CHAPTER III RESEARCH METHODOLOGY

3.1 Research Method and Research Design

The method which was used weak experiment method. According to Fraenkel, Wallen nad Hyun (2011) a weak experimental design involving one group that is pretested, exposed to a treatment, then posttested. That is related to the purpose of this study which is to investigate the effect of the implementation of discovery learning supported by Solar System Scope application towards students' concept mastery in learning solar system.

The design used in this reserach is One-Group Pretest-Posttest Design. One-group pretest-posttest design measuring a single group not only after being exposed to treatment of some sort, but also before the treatment. Treatment in this research is learning solar system using discovery learning supported by Solar System Scope application. Table 3.1 shows how the researh design.

OXOPretestTreatmentPosttest	One-G	Table 3. 1 Froup Pretest-Posttest	Design
Pretest Treatment Posttest	0	Х	0
	Pretest	Treatment	Posttest

(Fraenkel, Wallen, and Hyun 2011)

The method and design that used is appropriate with the purpose of the research which investigate the implementation of dsicovery learning supported by Solar System Scope application to enhance students' concept mastery and curiosity in learning solar system since the method of this research use only one class of students amd no control group for comparison.

3.2 Population and Sample

The location of this research is at one of Junior High School in Bandung. The curriculum that is used in this scool is Curriculum 2013. The population on this research is all the students in one of the class in 7th grade who have not studied the solar system topic before. The sampling technique used in this research was a convience sampling. According to Fraenkel, Wallen & Hyun (2011) convience sampling is a group of individuals who are aveliable for study. The researcher selects participants because they are available to be studied. Table 3.2 is the recapitulation of the sample.

Table 3	.2
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Data of the Sample				
Population	Sample		Percentage	Total
			(%)	(%)
7 th grade	Male	13	41.93%	100%
7 grade	Female	18	58.06%	10070

The table shows there are 31 students in one class at this school with 13 male students and 18 female students with age average 12-13 years old. The students as the sample to be studied because they are available and the researcher has the permission of the principal.

3.3 Operational Definition

In order to avoid misconception about this research, some operational definitions were explained in this research. Those terms are:

- Discovery learning is a learning model that developed based on constructivism. In this research, discovery learning refers to the lesson plan that made based on syntax by on Joyce, Weil and Showers (1992), which are stimulation, problem statement, data collecting, data processing, verification, and generalization. Meanwhile Solar System Scope application in this research is a tool to help students gain the data in data collecting step.
- 2. Concept mastery of students is competence of students to reach the level of cognitive process based on Anderson and Krathwohl (2001), in this research students' concept mastery consist of remembering (C1), understanding (C2), applying (C3), and analyzing (C4). Students'

concept mastery measured by 20 multiple choice questions for pre-test and post-test.

3. According to Shumakova (1992) it is great importance to the development of a child's creativity through curiosity and ability to phrase questions, which is why it is so important to assess and analyze students' curiosity to diagnosis their creative and intellectual abilities. Students' curiosity in this research assesed using questionnaire adopted from SCILE by Weible and Zimmerman (2016) which given to the students before and after learning using discovery learning supported by Solar System Scope application.. Questionnaire consists of three aspects which are science, stretch, and embrace.

3.4 Assumption

The assumption is the foundation of this study as follow:

- 1. Discovery learning as student-centered could help students to understand better rather than just memorizing the concept.
- 2. Solar System Scope application is the interesting planetarium software to help students learning solar system.
- 3. Students' answering the question of students' concept mastery test and questionnaire of students' curiosity honestly.

3.5 Hypothesis

Hypothesis that is tested in this study are as follow

- H_o: There is no enhancement in students' concept mastery and curiosity in learning Solar System after the implementation of discovery learning supporte by using Solar System Scope application.
- H₁: There is an enhancement in students' concept mastery and curiosity in learning Solar System after the implementation of discovery learning supporte by using Solar System Scope application.

3.6 Research Instrument

In this research, instrument is a substantial point to be used for gaining data. There are three types instrument that are used in this research which are objective test to measure students' concept mastery, questionnaire to measure students' curiosity and observation sheet. Those instruments are described below.

3.6.1 Students' Concept Mastery

In this research to measure students' concept mastery in learning solar system, researcher use objective test which consists of 20 multiple choices. The question distributed before and after conducting learning activity. Pretest distributed to the students before they learn about soalr system.

Solar System topic and posttest distributed after learning activity measure the enhancement in students' concept mastery. There are C1 (Remembering) until C4 (Analyzing) as cognitive domain that used in this research. Test item of students' concept mastery can be seen in Table 3.3

Table 3.3				
Test Item of Students' Concept Mastery				
No	Indicator	Test Item		
1	Remembering	1, 2, 6, 7, 8		
2	Understanding	4, 5, 9, 10, 11, 13, 14, 17		
3	Applying	3, 12,16		
4	Analyzing	15, 18, 19, 20		

The data was analyzed in term of its discriminating power, difficulty level, and validity by using ANATES

a. Validity

Appropriateness, correctness, meaningfulness, and usefulness of inferences to a researcher shall be referred to as Atika Zahara, 2019 THE IMPLEMENTATION OF DISCOVERY LEARNING SUPPORTED BY SOLAR SYSTEM SCOPE APPLICATION TO ENHANCE STUDENTS' CONCEPT MASTERY AND CURIOSITY IN LEARNING SOLAR SYSTEM

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validity (Fraenkel, Wallen, and Hyun 2011 In order to obtain the resulting validity of the studies, the instrument that will be used must be valid. To know the validity of the test-items the researcher uses software ANATES and its need the interpretation of validity. The interpretation of validity is tabulated in Table 3.4

Table 3.4 Interpretation of Validity

Reliability Test Coefficient	Classification
0.00 - 0.20	Poor
0.20 - 0.40	Fair
0.40 - 0.60	Moderate
0.60 - 0.80	Good
0.80 - 1.00	Very Good

(Arikunto, 2010)

b. Reliability

Fraenkel, Wallen, and Hyun (2012) stated that reliable references to the consistency of scores or answers from other instruments and from one item to another item. According to Vansickle (2015: 4) the classification of reliability test is shown in Table 3.5

Table 3.5 Classification of Reliability Test			
Value of r	Interpretation		
0.00 - 0.20	Very Low		
0.20 - 0.40	Low		
0.40 - 0.60	Enough		
0.60 - 0.80	High		
0.80 - 1.00	Very High		

(Vansickle, 2015)

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c. Difficulty Level

Jandaghi (2010) stated that when an item is dichotomously scored, the mean item score corresponds to the proportion of examinees who answer the item correctly. It also can be said that the number shows difficulty in test item defined as difficulty level or difficulty index. The interpretation of difficulty level is tabulated in Table 3.6

Table 3.6 Interpretation of Difficulty Level		
Value of Dificluty Index Interpretation		
0.0 - 0.30	Difficult	
0.30 - 0.70	Moderate	
0.70 - 1.00	Easy	

(Arikunto, 2010)

d. Discriminating Power

An index of how the item effectively can discriminates between the examinees that are relatively high of interest and those who are relatively low according on the criterion. The index of discrimination (D) in this research was calculated by ANATES program. The interpretation of discriminating power is tabulated Table 3.7

1000 5.7			
In	terpretation of Di	scriminating Power	
D=	Quality	Recommendations	
> 0.39	Excellent	Retain	
0.30 - 0.39	Good	Possibilities for Improvement	
0.20 - 0.29	Mediocore	Need to check/review	
0.00 - 0.19	Poor	Discard or revies in depth	
< -0.01	Worst	Definitely discard	

Table 3.7

(Backhoff, Larrazolo & Rosas, 2000)

e. Distractor

Distractor on a multiple choice item defined as an incorrect alternative. A distractor analysis could allow examining how many students in the high grades and low grades selected each option on a multiple choice item. To make sure that the test item has good distractors, the wrong answers contained in the multiple choices are tested in this research. The recapitulation of test item is tabulated in Table 3.8, details in Appendix B.1

Table 3.8Recapitulation of Test Item for Students' Concept Mastery

Question	Discriminating	Difficulty	X7 1 1.	<u> </u>
Number	Power	Level	Validity	Status
1	Good	Moderate	Enough	Used
2	Worst	Moderate	Very Low	Rejected
3	Excellent	Moderate	Enough	Used
4	Modiocore	Easy	Enough	Used
5	Excellent	Easy	Enough	Used
6	Good	Easy	Enough	Used
7	Poor	Moderate	Low	Revised
8	Excellent	Moderate	Enough	Used
9	Worst	Moderate	Low	Rejected
10	Good	Difficult	Enough	Used
11	Good	Easy	Enough	Used
12	Good	Difficult	Enough	Used
13	Excellent	Medium	Enough	Used
14	Poor	Easy	Enough	Revised
15	Good	Moderate	Enough	Used
16	Poor	Easy	Very Low	Rejected
17	Excellent	Easy	High	Used
18	Modiocore	Moderate	Enough	Used
19	Modiocore	Moderate	Enough	Used

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20	Worst	Easy	Very Low	Rejected
21	Modiocore	Easy	Enough	Used
22	Worst	Easy	Very Low	Rejected
23	Modiocore	Easy	Enough	Used
24	Modiocore	Easy	Enough	Used
25	Modiocore	Moderate	Enough	Used
26	Worst	Easy	Very Low	Rejected

The total number of multiple choice questions is 26 questions. The questions was distrbuted to be tested to 32 students of 8th grade in Junior High School who already learned about solar system topic. Those questions researcher use based on some book, national exam exercise, and some questions is from the research that already validated. From the Table 3.6, after analyze using ANATES there are 5 questions rejected and 20 questions is used with 2 questions are need some revision before used as objective test in this research. Details of the questions in Appendix B.2.

3.6.2 Students' Curiosity

Questionnaire was used to getting know the response of the students towards implementation of discovery learning supported by Solar System Scope application in learning solar system. The questionnaire which given to the students before and after learning activity was adapted from Wieble and Zimmerman (2016) called Science Curiosity in Learning Environment (SCILE). The questionnaire consist of 12 questions divided into three aspect, there are science, stretch, and embrace. The questionnaire was used five-likert scale where the scale consist of five choice there are "Always, often, sometimes, not often, never". The questionnaire statement is tabulated in Table 3.9, details in Appenidx B.3

No	Aspect	Statement
1	Science	1, 2, 3, 4
2	Stretch	5, 6, 7, 8
3	Embrace	9, 10, 11, 12

Table 3.9 Questionnaire Statement

3.6.3 Observation Sheet

Observation sheet was used by the observer to measure the tecahing learning activities done by the researcher. The observation sheet gave the information about the percentage of activities done based on the lesson plan. The observation is shown in Appendix B.5.

3.7 Research Procedure

There are three stages of this reaserach procedure: preparation, implementation, and completion stages. The there stages will be explained as follows:

a. Preparation Stage

In this stage, the researcher has to analyze the content all of the instrument that will be used to support this research. Some steps of this stage will be explained in this below.

- Literature review conducted to analyze the information about Curriculum 2013, discovery learning, Solar System Scope application, students' concept mastery, students' curiosity, and solar system topic.
- Arrangement of instruments including objective test, questionnaire to measure students' curiosity, and observation sheet intsructional tools will be used are lesson plan and worksheet that arranged to support the implementation of this research.
- 3) Judgement of instrumentation will be conducted by experts.

- 4) Trail test of objective test instrument will be conducted to identify the quality of instrument.
- 5) Revision of instruments will be done based on judgement result and test item analysis.
- b. Implementation Stage

This stage consist of the data gathering process which includes several steps as follows:

- 1) Pretets will be conducted to identify students' preliminary skills.
- Treatemnt will be conducted science the firts meeting until the last meeting of learning solar system.
- 3) Posttest will be conducted
- c. Completion Stage

In completion stage, the collected data gained during the implementation stage will be analyzing by the researcher. This stage also has several steps:

- 1) All of data will be obtained then calculated
- 2) The result of data calculation will be analyzed
- 3) Discussion will be done to elaborate the result of analysis.
- 4) Concluding the result of this study based on the analyzed data.



Figure 3.1 Research Procedure Flowchart

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3.8 Data Analysis

Data was obtained from both qualitative and quantitative data. Quantitative data was obtained from pre-test and post-test. These data is used to measure improvement of students' concept mastery. Qualitative data was obtained from questioner that is used to gain the students'curisoity of students from learning solar system before and after learning activity by implementing discovery learning supported by Solar System Scope application. Explanation of data processing techniques were obtained as follows:

3.8.1 Students' Concept Mastery

Analysis the objective test to measure students' concepet mastery was done by Microsoft Excel calculation to determine the score of pre-test and posttest. The process of data calculation is explained as follows:

a. Scoring of Test Item

Pre-test and post-test test item was calculated to know the result of each student. The question of each test item pre-test and post-test is 20 multiple choice questions.

b. Calculate the Gain and Normalized Gain

The normalized gain, introduced by Hake 1998 "as a rough measure of the effectiveness of a course in promoting conceptual understanding," has become the standard measure for reporting scores on research-based concept inventories. After scoring the test item, the data was processed to know the gain score and normalized gain score. The improvement (gain) from pretest to posttest can be computed for each participant by subtracting each person's pretest score from his or her posttest score (Becker, 2000). Hake defined the average normalized gain as:

$$< g > = \frac{\% S_f - \% S_i}{100 - \% S_i}$$

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Description:

<g>= Normalized gain

Sf= Post-test score

Si= Pre-test score

Table 3.10 Interpretation of N-Gain			
N-gain Score Category			
(<g>) > 0.7</g>	High		
0.7 > (<g>) > 0.3</g>	Medium		
(<g>) < 0.3</g>	Low		

(Hake, 1998)

c. Normality Test

Normality test is a test about the normal distribution of data. This test is the most widely performed test for parametric statistical analysis. The data that is normally distributed is a requirement for parametric tests. The data analyzed using SPSS 24.00 and was distributed normal.

d. Homogeneity

Homogeneity test aims to determine whether the measured score variance in both samples has the same variance or not. Populations with the same variance are called populations with homogeneous variance, whereas populations of unequal variance are called populations with heterogeneous varience.

e. Independent T Test

Independent sample T test was used to test the significance of the average difference of the two groups. This test is used to test the effect of the independent variable to the dependent variable. The significance value is 0.05 and determines the hypothesis.

3.8.2 Students' Curiosity

Students' curiosity that measured in this research was use questionnaire Science Curiosity in Learning Environments (SCILE) scale International Journal (Wieble and Zimmerman, 2016). The questionnaire was used five-likert scale where the scale consists of five choices there are "always, often, sometimes, not often, never". Students are given the questionnaire before learning activity and after learning activit by implementing dsicovery learning that supported by Solar System Scope application. There are 12 questions that divided into three aspects, there are sciece, stretch, and embrace.

The data was analyzed first to get the score of each students, reseracher use Microsoft Excel 2013 to analyze all of the data. The second is calculating the total average of before and after learning activity score to analyze the enhancement by calculating the N-gain. The third is calculating the average percentage of each students to know the difference in the number of students in each category before and after learning activity. Below is formula to get the interpretation of curiosity questionnaire.

I = 100 / Total Score (likert)

Then = 100 / 5 = 20, Result (I) = 20, this is the distance interval from 0% to 100%. The interpretation of curiosity questionnaire can be seen in Table 3.11

interpetation of Curiosity Questionnane	
Interval	Category
0% - 19.99%	Very (Disagree / Bad / Less once)
20% - 39.99%	Disagree / Unfavorable
40% - 59.99%	Fair / Neutral
60% - 79.99%	Agree / Good/ Like
80% - 100%	Very (Agree / Good / Like)

Table 3.11 Interpetation of Curiosity Questionnaire

 $(Darmadi, 201\overline{1})$