CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Design

The research method that used in this research is pre-experimental. In this method, there is only one group as the experimental group without any control group or extraneous factors which can influence internal validity (Fraenkel, Wallen, & Hyun, 2011). The Pre-Experimental method has three types of design, there are are (a) The one group pretest-post-test design; (b) The one group post-test only design; and (c) The post-test only non-equivalent group design (Fraenkel, Wallen, & Hyun, 2011).

This research generally described and investigate the students' critical thinking skill and communication skill of junior high school learners. The research also aims to investigate the correlation between students' critical thinking skill and students' communication skill after learning climate change by using discovery learning via screencast-o-matic application.

The design for this research is one group pre-test post-test design. A pretest is used to measure some attribute or characteristic of participants in an experiment before receiving treatment. While posttest is used to measure some attribute or characteristic of participants in an experiment after receiving treatment (Fraenkel, Wallen, & Hyun, 2011). The diagram of this design are shown in the Table 3.1 below.

Table 3. 1

Pre-experimental One Group Pretest-Posttest Design

O_1	X	O_2
Pre-test	Experimental Treatment	Post-test

(Fraenkel, Wallen, & Hyun, 2011)

3.2 Participants

The population were the 7th grade students of junior high school X. The school chosen because they use 2013 national curriculum and have a great digital based learning facilities including wi-fi, laptop for each student, and projector in every classes. This school also used English as the second language to communicate in the learning process. The research subject of this study is the 7th grade students, which consists of 26 students that come from School X. There are 17 male students, and there are 9 females students. The distribution of participants can be seen in Table 3.2

The sampling technique that will be used in this research is purposive sampling. Purposive sampling is a sampling technique where the researcher do not simply study whoever is available but can also make judgment to select a sample that they believe based on their prior information about a sample (Fraenkel, Wallen, & Hyun, 2011). The sample also would support provide the data they need.

Table 3. 2

Participants Distribution

Gender	Experiment Class	
	Number of Students	Percentage
Male	17	65.38%
Female	9	34.62%
Total	26	100%

3.3 Research Instrument

In this research, it is required to use the instrument to gather data. There are 2 types of instruments that will be used in this research, which are objectives test and rubric. These instruments are explained as follows:

3.3.1 Students' Critical Thinking Objective Test

The objective test is the instrument which used to test students' critical thinking skills. In this research, the objective test consist of pre-test and post-test and the topic is climate change. Pre-test will be given before conducting the treatment to know initial students' critical thinking skills.

Post-test will be given after the treatment to know the students' critical thinking skills in learning climate change after implementation of discovery learning by using screencast-o-matic application. Initially, in both pre-test and post-test, the students will be given seven questions. The type of question of pre-test and post-test is essay test.

The questions for students' critical thinking in this research measured by using critical thinking rubric where the indicators limited to 4 aspects indicators, which are basic clarification, inference, advance clarification, and non-constitutive, but helpful/formulating an action. The item constructed based on rubric adapted from Ennis (2018). The blueprint of the test item before being analyzed shown in Table 3.3

Table 3. 3

Objective Test Blueprint (Before Analyse)

Indicator of Critical Thinking Skills	Sub-indicator of Critical Thinking Skills	Questions	Total	Percentage (%)
Basic clarification	Analyzing arguments	1,2	2	28.60%
	Understand and use elementary graphs and maths	3	1	14.28%
Inference	Make and judge inductive inferences and arguments	4	1	14.28%
Advance clarification	Define terms and judge definitions	5	1	14.28%
	Deal with things in an orderly manner	6	1	14.28%
Non-Constitutive, But Helpful	Formulating an action	7	1	14.28%
Total			7	100%

3.3.1.1 Instrument Development and Analysis

In order to measure students' critical thinking skills, an objective test is made to be able to use the objective test in the research, some analysis is

required in order to be validated before it can be used as a pre-test and post-test. The objective test judged by the experts and also prepared before being validated and tested to students that have learned the climate change topic previously, in this case, are the grade 8 students. The validation of the test consists of validity, reability, level of difficulty, and discrimating power.

1) Validity

A researcher's relevance, accuracy, significant, and effectiveness of interpretations and suggestions are stated as validity (Fraenkel, Wallen, & Hyun, 2011). Validity is the most essential indication to consider while formulating or choosing instrument to be used as data dollection tools. To indetify and distinguish the validity of each questions of the test item, the researcher used ANATES Version 4.0. The formula used to determine test item validity is described as follow:

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

Where,

r_{xy} = items correlation coefficient.

X = items scores

N = amount of subject

(*Minium, King, & Bear, 1993*)

The value of r_{xy} turn out to be the result of validity. The interpretation of validity is stated in the Table 3.4 as follow:

Table 3. 4

The Interpretation of Validity

Value r	Interpretation
0,80, < r ≤ 1,00	Very High
0,60, < r ≤ 0,80	High
0,40, < r ≤ 0,60	Enough
0,20, < r ≤ 0,40	Low
0,00, < r ≤ 0,20	Very Low

(Ali, Carr, & Ruit, 2016)

2) Reliability

Reliability is the stability and dependability of students' test result. The stability and dependability means the consistency of students in responding question or feature on variable elements in test item. To identify the reliability of test item, researcher used the formula as follow:

$$K_{21} = \frac{K}{K-1} \left[1 - \frac{M - (K - M)}{SD^2} \right]$$

(Fraenkel, Wallen, & Hyun, 2011)

The symbol of K indicates to the number of items, the symbol of M indicates to mean of the arranged of test scores, and SD refers to the standard deviation of the arranged of test scores (Fraenkel, Wallen, & Hyun, 2011). The interpretation of reliability show in the Table 3.5

Table 3. 5

The Interpretation of Reability

Value r	Interpretation
0,80, - 1,00	Very High
0,60, - 0,79	High
0,40, - 0,59	Enough
0,20, - 0,39	Low
0,00, - 0,19	Very Low

(Ali, Carr, & Ruit, 2016)

3) Difficulty level

Difficulty level indicates the mean score of item test that relate to the amount of students who response and answer properly and accurately. To determine the difficulty level of question, the researcher used the formula below:

$$Dl = \frac{A}{N} \; x \; 100$$

(Cohen, Manion, & Morrison, 2007)

The symbol Dl indicates difficulty level, A for the number of students who response the accurate answer, and N for the total number of students (Cohen, Manion, & Morrison, 2007). The interpretation of level of difficulties can be seen in the Table 3.6 as follow:

Table 3. 6

The Interpretation of Difficulty Level

The Value of Difficulty Level	The Interpretation
0.00-0.30	Difficult
0.31-0.70	Medium
0.71-1.00	Easy

(Kaplan & Saccuzzo, 2017)

4) Discriminating power

Discriminating power means the question that possibly can be answered accurately by students who have high-level achieving group and it can be answered inaccurately for students in low-level achieving group (Cohen, Manion, & Morrison, 2007). To determine the discriminating power, researcher used the formula below:

$$D = \; p_{u-} \, p_i$$

(Crocker & Algina, 2008)

Where pu is the amount of higher group who answer the item accurately and pl is the amount of lower group who answer the item accurately. Discriminating Power Interpretation is shown in Table 3.7 below:

Table 3. 7

Discrimination Index Interpretation

Discrimination Index	Interpretation
0.4 and above	Very Good
0.3-0.39	Acceptably good, requisite improvement
0.2-0.29	Minimal items, requisite improvement
0.1-0.19	Deficient item, rejected or revised

(Escudero, Reyna, & Morales, 2000)

3.3.1.2 Instrument Development and Analysis Result

Before the test items for the climate change topic will be used, the test items has to qualify several test until it can be reflected valid. The test items was tested on students on higher grade/ other class who already studied the topic of climate change. In this validation, the test items test was tested on 8th-grade students of the same school. The test items consists of 7 questions before being validated, investigated, and examined. The validity, reliability, difficulty level and discriminating power of the test items are then examined. The test was given to 30 8th grade students. The recapitulation of the analysis of the test items is shown in Table 3.8.

Test Item Recapitulation

Reliability Test: 0,88 (Very High)

Table 3. 8

Test Item Recapitulation

Question Number	DP	Category	DL	Category	Validity	Category	Status
1.	0.25	Medium	0.43	Medium	0.58	Enough	Used
2.	0.43	Very Good	0.34	Medium	0.68	High	Used
3.	0.46	Very Good	0.35	Medium	0.62	High	Used
4.	0.31	Good	0.34	Medium	0.48	Enough	Used
5.	0.40	Very Good	0.48	Medium	0.53	Enough	Used
6.	0.34	Good	0.42	Medium	0.64	High	Used
7.	0.31	Good	0.50	Medium	0.68	High	Used

The test item also established judgement by several experts as confirmed in Appendix A after has been tested in terms of validity, reliability, discriminating power, and difficulty level. After having been expertly judged and analyzed by statistical software (ANATES), the results of 7 test items, all test items are used in the research. The new blueprint of test item is shown in Table 3.9. The detailed recapitulation can be seen in Appendix B.

Table 3. 9

Objective Test Blueprint (After Analyse)

Indicator of Critical Thinking Skills	Sub-indicator of Critical Thinking Skills	Questions	Total	Percentage (%)
Basic clarification	Analyzing arguments	1,2	2	28.60%
	Understand and use elementary graphs and maths	3	1	14.28%
Inference	Make and judge inductive inferences and arguments	4	1	14.28%

Indicator of Critical Thinking Skills	Sub-indicator of Critical Thinking Skills	Questions	Total	Percentage (%)
Advance clarification	Define terms and judge definitions	5	1	14.28%
	Deal with things in an orderly manner	6	1	14.28%
Non-Constitutive, But Helpful	Formulating an action	7	1	14.28%
	Total		7	100%

3.3.2 Students' Critical Thinking Rubric

The rubric is also the instrument which used to test students' critical thinking skills. In this research, the rubric used to determined score for objective test. According to Ennis (2018), Critical thinking skills are classified into five indicators, which are Basic clarification, Bases for a decision, Inference, Advance clarification, and Non-Constitutive, But Helpful/formulating an action.

In this research, the indicators that will be used are only basic clarification, inference, advance clarification, and non-constitutive, but Helpful/formulating an action (Ennis, 2018). The instrument of Students' critical thinking skills rubric will be analyzed with the judgement from experts. Critical Thinking skills rubric are shown in Table 3.10 as follows.

Table 3. 10

Students' Critical Thinking Skills Rubric

Sub-Indicator	Score				
	4	3	2	1	0
Analyzing arguments	The all concepts are correct, clear, and specific	Most of the concepts are correct, clear, and less specific	The small part of the concepts is correct and clear	The concepts are less focus or extravagant or doubtful	No answer or the answer is incorrect
Understand and use	The all answer	Most of the answer	The small part of the	The answer elaborations	No answer

Sub-Indicator	Score				
	4	3	2	1	0
elementary graphs and maths	elaborations are correct, clear, specific, and supported with strong, correct, and clear argument(s)	elaborations are correct, clear, and less specific	answer elaborations is correct and clear, but the reason and argument undergirding are unclear	were less supporting	or the answer is incorrect
Make and judge inductive inferences and arguments	The thinking plot is good, the all concepts are linked and integrated	The thinking plot is good, the all concepts are linked and integrated	The thinking plot is good enough, and small parts are linked	The plot is less good, the concepts are unlinked	No answer or the answer is incorrect
Define terms and judge definitions	The all aspects appear, the evidences served are good and balance	The all aspects appear, but unbalance	Most of the aspects appeared are likely correct	The small parts of aspects appeared are likely correct	No answer or the answer is incorrect
Deal with things in an orderly manner	The all concepts are correct, clear, and specific	Most of the concepts are correct, clear, and less specific	The small part of the concepts is correct and clear	The concepts are less focus or extravagant or doubtful	No answer or the answer is incorrect
Formulating an action	The all answer elaborations are correct, clear, specific, and supported with strong, correct, and clear argument(s)	Most of the answer elaborations are correct, clear, and less specific	The small part of the answer elaborations is correct and clear, but the reason and argument undergirding are unclear	The answer elaborations were less supporting	No answer or the answer is incorrect

(Adapted Finken and Ennis, 1993)

3.3.2.1 Instruments Development and Analysis

The rubric of students' critical thinking skills judged by the experts. The rubric used to determine students' critical thinking skills with test items. The test items includes 7 questions related to climate change topic. After the score of test is obtained, it will be interpreted. The criteria for the interpretation are detailed in Table 3.11 Below.

Table 3. 11

Intrepretation of Indicators of Critical Thinking Skills

Score	Interpretation
3.51 – 4.0	Master Thinker
3.11 – 3.5	Advanced Thinker
2.41 – 3.10	Practicing Thinker
1.71 – 2.40	Beginning Thinker
1.01 – 1.70	Challenged Thinker
0 – 1.0	Unreflective Thinker

(Paul & Elder, 2009)

3.3.2.2 Instruments Development and Analysis Results

The rubric accepted judgement by several experts as confirmed in Appendix A so that it is acceptable and sufficient to be used as the research instrument to obtain the data of students' critical thinking ability.

3.3.3 Students' Communication Skills Rubric

Students' communication skills will be assessed by using Rubric. The rubric adapted from Dunbar, Brooks, and Miller (2006). The instrument of Students' communication skills rubric will be analyzed with the judgement from experts. The rubric used to measure students' verbal communication skills in learning climate change by using screencast-o-matic application. The score is determined using rubric that shown in Table 3.12 below.

Table 3. 12

Communication Skills Rubric

Indicators	Assessment Criteria				
	Advanced 4	Proficient 3	Basic 2	Minimal 1	Deficient 0
Chooses and narrows a topic	Topic engages audience; topic is worthwhile, timely, and presents new information to the audience	Topic is appropriate to the audience and situation and provides some useful information to the audience	Topic is untimely or lacks originality; provides scant new information to audience	Topic is too trivial, too complex, or inappropriate for audience; topic not suitable for the situation	A single topic cannot be deduced
Communication thesis/specific purposes	Excellent attention getter; firmly establishes credibility; sound orientation to topic; clear thesis; preview of main points cogent and memorable	Good attention getter; generally establishes credibility; provides some orientation to topic; discernible thesis; previews main points	Attention getter is mundane; somewhat develops credibility; awkwardly composed thesis; provides little direction for audience	Irrelevant opening; little attempt to build credibility; abrupt jump into body of speech; thesis and main points can be deduced but are not explicitly stated	No opening technique; no credibility statement; no background on topic; no thesis; no preview of points
Provides appropriate supporting material	All key points are well supported with a variety of credible materials (e.g., facts, stats, quotes, etc.); sources provide	Main points were supported with appropriate material; sources correspond suitably to thesis; nearly all sources cited	Points were generally supported using an adequate mix of materials; some evidence supports thesis; source citations need to be clarified	Some points were not supported; a greater quantity/quality of material needed; some sources of very poor quality	Supporting materials are nonexistent or are not cited

Indicators	Assessment Criteria				
	Advanced 4	Proficient 3	Basic 2	Minimal 1	Deficient 0
	excellent support for thesis; all sources clearly cited				
Uses an appropriate organizational pattern	Very well organized; main points clear, mutually exclusive and directly related to thesis; effective transitions and signposts	Organizational pattern is evident, main points are apparent; transitions present between main points; some use of signposts	Organizational pattern somewhat evident; main points are present but not mutually exclusive; transitions are present but are minimally effective	Speech did not flow well; speech was not logically organized; transitions present but not well formed	No organizational pattern; no transitions; sounded as if information was randomly presented
Uses vocal variety in rate, pitch, and intensity	Excellent use of vocal variation, intensity and pacing; vocal expression natural and enthusiastic; avoids fillers	Good vocal variation and pace; vocal expression suited to assignment; few if any fillers	Demonstrates some vocal variation; enunciates clearly and speaks audibly; generally avoids fillers (e.g., um, uh, like)	Sometimes uses a voice too soft or articulation too indistinct for listeners to comfortably hear; often uses fillers	Speaks inaudibly; enunciates poorly; speaks in monotone; poor pacing; distracts listeners with fillers
Uses appropriate pronounciation, grammar, and articulation	Language is exceptionally clear, imaginative and vivid; completely free from bias, grammar errors	Language appropriate to the goals of the presentation; no conspicuous errors in grammar; no evidence of bias	Language selection adequate; some errors in grammar; language at times misused (e.g., jargon, slang, awkward	Grammar and syntax need to be improved as can level of language sophistication; occasionally biased	Many errors in grammar and syntax; extensive use of jargon, slang, sexist/racist

Indicators	Assessment Criteria				
	Advanced 4	Proficient 3	Basic 2	Minimal 1	Deficient 0
	and inappropriat e usage		structure)		terms or mispronun ciations

(Adapted from Dunbar, Brooks, and Miller, 2006)

3.3.3.1 Instruments Development and Analysis

The rubric of students' communication skills judged by the experts. The rubric used to determine students' verbal communication by using screencast-o-matic application in climate change topic. The interpretation of communication rubric are detailed in Table 3.13 Below.

Table 3. 13

Interpretation of Communication Rubric

Proficiency Rating Scale	
4.00 - 3.25	Advanced
3.24 - 2.75	Proficient
2.74 - 2.25	Basic
2.24 - 1.00	Minimal
0.99 - 0	Deficient

(Schreiber, Paul, & Shibley, 2012)

3.3.3.2 Instruments Development and Analysis Results

The rubric established judgement by several experts as confirmed in Appendix A so that it is acceptable to be used as the research instrument to gain the data of students' verbal communication.

3.3.4 The Correlation of Students' Critical Thinking and Communication Skills

After the data of students' critical thinking skills and students' communication skills were gained, the correlation between both variable was calculated by using SPSS software. The data were measured through correlation bivariate test to determine the correlation between the variables. After the coefficient correlation is gained, it is categorized into correlation

test criteria in Table 3.14 to define whether both variables have any correlation.

Table 3. 14

Correlation Test Criteria

Correlation Test Criteria	
0,00 – 0,30	no correlation
0,31 – 0,50	low correlation
0,51 – 0,70	medium correlation
0,71 – 0,90	strong correlation
0,91 – 1,00	perfect correlation

(Hinkle, Wiersma, & Jurs, 2003)

3.4 Research Procedure

For doing this research, there are procedures that consist of preparation stage, implementation stage, and completion stage. The steps that conducting this research are formulated as follows:

3.4.1 Preparation Stage

1) Formulating the problem and research objectives.

2) Determining variables of the research.

3) Conducting literature review about discovery learning, screencast-o-matic application, students' critical thinking skills, students' communication skills, and climate change topic.

4) Determining the sample and the population of the research.

5) Designing research instruments.

6) Testing research instruments.

7) Conducting and revising research paper.

3.4.2 Implementation Stage

1) Giving Pre-test to the students.

2) Implement treatment to the students.

3) Giving Post-test to the students.

3.4.3 Completion Stage

1) Calculating the data.

2) Analyzing the data.

3) Discussing the findings.

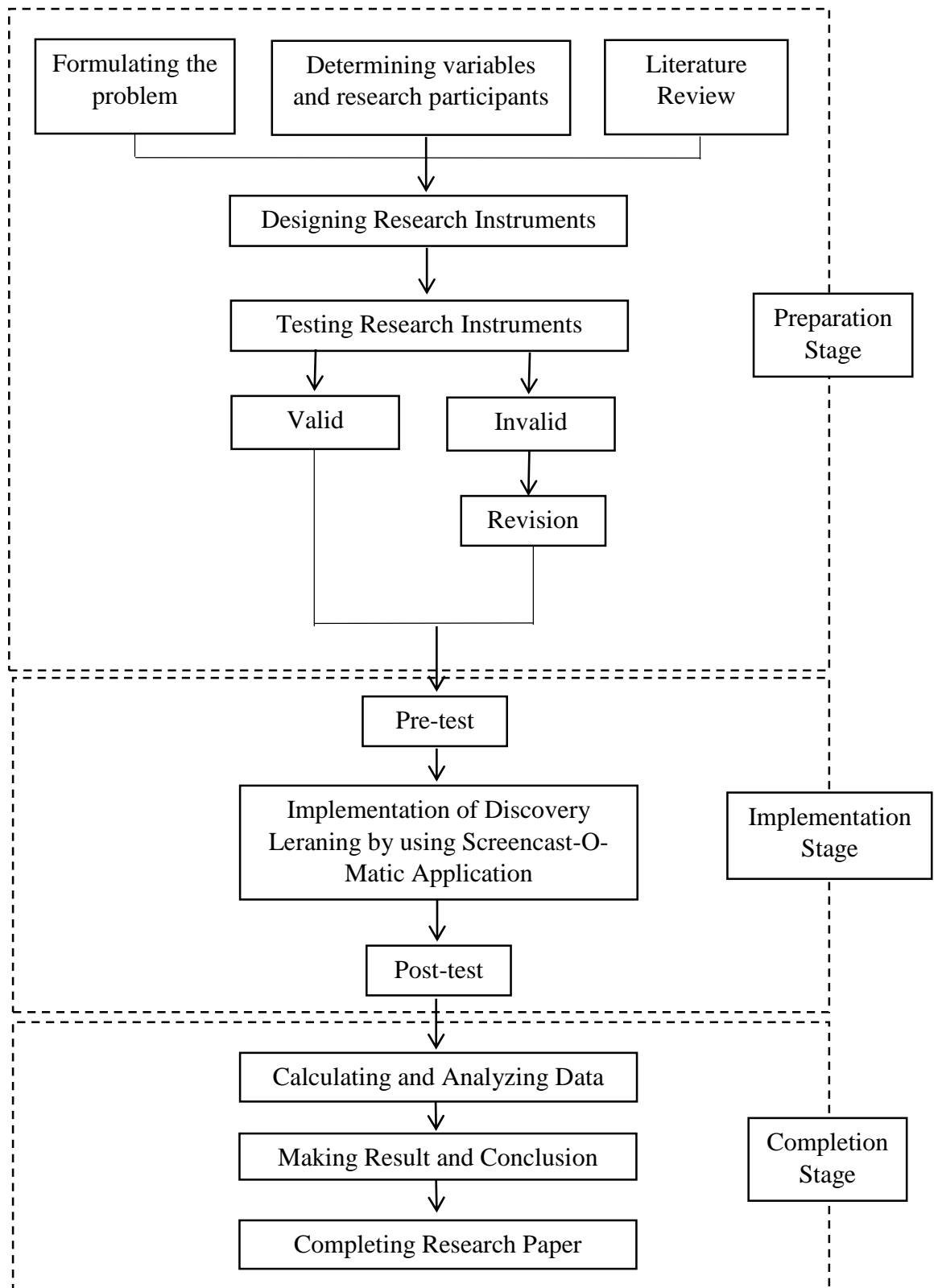4) Making results and conclusion.

5) Reporting of the research paper.

Figure 3. 1 The Flowchart of Research Procedure

3.5 Data Analysis

3.5.1 Students' Critical Thinking Skills

1) Scoring of Test

   The data collected from test items is the test score. The test items included essay questions with 7 test items, and each correct answer for a question is worth 4 marks, while 0 marks would be an incorrect answer. The score is determined from students' critical thinking skills rubric adapted from Ennis (2018).

2) Calculation of Gain Score and Normalized Score

   The gain score is the difference between pre-test and post-test score, to determine the development of students' critical thinking ability. It indicates the result after the treatment, or the impact of the treatment applied to the students. Normalized gain is determined after the measurement of the actual gain. The normalized gain then analyzed to classify the result of research into present standards that states the range of the improvement resulted from the treatment. The formula to measure actual gain is as shown:

$$G = Sf - Si$$

Note

G = Gain score

Sf= Score of Post-test

Si= Score of Pre-test

(Hake,1998)

As stated before, the gain score is not acceptable to enhance the range of the students improvement during the treatment. It is also essential to calculate the normalized gain of the data as well. The normalized gain score then interpreted and calculated based on the Hake (1998) criteria. The normalized gain formulation is as shown:

$$\langle g\rangle = \frac{Sf - Si}{Smax - Si}$$

Note

$\langle g\rangle$ = Normalized gain

Smax = Maximal score

Sf= Score of Post-test

Si= Score of Pre-test

(Hake,1998)

5) Normality Test

The normality test is used to test the hypothesis. The normality test is used to determine whether the test result is distributed normally or not. The normality test also aids to determine the likeliness of a unintentional variable in a data set to be normally distributed (Razali & Wah, 2011). The research used a parametric or non-parametric analysis test as a aspect in arranging the data analysis. When data is certainly distributed, then the homogeneity will be calculated. Thus, if the distribution of data is not normal, Wilcoxon Test could be used for the data analysis. In this research, the normality test had been calculated using SPSS software.

6) Homogeneity Test

Homogeneity test is required to determine which approach is appropiate for analyse the hypothesis while the test of normality cannot yet be selected. According to Krus & Blackman (1988), the homogeneity test is required to validate that any element of the data has the same statistical properties, contrast to any element of the total data. Sudjana (2005) also states that data will be categorized as homogeneous if the significance value is greater than 0.005. If the normality test results in normal distribution and the data tends to be

homogeneous, then the Paired Sample T-Test will be used for a single group pre-test post-test research design. However, the data of this research is proven to be not normal, although it is homogenous and therefore requires the Wilcoxon hypothesis test.

7) Mean Difference Test

Mean Difference Test is test to calculate the mean between the pre-test, and the post-test and decide if the score of the two tests is different or not. Wilcoxon testing could be used if the data is not normally distributed or not homogeneous, while if the data is normally distributed and also homogeneous, a paired T-test should be adequate.

3.5.2 Students' Communication Skills

1) Scoring Test

The data gathered for students' communication skills is the score from pre-test and post-test. The score is determined from rubric of communication skills adapted from Dunbar, Brooks, and Miller (2006). The rubric has six indicators to be measured. The most suitable criteria is worth 4 marks, whereas a not related criteria will obtain 0 marks.

2) Calculation of Gain Score and Normalized Score

The gain score is the difference between pre-test and post-test score to measure the improvement of students' communication skills. It indicates the effect of the treatment, or the result of the treatment applied to the students. Normalized score ($< g >$) of the data must also be calculated.

3) Normality Test

For testing the hypothesis using the most suitable approach, the normality of communication skills must be calculate first. The normality test in this research is calculated by using SPSS software.

The normality test is used to determine whether the test result is normally distributed or not. According to Razali & Wah (2011), Normality test also aids to determine the likeliness of a random variable in a normally distributed data set.

4) Homogeneity Test

According to Krus & Blackman (1988), a homogeneity test is needed to validate that any element of the data has the same statistical features as any element of the overall data. In this research, homogeneity test is calculated by using SPSS software.

5) Mean Difference Test

Mean Difference Test is to measure the mean between the pre-test and the post-test, it will determine if the score of the two tests is different. The Wilcoxon test should be used if the data is not normally distributed or not homogeneous, whereas if the data are normally distributed and also homogeneous, a paired T-test should be appropriate.

3.6   Assumption

The assumptions as the foundation of this research are as follow:

1) Discovery learning is a learning model that helps students to learn for themselves and apply what they understand and comprehend in new situations and condition which directed into reaching effective and successful learning in class (Mahmoud, 2014).

2) Critical thinking is a human skill of thought with the trusted argument. There is a difference on critical thinking skills between the students, students must have critical thinking skills to solve the problem of social life (Hapsari, 2016).

3) Effective classroom communication needs teachers and students that are able to properly send and receive lessons. The flexibility to reflect and argue is understood from a reasonable ideas of interpretation and understanding as an individual ability, but rather

to enhance a usual teaching, to discover how to differentiate completely between different meaning and finding by pay attention to others (Wahlström, 2010).

3.7 Hypothesis

Hypothesis that is tested in this research stated as follow:

H_0: There is no improvement on students' critical thinking and communication skills in learning climate change after the implementation of discovery learning by using a Screencast-O-Matic application.

H_1: There is an improvement on students' critical thinking and communication skills in learning climate change after the implementation of discovery learning by using a Screencast-O-Matic application.

3.8 Operational Definition

In order to summarize and avoid misconception about this research. The operational definitions are explained in this research. Those research variables are explained as follow;

1) Discovery Learning

Discovery Learning model in this research is done in six stages, which are (a) stimulation, (b) problem statement, (c) data collection, (d) data processing, (e) verification, and (f) generalization. The learning stages are based on discovery Learning strategy by Hosnan (2014).

2) Students' Critical Thinking Skills

Students' critical thinking in this research measured by using an objective test in the form of essay test which consist of 7 questions in the pre-test and post-test. In this research, objective test score of students' critical thinking skills measured by using critical thinking rubric that consists indicators limited to 4 indicators, which are Basic clarification, Inference, Advance clarification, and Non-Constitutive, But Helpful/formulating an action (Ennis, 2018).

3) Students' Communication Skills

Students' communication skills communication is the process of sending, receiving and understanding ideas and feelings in the form of verbal or nonverbal messages intentionally or unintentionally (Iriantara, 2014). In this research, students' communication skills assessed by using communication skills rubric that consists of 6 indicators, which are Chooses and narrows a topic, Communication thesis/specific purposes, Provides appropriate supporting material, Uses an appropriate organizational pattern, Uses vocal variety in rate, pitch, and intensity, and Uses appropriate pronounciation, grammar, and articulation.