

## CHAPTER III

### RESEARCH METHODOLOGY

#### A. Research Method and Design

##### 1. Research Method

The research used Pre-Experimental method. As Cohen, Manion and Morrison (2007) gave an example of pre-experimental in a study involving a group following a course of training (program of study) to equip them to the variable of study. The researcher wished to find out whether the program of study as treatment researcher had devised would effect changes on the variable of the study or research. The Pre-Experimental method has three types of design, there are are 1) The one group pretest-post-test design; 2) The one group post-test only design; and 3) The post-test only non-equivalent group design (Cohen, Manion, and Morrison, 2007). Referring to the case example and the designs, it was considered as an appropriate method to support the purpose of study.

##### 2. Research Design

The design that was conducted in this research was pre-experimental: one group pretest-post-test design (Cohen, Manion, and Morrison, 2007). The researcher assigned intact group the treatments for experimental, it involved three steps: (1) administering a pretest for measuring dependent variable; (2) conducting experimental treatment X to subjects; (3) administering a post-test to measure the dependent variables.

**Table 3.1**  
**Research Design for Two Different Dependent Variables**

O	X	O
Pretest	Experimental Treatment	Post-test

*(Cohen, Manion and Morrison, 2007)*

## B. Population and Sample

The research was conducted in International Secondary School in Bandung. It uses English as instructional language and implements Cambridge curriculum. The population in this research was all 8<sup>th</sup> grade students. The samples were 8th grade students from one class in the school with Convenience Sampling as sampling technique used. In accordance to Fraenkel and Wallen (2011) who stated that convenience sampling is sample acquired by taking (conveniently) group of individuals who are available.

## C. Assumptions

1. Student-created slow motion animation (*Slowmation*) can influence students' understanding due to the increase of students' engagement to the lesson in learning Heat Transfer since it involves students thinking about the content in multiple ways and incorporates many connected learning processes.
2. Constructing *Slowmation* can measure creativity of students by creating a platform to share students' idea about Heat Transfer within a group.

## D. Hypothesis

$H_0$  : There is no significance influence before the implementation of *Slowmation* on students' understanding of Heat Transfer and after the implementation of *Slowmation*: Student-created slow motion animation ( $\mu \geq 0.05$ ).

$H_1$ : There is significance influence before the implementation of *Slowmation* on students' understanding of Heat Transfer and after the implementation of *Slowmation*: Student-created slow motion animation ( $\mu < 0.05$ ).

## E. Operational Definition

In order to avoid incorrect view because of based on faulty thinking about this research, some operational definitions were explained in this research. The terminologies are explained as follow:

1. Learning activities using *Slowmation* is done by constructivist learning. Where learners construct knowledge for themselves. Learning process is conducted

through creating slow motion animation narrated with either audio which students' voice or verbal which narrated text that is integrated into the media. Six stages of *Slowmation* that were used in this research are the representation strategy.

2. Creativity in this research refers to creativity of process and product. The process is measured by creativity observation sheet that is adapted from creativity component. Moreover, the creativity for product is measured by using the rubric of Common Core State Standard Aligned (CCSS-Aligned) Creativity that is developed by Buck Institute (2013). The 'process' part of this rubric helps teachers guide secondary level students in using a knowledge, creative thinking, and motivation components for creativity in various stages of a project, and it can be used to assess learners' performance. The 'product' part of the rubric can be used to assess the degree of creativity shown in the products students constructed.
3. Understanding in this research is the competence of students that covers the level of cognitive process including remembering (C1), understanding (C2), applying (C3), analyzing (C4), and evaluating (C5). Considering C5 (evaluation) of cognitive process level as the learning implementation goes through some processes that trigs the evaluation process level through hypothesizing. Knowledge component as part of creativity during the process of *Slowmation* is also studied for its relation to understanding. The indicators are The Causes of Heat transfer, Conduction, Convection, Radiation, and Its application. This competence of understanding was measured by using 22 multiple choice questions for both pre-test and post-test.

#### **F. Research Instrument and Analysis**

In this research, instrument was necessary to be used for gaining data. There were three types of instruments that werse used in this research, namely objective test, observation sheet, and creativity CCSS-aligned rubric for product form. Those instruments are described below.

### 1. Creativity Observation Sheet

The observation sheet contains the sequence of students' activities based on *Slowmation* stages. Students' activities during *Slowmation* stages were conducted in accordance with students' creativity based on creativity components that consist of knowledge component, creative thinking component, and motivation component (Amabile, 1998). This adapted observation sheet for creativity had been judged by experts.

This observation sheet was used to measure students' creativity during the process of learning as the non-test required instrument. Two observers and teacher analyzed students creativity based on creativity component observation sheet arranged. This data was obtained from the beginning until the end of the lesson by observing the lesson and giving checklist in the criteria that exist in the observation sheet as the design is described in the following table.

**Table 3.2**  
**Blueprint of Creativity Observation Sheet during *Slowmation* Stages**

Stages	Component of Creativity	Applied activities
Research Note	Knowledge	Each group identifies the application of radiation, or convection, or conduction in daily life. (Identify)
	Creative Thinking	Every group distinguishes the information about their own sub topic from other's group sub topic. (Selective Encoding)
		Student within group judges the value of other student's own ideas about the topic. (Judge the value)
	Motivation	Students recognize creative work even before impact of project is known. (Recognize creative work)
		Each student gives autonomy to themselves to seek the information related to subtopic. (Give autonomy)
		Students encourage risk-taking to take information of subtopic innovatively. (encourage risk-taking)
		Every student in group share information. (Information sharing)
Storyboarding	Knowledge	Students design storyboard whereby the concept

Stages	Component of Creativity	Applied activities
and Annotating		of each group is broken down into several scenes. (Designing)
		Students organize scenes in coherent sequence. (Organizing)
		Students explain idea for narration. (Explaining)
Storyboarding and Annotating	Creative Thinking	Every group combines any example of application and concept of subtopic in storyboard. (Selective Combination)
		Each groups compares new information to old information by placing scenes in coherent sequence. (Selective comparison)
		Student distinguishes information from research note to storyboard for narration. (Selective Encoding)
		Each student evaluates their strengths and weaknesses through having responsible with their own special role. (Evaluate)
	Motivation	Every student gives friends and themselves autonomy to choose their own responsibility in regard to specific task in project. (Give autonomy)
		Students resource time and idea to design storyboard. (Resource)
		Students combine and combust every idea in interesting way of storyboarding and making narration. (Combine idea)
		Students aware to place scenes coherently. (Aware)
		Students aware to make narration appropriately. (Aware)
		Every student matches themselves to role where challenge is optimized. (Match to jobs)
Modeling	Knowledge	Students construct models regarding designed storyboard. (Constructing)
		Students implement the designed storyboard by moving models in small steps of 20-40 for each of episode. (Implementing)
		Students construct models regarding designed storyboard. (Constructing)
	Creative Thinking	Students combine bits of storyboard to create models. (Selective Combination)
		Models makers apply storyboard into model creation using 2D or 3D media. (Apply)

Stages	Component of Creativity	Applied activities
		intellectual skills)
		Students judge model maker's idea through moving models in small steps. (Judge the value)
	Motivation	Students aware of creating good models where information can be shared. (Aware)
		Students collaborate every model in small steps of 20-40 for each of episode. (Collaboration)
Photograph	Knowledge	Students execute to take photo at each step of manipulating small movement in the manual model. (Executing)
	Creative Thinking	Students apply each step of manipulating small movement and take photo in the manual model. (Apply intellectual skills)
	Motivation	Students combine ideas of models and storyboard in taking photo at each step of manipulating small movement. (Combine idea)
Animation	Knowledge	Students interpret the narration idea (either audio or text) into animation.(Interpreting)
	Creative Thinking	Students apply to add match narration that can be added to the animation. (Apply intellectual skills)
	Motivation	Students recognize to creative work of adding narration into animation. (Recognize creative work)
Show	Knowledge	Each group of students recalls the concept of their own animation through presentation. (Recalling)
		Other groups check the concept of radiation, convection, conduction, and its application through QandA session. (Checking)
	Creative Thinking	Students sell their creative ideas of <i>Slowmation</i> by presenting the animation to an entire class. (Sell creative idea)
	Motivation	Students share information to other groups. (Information sharing)
		Students collaborate the information from their group and other groups'. (Collaboration)

(source: Hoban and Nielsen, 2011; Amabile, 1998; Adams, 2006)

## 2. CCSS Aligned Creativity Rubric

This instrument was adjusted with creativity rubric that was published by Buck Institute of Education (2013) as another non-test required instrument. It was designed in accordance with creativity as one of twenty first century skills needed. The rubric of creativity and innovation CCSS-Aligned was used to measure product of students' creativity. *Slowmation* as the student-created slow motion animation is the product students made. This product was assessed based on the criteria available in rubric by giving the score for every group. The design of creativity rubric is presented in the following table:

**Table 3.3**  
**Blueprint of Creativity Rubric for Product**

	<b>Below Standard</b>	<b>Approaching Standard</b>	<b>At Standard</b>	<b>Above Standard</b>
<b>Originality</b>	1. No new models, ideas, or directions 2. Uses materials and ideas in typical ways	1. New ideas are conventional 2. New uses for common materials or ideas.	1. New, unique, surprising. 2. May successfully break rules and conventions.	1. New, unique, surprising. 2. Use common materials or ideas in new, clever, and surprising ways.
<b>Value</b>	1. Not useful to the intended audience. 2. impractical or unfeasible.	1. Useful and valuable to some extent. 2. Unclear feasibility	1. Useful and valuable. 2. Meets the minimum identified need. 3. Feasible.	1. Useful and valuable. 2. Solves the defined problems. 3. Meet beyond the identified need.
<b>Style</b>	1. play safe, ordinary, made in a conventional style. 2. has elements that do not fit together.	1. Has interesting touches. 2. Lacks a distinct style. 3. Some elements do not fit together well.	1. Well-crafted and striking. 2. Combines different elements into mostly coherent.	1. Well-crafted and striking. 2. Designed with a distinct style and appropriate to the aim. 3. Combines different elements into mostly coherent whole.

(Buck Institute of Education, 2013)

### 3. Objective Test

Students' Understanding is the quantitative data on the study. The objective test instrument was purposed to measure understanding which was more emphasized on revised Bloom's Taxonomy as cognitive process dimension. Final objective test consisted of 22 test-items in the form of four options multiple choices related to heat transfer topic.

The 22 questions of objective test were given to be validated first for measuring students' understanding. The test items had been judged by some experts and revised by researcher. The objective test was given to 31 students who had learnt heat transfer topic previously. Results of their answers were analyzed to test the validity, reliability, discriminating power, and difficulty level of objective test instrument. The recapitulation of test items analysis is shown in the following table.

#### Test item recapitulation:

Reliability test: 0.77 categorized in high degree (Minium et al., 1993).

**Table 3.4**  
**Test Items Recapitulation for Students' Understanding**

Question Number	Discriminating Power	Difficulty Level	Validity	Status
1	Mediocre	Hard	Enough	Accepted
2	Mediocre	Medium	Low	Accepted
3	Mediocre	Medium	Enough	Accepted
4	Excellent	Hard	High	Accepted
5	Excellent	Medium	Enough	Revised
6	Mediocre	Medium	Low	Accepted
7	Mediocre	Medium	Low	Accepted
8	Mediocre	Hard	Enough	Accepted
9	Mediocre	Medium	Low	Accepted
10	Excellent	Hard	High	Accepted
11	Mediocre	Medium	Enough	Accepted
12	Excellent	Medium	High	Accepted
13	Poor	Medium	Low	Accepted
14	Excellent	Medium	Enough	Accepted
15	Mediocre	Medium	Low	Accepted
16	Mediocre	Medium	Enough	Accepted



Question Number	Discriminating Power	Difficulty Level	Validity	Status
17	Poor	Easy	Low	Revised
18	Mediocre	Medium	Enough	Accepted
19	Mediocre	Hard	Low	Accepted
20	Mediocre	Medium	Enough	Revised
21	Mediocre	Medium	Enough	Accepted
22	Mediocre	Medium	Low	Accepted

After the reliability, discriminating power, difficulty level, and validity of the test item were tested, thus the adequate test item was ready to be used as research instrument to collect the data of students' understanding. The final result of test item specification is distributed as in the following table.

**Table 3.5**  
**Objective Test (Pretest-Post-Test) Distribution**

Concept	Level of Cognitive Domain					Total	Percentage (%)
	C1	C2	C3	C4	C5		
Transfer of Heat	2, 3	1, 4	-	-	-	4	19
Conduction	5	-	6	7	-	3	15
Convection	10	8	9, 11, 12	-	-	5	22
Radiation	15	13, 16, 17	14	-	-	5	22
Heat Transfer Application	-	18, 19	21, 22	-	20	5	22
<b>Total</b>	5	8	7	1	1	<b>22</b>	
<b>Percentage (%)</b>	22	36	32	5	5	<b>100</b>	

The instrument of objective test was analyzed with the following requirements.

#### **a. Validity**

A researcher's appropriateness, correctness, meaningful-ness, and usefulness of inferences are referred as validity (Fraenkel, 2011). Validity is the most important

idea to consider while preparing or selecting to-be-used-instrument. To know the validity of each number of the test-items, the researcher used ANATES Version 4.0 with the interpretation follows Minium et al. (1993) rule.

### **b. Reliability**

Individuals' deviation scores or z-scores have degree, it remains relatively consistent over repeated administration of the same test or alternative test forms. To measure reliability of test items, the researcher used the program of ANATES Version 4.0. The classifications of items reliability follow the rule from Minium, et.al. (1993).

### **c. Difficulty level**

According to Jandaghi (2010), when an item is dichotomously scored, the mean of item score corresponds to the proportion of examinees who answer the item correctly. This proportion for item “ $i$ ” is usually denoted as  $p_i$  and is called item difficulty. It also can be said that number that shows difficulty or easiness of a test items is known as difficulty index or level of difficulty. The difficulty of an item is understood as the proportion of the persons who answer a test item correctly. Researcher used ANATES Program to calculate the difficulty level.

### **d. Discriminating Power**

An index of how effectively the item discriminates between examinees who are relatively high on the criterion of interest and those who are relatively low is known as the term of discriminating power. The index of discrimination ( $D$ ) in this research was calculated by ANATES v.04 program. Values of  $D$  may range from -01.00 to 01.00. Positive values indicate that test-item discriminates in favor of the upper group; negative values indicate test item is a reverse discriminator, favor in lower-scoring group.

## G. Research Procedures

The research procedures were arranged into three stages in order to be a good systematic research. Those three stages are preparation stage, implementation stage, and completion stages.

### 1. Preparation Stage

During the stage, researcher concerned to all preparation steps to conduct and support the research. The steps of preparation stages were described as follow:

- a. Formulating problem to be investigated;
- b. Determining focus of variable research;
- c. Conducting literature review of *Slowmation*, students' creativity, students' understanding, and heat transfer topic;
- d. Arranging research proposal with the contents of Chapter I to Chapter III that was presented in proposal seminar;
- e. Designing research instrument for objective test, observation sheet, and creativity product and then were judged by experts;
- f. Revising research instrument after getting suggestions from expert judgements and supervisor;
- g. Trying out objective test instrument;
- h. Checking validity, reliability, difficulty level, discriminating power, distractor test of objective test instrument using ANATES version 4.0;
- i. Revising research instrument based on the result of instrument try out analysis..

### 2. Implementation Stage

The stage explains how the research was implemented. The steps consist of:

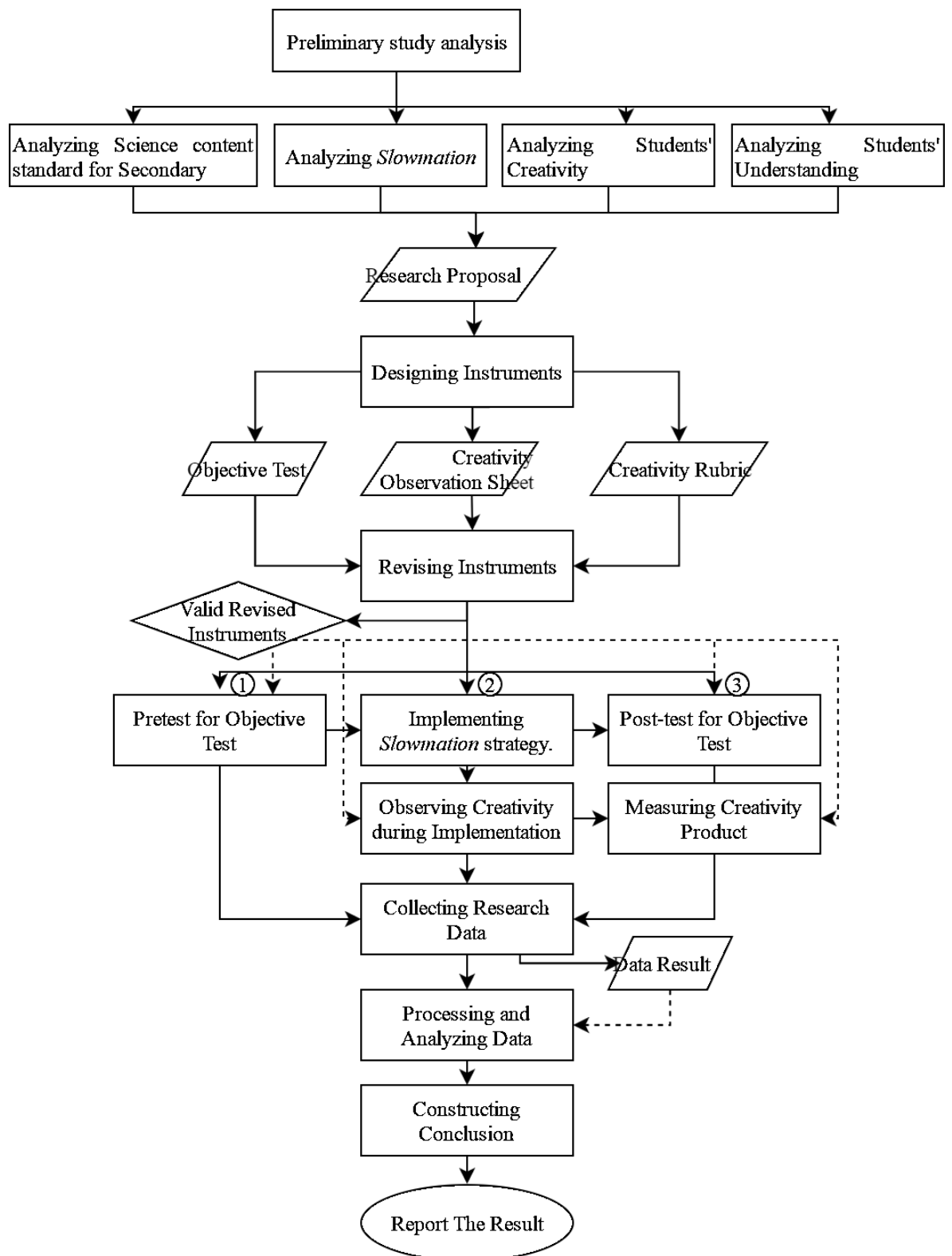
- a. Determining the experimental class by convenient sampling technique;
- b. Conducting pretest in experimental class;
- c. Experiment treatment: implementing *Slowmation* procedures (*Slowmation* stages) as the strategy in learning Heat Transfer;
- d. Observing students' creativity during the treatment by the observer;

- e. Conducting post-test to the class in order to gain information of students' influence in creativity and understanding;

### **3. Completion Stage**

Through this stage, the obtained data were reported as research paper. It consists of three systematic steps:

- a. Analyzing the research whole data;
- b. Discussing data results and constructing conclusion of experiment.
- c. Arranging research report.



**Figure 3.1 Research Procedure Diagram**

## H. Data Processing Technique

Three data was gained by both quantitative and qualitative data. Quantitative data were gained from pretest and post-test of objective test which was used to measure students' understanding. Meanwhile, qualitative data were gained from observation sheet and creativity CCSS-aligned rubric, these data were used to measure students' creativity of both the processes and product of *Slowmation*. Data processing techniques are explained as follow:

### 1. Quantitative Data Analysis

#### a. Scoring of Test Item

The research used the scoring of test item as the initial step of data calculation. Test item consisted of 22 multiple choice problems. Every correct answer was given +1 score and 0 score for the incorrect answer.

#### b. Calculation of Gain Score and Normalized Gain Score

The obtained test item data was processed through gain score and normalized gain score. Gain score is obtained by calculating the difference scores from each post-test and pretest (Hake, 1999). It could be assumed as the effect from given treatment. Moreover, normalized gain score was supposed to determine the acceptance or rejection of hypothesis and also the categories of students' understanding. The influence of *Slowmation* on students' understanding in heat transfer topic was analyzed and categorized from normalized gain score. The formula that was applied to calculate normalized gain based on Hake (1999) finding. The obtained normalized gain was continued to be interpreted based on the category description in refer to Hake (1999).

#### c. Normality Test

The use of parametric statistic has a deal with assumption that each analyzed variable in this is a normal distribution. The homogeneity variant test cannot be done if the data is abnormal or the parametric technique cannot be applied. Therefore if the data is abnormal, the non-parametric technique is used. Normality

test aims to know the sample which comes from population has normal distribution or not. In this research, Normality statistic test is calculated SPSS 20.

#### **d. Homogeneity Test**

A sample from population that is originated from two classes that homogenous can be determining using homogeneity test. In this research, the homogeneity test uses statistical test from SPSS 20, with significance level ( $\alpha$ ) is 0.05. Minium et al. (1993) stated that the data is homogenous when significance value  $\geq 0.05$ .

#### **e. Paired T-Test and Wilcoxon Test**

A paired t-test is used to compare two population means where you have two samples in which observations in one sample can be paired with observations in the other sample. The test is represented by the result of pretest and post-test score by using *Wilcoxon Test* in SPSS 20. Wilcoxon test is done when the data show the distribution from one or all data is not distributed normally.  $H_0$  is rejected if the level of significance (Asymp. sig)  $\leq 0.05$  and  $H_0$  is retained if the level of significance (Asymp. sig)  $> 0.05$ .

#### **f. Correlation between Variables**

Correlation analysis in this research was performed to find the value of correlation coefficient. According to Tanner (2012), correlation is able to define the strength of relationship between two variables, which are in the research has students' creativity with cognitive achievement, also students' creativity with motivation. Processing the value of correlation coefficient is done by SPSS 20. The category interpretations for correlation coefficient refer to Tanner (2012).

## **2. Qualitative Data Analysis**

Qualitative data were obtained from the data of both observation sheet for the processes and creativity rubric for product of *Slowmation*. The analysis of all observation sheet, rubric, and questionnaire is done by converting raw score into percentage (Arikunto, 2013)

Yet, the interpretations of score percentage for observation sheet and rubric are differentiated by the categorization. Observation sheet data were interpreted into some criteria according to Arikunto (2013). Rubric that was developed by Buck Institute of Education (2013) as the other instrument to obtain another qualitative data has its own criteria for categorizing the creativity of product. The interpretation is used as well as for the criteria for students' creativity for overall data.