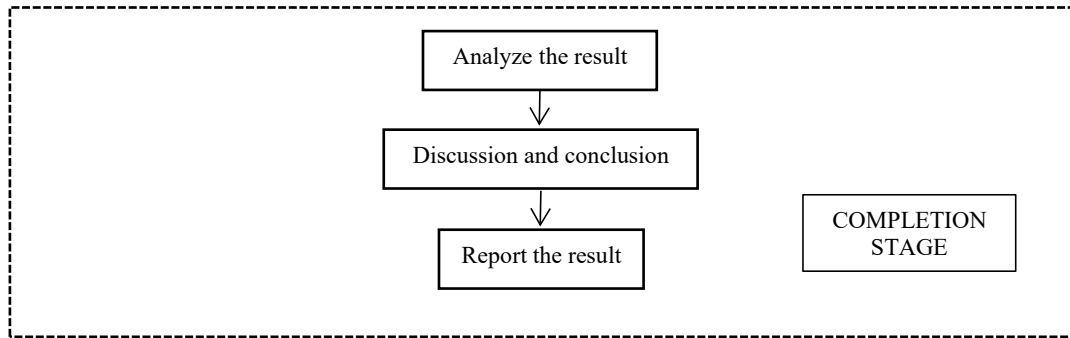3. Arrange the report of the research

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│                      ┌──────────────────────────┐                             │
│                      │  Formulate the problem to │                            │
│                      │       be explored         │                            │
│                      └──────────────────────────┘                             │
│                                  ↓                                             │
│                      ┌──────────────────────────┐                             │
│                      │  Set the focus of variables│                           │
│                      └──────────────────────────┘                             │
│            ┌──────────────┬──────────────┬──────────────┐                     │
│            ↓              ↓              ↓              ↓                       │
│    ┌────────────┐ ┌────────────┐ ┌────────────┐ ┌────────────┐               │
│    │ Literature │ │ Literature │ │ Literature │ │ Literature │               │
│    │ review of  │ │ review of  │ │ review of  │ │ review of  │               │
│    │ round table│ │  concept   │ │  science   │ │   global   │               │
│    │cooperative │ │  mastery   │ │  anxiety   │ │  warming   │               │
│    │  learning  │ │            │ │            │ │            │               │
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Formulate the problem to be explored

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Set the focus of variables

- Literature review of round table cooperative learning
- Literature review of concept mastery
- Literature review of science anxiety
- Literature review of global warming

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Arrange the research instrument

- Science anxiety questionnaire
- Objective test

↓

Judged by an expert or a lecturer

↓

Revised research instrument

↓

Try out the research instrument

PREPARATION STAGE

- Pretest in experiment group
- Pretest in control group

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- Conducting Round Table
- Conducting Lecturing

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- Post test in experiment group
- Post test in control group

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Science anxiety questionnaire

IMPLEMENTATION STAGE

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Figure 3.1. Research Procedure

3.7. Data Process

In data process, it will be divided into 3 sections which are hypothesis test, analysis of students' concept mastery, and analysis of students' concept mastery.

3.7.1. Hypothesis Test

Hypothesis test is done to identify whether there is a significant difference on students' concept mastery and science anxiety in learning global warming through round table. The data analysis is done by parametric test (independent t-test) for concept mastery in condition that the data is normally distributed and homogeneous. Thus, hypothesis that is tested in this study are as follow:

H_0: There is no difference on the effect of Round Table Cooperative Learning towards students' concept mastery

H_1:There is difference on the effect of Round Table Cooperative Learning towards students' concept mastery

3.7.2. Analysis of Students' Concept Mastery

After get the data of the test item score, the data is processed through gain score and normalize score. Gain score is used to determine the improvement of learning outcome after implementing Round Table. Normalized gain test is to determine the categories of students' concept mastery improvement. According to Hake (1999), the gain score can be obtained by this formula:

$$G = S_r - S_i$$

Description:

G = Gain score

S_r = Post test score

S_i = Pretest score

(Source: Hake, 1999)

The effectiveness of round table on students' concept mastery in learning global warming can be observed from the result of the normalized gain that achieved by students during the learning process. The calculation of the normalized gain value and its classification uses equations described as below:

$$<g> = \frac{\% <G>}{\% <G> \max} = \frac{(\% <Sf> - \% <Si>)}{(100 - \% <Si>)}$$

Description:

<g>   = Normalized gain

<G>   = Actual gain

<G>max   = Maximum gain possible

<Sf>   = Average of post test

<Si>   = Average of pretest

(Source: Hake, 1999)

The value of normalized gain has been gained is interpreted using interpretation below.

Table 3.11

Criteria of N-Gain

Normalized Gain <g> Score	Interpretation
G > 0.7	High
0,3 < g < 0,7	Medium
G < 0,3	Low

(Source: Hake, 1999)

3.7.3. Analysis of Science Anxiety

The science anxiety is measured by questionnaire from Diana K. May (2009) which is analyzed science anxiety in each category. Researcher calculated the

point from 1 until 5 based on the answer. Each category is interpreted in different statements on the questionnaire. The category of science anxiety and its statements are shown below.

Table 3.12

Category of Science Anxiety

Category	Statements
Self efficacy	1, 2, 3, 4, 5, 6, 7
Grade anxiety	8, 9, 10, 11, 12, 13, 14, 15
Future	16, 17, 18, 19, 20, 21, 22, 23
In class and assignment	24, 25, 26, 27, 28

(Source: May, 2009)

Then, it will be calculated for the point starting from 1 (never) until 5 (always) for negative statement and 5 (never) until 1 (always) for positive statement. After that, it will be processed with Mann-Whitney U Test.

3.8. Operational Definition

In order to avoid some misunderstanding, this research will be explained about some operational definition. Those term are:

1. Round Table Cooperative Learning in this research combined academic and social skills with the steps grouping, preparing, brainstorming, writing, presenting, evaluating, and revising

2. Science Concept Mastery in this research will use 25 multiple choices conceptual question as a measurement. For the level cognitive, it will focus on C1 (Remembering), C2 (Understanding), C3 (Applying) and C4 (Analyzing). The questions will consist of 9 questions of C1, 10 questions of C2, 2 questions of C3, and 4 questions of C4.

3. Science Anxiety in this research will observe based on divides into four aspects which are self-efficacy, grade anxiety, future, and in class and management.