CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Method

According to the research method that was used in this research was pre-experiment. In pre-experiment, either a single group of a participant or multiple groups is observed after some intervention or treatment is presumed to cause change. Although they do follow some basic steps used in experiments, pre-experiment either fail to include a pretest, a control or comparison group, or both; in addition, no randomization procedures are used to control for extraneous variables (Salkind, 2012). This method is suitable with the purpose of the research which is to investigate the improvement of students' retention and motivation in learning science.

3.2 Research Design

Research design used in this research is One Group Pre-and Post-test Design. The variable measured in this design is once before the experiment and once after the experiment (Marsden & Torgerson, 2012). The experiment design is shown in Table 3.1.

Table 3.1
Research Design: The One Group Pretest-Posttest Design

O_1	X	O_2
Pre-test	Treatment (Science-content music)	Post-test

(Salkind, 2010)

In this research design, all the participants are first assigned to the experimental group. Then, the group is observed at two-time points, pretest and posttest. The pretest is recoded before the intervention (independent variable). Then after the intervention, a second observation is conducted in the form of a posttest. Changes form the pretest to the posttest is the outcome of interest, which are presumed to be the result of the intervention (Salkind, 2010). This research design is used to find out the improvement of students' retention and creativity through science-content music in learning solar system.

3.3 Population and Sample

The location of this research was conducted in one of private junior high school located in Bandung. The population were the 7th grade students of junior high school academic year 2019/2020 from Private School "X". The curriculum used in this school is 2013 national curriculum which very suitable with the topic content used in this research, which is solar system topic.

The sampling technique used for this research is Convenience Sampling. Convenience sampling is a sampling in which researchers take a sample acquired by taking (conveniently) group of individuals who are available (Fraenkel & Wallen, 2011).

3.4 Operational Definition

In order to summarize and avoid misconceptions about this research, the operational definitions are explained in this research. Those research variables are explained as follow:

1) Science-content music

Science-content music in this research, the music video will be produced by the students individually the music video contains solar system content as the lyric of the music. Science-content music is implemented to help the improvement of students' retention and creativity. The topic used to implement science-content music as teaching media is solar system.

2) Students' Retention

Scientific retention in this research is the increasing of the ability to remember the concept in the long term period, the length of time for this research is a month after the concept given. It will be measured using Bloom's Taxonomy revised, which consist of C1 (remember), C2 (understand), C3 (apply), C4 (analyze), C5 (evaluate), C6 (Create) with pretest and posttest (Anderson, Krathwohl, & Bloom, 2001).

3) Students' Creativity

Creativity is a process of making the originality. Creativity in this research refers to the product as the result of science-content music which is a music video. CPAM Rubric will be used as an instrument for evaluating students' products individually and measure students' creativity.

3.5 Assumption

The Assumption as the foundation of this study are as follow:

1) Both these students and their teachers emphasized the socio-cultural appeal of music as a potential advantage for using science-content songs for teaching, and found that analyzing lyrics can help students connect ideas and construct understanding of scientific concepts. (Gregory, Tom, Jean & Katie, 2016)
2) Songs aid motivation and help learners develop a love for language learning. Students motivated in this way are imaginative, creative, and eager to learn and succeed. (Džanić & Pejić, 2016)
3) The value of using songs to teach science was appreciated by teachers for their use in developing scientific vocabulary and presenting concepts to students in alternative ways. (Gregory, Tom, Jean & Katie, 2016)

3.6 Hypothesis

Hypothesis that is tested in this study are as follow:

H_0: There is no significant improvement of students' retention in learning solar system using science-content music.

H_1: There is significant improvement of students' retention in learning solar system using science-content music.

3.7 Research Instrument

In this study, it is necessary to use the instrument to gather data. There are two types of instruments that will be used, which are Objective Test and Creative Product Analysis Matrix (CPAM). Those instruments are described below:

3.7.1 Observation Sheet

Observation sheet is one of assessment techniques which aimed to analyze students' activities and teacher implementation according to learning process take place (Maxwell, 2001). The observation is conducted by administrators and senior teachers for evaluation. The sheet of observation sheet attached on the appendix.

3.7.2 Objectives Test

Objective test based on Bloom's Revised used to measure students' cognitive mastery. The question includes only four cognitive process dimensions, which are: C1 (remember), C2 (understand), C3 (apply), C4 (analyze), C5 (evaluate), and C6 (create) before and after implementing science-content music as teaching media. It consists of pre-test and post-test. Pre-test conducted to measure students' prior knowledge, while post-test conducted to identify the increasing of students' cognitive skill and students' retention after one month. The blue print of the objective test shown in Table 3.2.

Table 3.2
Blue Print of Environmental Pollution Objective Test

No	Sub-topic	C1	C2	C3	C4	C5	C6	Total
1	Solar System	1,2,3,5,6	7,8,9,10,13	-	11,12,22	28,29	30	30
2	Earth Condition	-	14,15	27	-	-	-	
3	Moon Phase	-	16	25	17,18,19,23,24	-	-	
4	Eclipse	26	-	21	20	-	-	

3.7.2.1 Validity

Validity is the extent to which a test measures the quality it purposes to measure. It also can be defined as the agreement between a test score and the quality it is believed to measure. In this research, the validity is used to check validation of the objective test as instrument to measure students' retention. The formula to calculate the validity is:

$$r_{xy} = \frac{n \sum xt - \{(\sum x)(\sum y)\}}{\sqrt{\{n \sum x^2 - (\sum x)^2\}\{n \sum y - (\sum y)^2\}}}$$

Where:

r_{xy} = Items correlation coefficient

x = Items scores

y = Total score of each student

n = Amount of subject

$\sum x$ = Sum of total score of all students for each question's item

$\sum y$ = Sum of total score of all students for whole test

For the validity interpretation is represented in Table below.

Table 3.3
Validity interpretation

The amount of r value	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

(Source: Saccuzo & Kaplan, 2004)

3.7.2.2 Reliability

Reliability is the consistency of students' test result. The consistency here means the stability of students in answering question or aspect-aspect on variable dimension in questioner. To measure the reliability of test item, research use the formula below:

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

Where:

K = Number of items on the test

M = Set of test scores

SD = Standard Deviation of the set of test scores

(Source: Fraenkel, 2015)

The reliability value can be interpreted in the Table 3.4 as follow:

Table 3.4
Interpretation of Reliability

r Value	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

(Source: Fraenkel, 2012)

3.7.2.3 Difficulty Level

Difficulty level Difficulty level refers to mean score of item test that correspond to the proportion of who answer correctly.

To measure the difficulty level of question, the researcher uses the formula below:

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

Where:

Dl = Difficulty level

A = Number of students who answer the correct answer

N = Total number of students

(Source: Cohen, 2007)

The level of difficulties can be interpreted in the Table 3.5 as follow:

Table 3.5
The Interpretation of Dl

The Value of Dl	Interpretation
Dl ≤ 0.30	Difficult
0.31 < Dl ≤ 0.70	Medium
0.71 > Dl	Easy

(Cohen, Manion, & Morrison, 2002)

3.7.2.4 Discriminating Power

Discriminating power refers to the question that potentially can be answered correctly by students who have high scoring group and it can be answered incorrectly for students in low scoring group (Cohen, 2007). To measure the discriminating power, researcher use the formula below:

$$Dp = \frac{A - B}{\frac{1}{2}N}$$

Where:

Dp = Discriminating power

A = Number of the students in high scoring group

B = Number of students in low scoring group

N = Total number of students

(Source: Cohen, 2007)

The value of discriminating power can be interpreted in the Table 3.6 as follow:

Table 3.6

The Interpretation of discriminating power

Discriminating Power Value	Interpretation
0,70 – 1,00	Excellent
0,40 – 0,70	Good
0,20 – 0,40	Satisfactory
0,00 – 0,20	Poor
Negative	Very Poor

(Source: Croker & Algina, 2006)

3.7.2.5 Distractor

Distractor is the incorrect option in a multiple-choice question. Good or bad determination of distractor works can be determined by the pattern of the choice answer, the more distractor chosen the greater quality of the distractor. The formula to be used in order to obtain the distractor is:

$$Corrected\ Score = R - \frac{W}{n-1}$$

Where:

R = Number of right answers

W = Number of wrong answers

N = Number of choices in each item

(Source: Kaplan & Saccuzzo, 2017)

3.7.3 CPAM Rubric

In order to analyze students' creativity based on their products, this research used rubric scoring in order to evaluate students' product of science-content music. Creative Product Analysis Matrix (CPAM) rubric is the most suitable rubric used, it's developed by Besmer and Treffinger used to analyze students' creativity.

Creativity Product Analysis Matrix consist of three creativity dimension (Novelty, Resolution, and Elaboration and Synthesis), eleven indicators, and score using scale from 1-3 point. Data of students' creativity product are gain from science-content music product. The rubric is shown in Table 3.7.

Table 3.7
CPAM Rubric

No.	Dimension	Criteria
1.	Novelty	1. Originality 2. Germinal 3. Transformational
2.	Resolution	1. Adequate 2. Appropriate 3. Logical 4. Value 5. Usefulness
3.	Elaboration	1. Attractive 2. Complex 3. Elegant 4. Organic 5. Well-crafted

	6. Expressive

(Source: Besemer & Treffinger, 1981)

3.8 Data Processing Technique

3.8.1 Validation of Research Instrument using ANATES

In order to validate the instrument before conducting pre-test and post-test, the researcher checked the reliability, validity, discriminating power, and difficulty level using ANATES program. The data was taken from 50 students of 8th grade student in Private Junior High School in Bandung. The result of test items validation is shown in appendix.

The data from the result of validation by the student was analyzed to eliminate the low-quality ones of the test item. The test item was analyzed based on its validity, difficulty level, and discriminating power by using ANATES software. There were 50 multiple choice questions in the beginning, turn in to 30 questions used both for pre-test and post-test ater the test item was analyzed.

3.8.2 Students' Retention Data Analysis

Students' scientific literacy data analysis which measured by an objective test was done by using Microsoft Excel software in order to determine the score of post test. The first step to process data was scoring the test item. Test item consists of 20 multiple choice questions. The test was taken by students in one class and the data was analyzed by using microsoft excel software to find out the average score of the class. The average score is used to capture the knowledge of learners in the environmental pollution topic.

After the average score of the class was gained, the average score of each indicator in students' scientific literacy was calculated as well to determine which score is the highest and the lowest. The indicators are concept, competencies, and attitude.

3.8.2.1 Score of test item

To find the Gain and Normalized Gain, the researcher give 0 score for incorrect answer and 1 for correct answer. The question consist of 30 multiple choice questions.

3.8.2.2 Gain and Normalized Gain

After compile student's result of test item pretest and posttest, gain score calculated by determine the differences between pretest and posttest score. So, the improvement can be seen clearly. The researcher can analyze how the model of learning can improve students' concept mastery. The next step is categorized (N-Gain) of student achievement. The way to calculating the concept mastery data result, researcher using the formula by Hake follows:

$$G = S_f - S_i$$

Where:

G = Gain Score

S_f = Posttest Score

S_i = Pretest Score

(Hake, 1999)

The result of N-Gain (Normalized Gain) can shows the improvement of students' retention in solar system through science-content music. N-Gain calculated by the formula by Hake as follows:

$$\langle g \rangle = \frac{S_{post} - S_{pre}}{S_{\max} - S_{pre}}$$

Where:

<g> = Normalized Gain

S_{post} = Posttest Score

S_{pre} = Pretest Score

S_{max} = Maximum Score

(Hake, 1999)

After conducting Normalized Gain calculation, the result can be categorized as many categories as shown on Table 3.8

Table 3.8
Categorizes of Normalized Gain

Value <g>	Category

$\langle g \rangle \geq 0.7$	High
$0.7 < \langle g \rangle \geq 0.3$	Medium
$\langle g \rangle < 0.3$	Low

(Hake, 1999)

3.8.2.3 Normality

To checking the data were distribute normally, the researcher analyzed by using SPSS IBM 24. The result of the data is normal and homogenous, so normality test can be use. The level significance of Kolmogorov-Smirnov is 0.05, if the result show on level 0.05 means H_0 is accepted, while the result show value more than 0.05 is rejected. Moreover, normality test aim is to know the data distribute has normal result or not. The hypothesis will be check should be arrange following:

H_0: There is no improvement of students' retention and students' creativity in learning solar system using science-content music.

H_1: There is improvement of students' retention and students' creativity in learning solar system using science-content music.

3.8.2.4 Homogeneity

The aims of this test to determine the sample that has two class as sample population homogenous. The application that used still IBM SPSS 24, with significance value (α) = 0.05. If the value $\leq$ 0.05 means the data, determine as homogenous. The data that already test by homogeneity test and the result normal or homogeny can be continue independent T-Test.

3.8.2.5 Paired T-Test

To measure the hypothesis that already arrange by the researcher T-test that used. This test was conduct after normality and homogeneity test of data. T-test used after knows the data distribute normally and homogenous. IBM SPSS 24 used in this research, if the result of level significance (sig) $\leq$ 0.05 means H_0 rejected, whether (sig) > 0.05 means H_0 accepted.

3.8.3 Students' Creativity Analysis

Students' creativity was investigated based on their product results. Students'creativity indicators were assessed by using rubric scoring under creativity

dimension from Besemer and Treffiger, and converted into percentage form through formula as follows:

$$\text{NP} = \frac{R}{SM} \text{x } 100\%$$

Where:

NP = Percentage

R = Raw score

SM = Maximum score

(Source: Purwanto, 2019)

The interpretation of score percentage of student creativity is categorized into certain criteria which shown on Table 3.9

Table 3.9
The Interpretation of Students' Creativity

Percentage (%)	Criteria
86 - 100	Very Good
76 – 85	Good
60 – 75	Enough
55 – 56	Lack
< 54	Very Lack

(Source: Purwanto, 2019)

3.9 Research procedure

In order to make the research arranged systematically, there are 3 main stages in the research that consist of preparation stage, implementation stage, and completion stage.

1) Preparation Stage

a) Identifying research problem

b) Formulating research objective

c) Reviewing literature on Science-content music, memory retention, creativity, and Solar System

d) Making research instruments. There are two instruments; objective test and rubric

e) Validating research instrument by expert

f) Revising research instrument

2) Implementation Stage

a) Determining the research subject

b) Conduct pre-test to students' sample

c) Implementing science-content music as teaching media in learning solar system

d) Conduct post-test to gain the data

3) Completion Stage

a) Analyzing the data gained from the research

b) Discussing findings resulted from the data

c) Making conclusions from the data analysis result

In order to make the research systematically arranged, the author made the stages into the flowchart. The flowchart is shown in Figure 3.1.

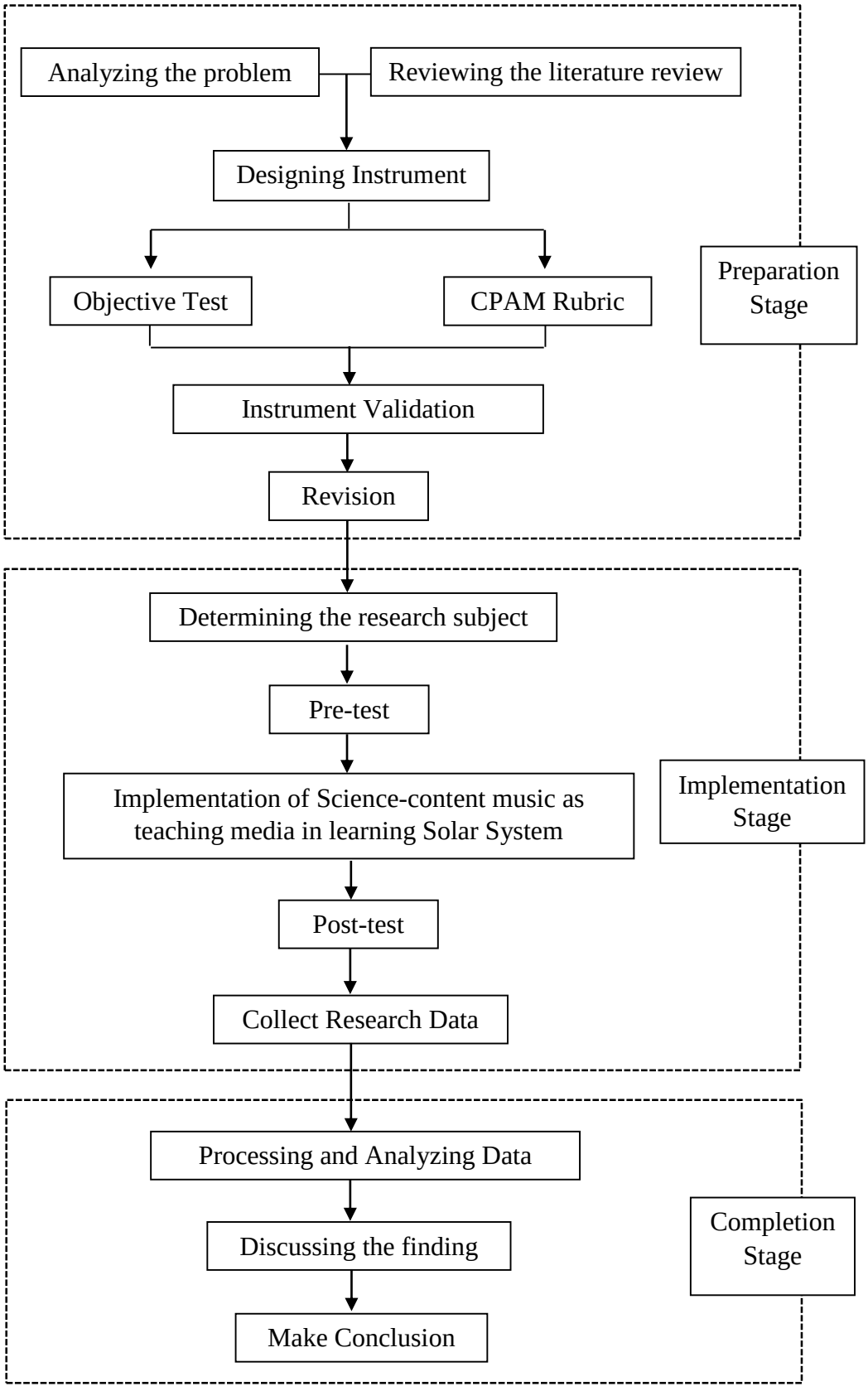

Figure 3.1 Research Flowchart