CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Method and Research Design

3.1.1 Research Method

The research method used in this research is quasi-experiment. Quasi-experiments involving experimental group and control group, including assignment of this method, but not random group assignment of participants. These experiments can be carried out when researchers have to use intact groups. The comparison between the experimental group and the control group could be made after treatment which is Jigsaw design given to the experimental group, while control group is given any treatment and just conducting conventional method in teaching learning process (Cresswell, 2017).

3.1.2 Research Design

The design used was matching only pre-test and post-test in control group (Fraenkel, Wallen, and Hyun, 2011). The research design for two classes as a treatment and has learned about the topic. The experimental group, which received "Monopoly Game" treatment during the course of students, learned about the interaction of living things and their environments. Meanwhile the control group was treated as play a guess game and quiz game when they learned about the same subject with the experimental group. Than conducted post-test, the same questions with the pre-test form are distributed to two classes. The pre-and post-test form was used as a multi-choice paper test to measure the students' concepts mastery of the subject that was learned during the treatment, the design can be seen on Table 3.1.

Table 3.1
Research Design

Group	Pre-Test	Treatment	Post-Test
A (Experimental Group)	O	X_1	O
B (Control Group)	O	X_2	O

(Creswell, 2017)

3.2 Population and Sample

This research is conducted in one of School in Bandung which applies *2013 National Curriculum* in the teaching and learning process. The data was taken on March 2019. The population in this research was 7th grade students at Junior High School "X" in Bandung, and the samples are 29 students consist of two classes in seven grades, which are 7-A and 7-C, there will be given treatment 7-C is experiment group which is implementing Monopoly Game and 7-A are Control group is playing a guess word and quiz game. Convenience sampling was be as a sampling technique that applied in this research. Based on Fraenkel, Hyun and Wallen, (2011) stated that a convenience sample is a group of individuals who (conveniently) are available for reseach. A certain group of people was selected for this reseach because they were available.

3.3 Operational Definition

1. Monopoly game based learning is defined as learning to increase concept mastery and motivation in learning science. Monopoly game based learning conducted by playing the game in learning that can be asses by a lesson plan and observation using the observation sheet,

2. Students' Concept Mastery in this research based on Anderson and Krathwohl theory (2001) in the revised Blooms' Taxonomy, such as Remembering (C1), Understanding (C2), Applying (C3), Analyzing (C4), Evaluating (C5), and Creating (C6). Using multiple choice question and essay in Pre-Test and Post-Test can be measured for this competence.

3. In this study, student motivation refers to the ARCS model created by Keller 1987. The motivation element of learning is measured by Attention, Relevance, Confidence, and Satisfaction. Data obtained through a questionnaire that is adapted from the ARCS Model given for students at the end of the treatment.

3.4 Assumption

The assumptions as of the foundation of this study as follow:

1. An educational game utilizes an educational technique to assist learners to acquire understanding by engaging them with preset guidelines in a competitive exercise.

2. Using a monopoly in a learning activity, the student can be improved to understanding the material and can be more positive from the increasing student attitudes, and they should be able to integrate a number of learning.

3. The motivation of teachers and educators as an explanatory factor in subjective theories.

4. There are two sides that teach and interest to motivate and teach a coin that cannot be segregated. The motivation is to understand the idea correctly and to make interesting students learn.

3.5 Hypothesis

The hypothesis that is tested in this study is as follow:

H_0: There is no difference in students' concept mastery and students' motivation in learning interaction of living things and environment using monopoly game based learning.

H_1: There is a difference in students' concept mastery and students' motivation in learning interaction of living things and environment using monopoly game based learning.

3.6 Research Instrument

In this research, the instrument is necessary to be used for gaining data. There are three type instruments that are used in this research which are rubric, observation sheet, and objective test. These instruments are described below.

3.6.1 Rubric Judgment

In this rubric judgment, researcher submit the research instrument consisting of objective test, questionnaire and design of monopoly game based learning to the lecturer who is an expert in the product's content, also discussed with science teacher in Junior High School in which the researcher take the data. On the judgment, the expert also give the suggestion on the item test whether it should be reject, revise or retain. The rubrics to measure students' concept mastery is shown in Table 3.2 and the detailed presented in Appendix B.1 shown that experts judgment decided the acceptable questions questionnaire and monopoly game based learning and give the comment. There are seventeen questions that are not accepted because the sentence is not good enough, the questions are not understood, and are not match with the cognitive domain.

Table 3.2
Rubric Judgments

Experts Judgment	The comment of Instruments		
	Objective Test (Multiple Choice Questions)	ARCS Questionnaire	Monopoly Game Based learning
Expert Judgment 1	Some revision are needed!	Some revision are needed!	-
Expert Judgment 2	Major revision for questions answer in term of their redaction, types and some are difficult to be understood!	The questionnaire has too many grammar errors and mismatch between indicator and the statements. Can I have the original questionnaire? I want to compare them.	-
Expert Judgment 3	-	Consider the number of statements for each	-

Experts	The comment of Instruments		
Judgment	Objective Test (Multiple Choice Questions)	ARCS Questionnaire	Monopoly Game Based learning
		specifications. Revise the statement on the sentences.	
Expert Judgment 4	-	-	Please design the layout of card for supporting the theme of monopoly game in living things and environment topic. Arrange the rate for playing game
Expert Judgment 5	-	-	Need to revise in order to make it better
Expert Judgment 6	-	-	Perlu dijelaskan bagaimana guru menilai proses pembelajarannya.

After judging the content from the expert, the researcher conducted the validity test was also introduced to 8th graders who had learned the concept of interaction of living things and its environment. After answering the question of objective test the item test was analyze and test the validity. Based on this step, the researcher found that the validity and prepared to be applied to the research' class.

3.6.2 Observation Sheet

The observation sheet in this research contain the activities was done by the researcher in implementing the Monopoly Game Based Learning also Guess word and quiz game. The observation sheet feature used in this studies ensures that the investigator follows the suitable procedures in the activities during the study process and also acts as a guideline for the researcher, result of observation sheet presented in Appendix B.5.

3.6.3 Objective Test

The objective test is used to assess the mastery idea of learners in studying in the interaction of living things and the environment. In this study, the objective test is various options and the essay is used to evaluate the conceptual mastery of learners after treatment with Monopoly Game in learning interaction of living things and environment. To measure the cognitive process dimension based on Revised Bloom's Taxonomy from C1 until C6 only is the purpose of objective as test. Table of 3.3 shown the blue print of objective test item.

Table 3.3
Blue Print of Objective Test item

Sub Topic	Cognitive Level Domain and Number of Item test					
	C1	C2	C3	C4	C5	C6
Ecosystem components	1,2	3,5,6,7	-	-	20	-
Unit of Ecosystem	-	12	21,25	23	-	15,16
Interaction of Living things	10	-	-	-	-	-
Food chain an ecosystem	-	17,18	-	13,19	-	-
Food web an ecosystem	-	-	8,24	14,	4,22	-
Relationship between biotic and abiotic component also biotic and biotic component	9	11,	-	-	-	-

Sub Topic	Cognitive Level Domain and Number of Item test					
	C1	C2	C3	C4	C5	C6
TOTAL	**4**	**8**	**4**	**4**	**3**	**2**

In order for the test items of the research instruments to be appropriate for this research, the test items were firstly checked for its validity as follows:

a. Validity

Validity is the appropriateness, relevance, correctness and usefulness of the researcher's involvement. The proof is collected and analyzed to support inferences (Fraenkel, Wallen & Hyun 2011). The sort of validity to be used in this study is the validity of the information, the content and the format of the tool.

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

Where,

r_{xy} = items correlation coefficient

X = items scores

N = number of subjects

(Minium, 1993)

The above formula may be used to determine the validity of the sample item. The following table may be used to define the validity of each element.

Table 3.4
Interpretation of r value (Correlation)

Gained r value	Interpretation
0.80 – 1.00	Very high
0.60 – 0.79	High
0.40 – 0.59	Medium
0.20 – 0.39	Low
0.00 – 0.19	Very low

b. Reliability

Reliability is described as the consistency of the results acquired, the consistency of each person from one tool to another and from one product to another that focuses on precision and precision (Kaplan and Saccuzo, 2012).

Therefore, reliability will be calculated using the following formula:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{t=1}^{K}\sigma_{Yi}^2}{\sigma_x^2}\right)$$

Where,

K = number of items

σ_x^2 = the variance (square of standard deviation)

σ_{Yi}^2 = observed variance from item i

(Cronbach, 1951)

Table 3.5
Interpretation Reliability Coefficient

Gained r value	Interpretation
0.80 – 1.00	Very high
0.60 – 0.79	High
0.40 – 0.59	Medium
0.20 – 0.39	Low
0.00 – 0.19	Very low

(Jacobs and Chase, 1992)

c. Difficulty Level

The complete percentage of people who answer the question properly is known as the IF or P difficulty coefficient, and the difficulty or ease of the sample products is known as the difficulty index or difficulty level (Seif, 2004;Brown, 2004).

$$IF = \frac{B}{JS}$$

(Brown, 2004)

Where:

IF = Level of Difficulty per Item

B =Number of test-takers answering the item correctly

JS =Number of test-takers responding to that item

An Item was conducted difficulty index value was less than 30% abd considered easy when the index was more thn 70%, the value between 30-70% was acceptable, and between 50-60% are ideal (Ananthakrishnan, 2000).

d.   Discriminating Power

Discriminating authority is the provision of data on the individual differences either on the construction that is supposed to be measured by the test. The objective is to distinguish items for which high-scoring examinations have a high probability of responding properly and low-scoring examinations have a low probability of responding properly. Once the upper and lower groups have been identified, the index of discriminating (D) is computed as:

$$D = P_u - P_1$$

(Crocker, 1986)

Table 3.6
Discriminating power of the answers according to their D value

D =	Quality	Recommendations
>0.39	Excellent	Retain
0.30 – 0.39	Good	Possibilities for improvement
0.20 – 0.29	Medium	Need to check / review
0.00 – 0.28	Poor	Discard or review in depth
< -0.01	Worst	Definitely discard

(Backhoff, Larrazolo, and Rosas, (2000)

e.   Distractor

Distractors are the correct option given in a question of various decisions and learners should choose the right option. Usually, four options are given in each issue of various decisions.

$$corrected\ score = R - \frac{W}{n-1}$$

Where,

R = number of right answers

W = number of wrong answers

n = number of choice in each item

(Kaplan and Saccuzo, 2012)

3.6.4 Questionnaire

To gain feedback and measure the motivation level of students in learning the concept of interaction of living things and its environment based on the ARCS Model by Keller (1987). The questionnaire was used on four likert scales where the information was first evaluated to obtain each student's scores the investigator used Microsoft Excel 2013 to evaluate all the information, and the questionnaire shown in Appendix B.4. After studying activity score to evaluate the improvement by calculating the N-gain. Below is a formula to get the motivational questionnaire interpretation.

I = 100 / Total Score (likert)

Then = 100 / 4 = 25, Result = 25, this is the distance interval from 0% to 100% (Darmadi, 2011). The interpretation of questionnaire motivation shown in Table 3.7, and in Table 3.8 has shown the questionnaire sheet.

Table 3.7
The interpretation of scoring at Motivational Questionnaire

Score	Category
0% - 24,99%	Very (Dissagree/ Bad/ Less once)
25% - 49.99%	Dissagree/Unfavorable
50% - 74.99%	Agree/Good/Like
75% - 100%	Very(Agree/Good/Like)

(Darmadi, 2011)

Table 3.8
Questionnaire sheet

No	Condit	Specific	Likert scale

	ion	ation	Statement	Strongly Dissagree	Disagree	Agree	Strongly Agree
1	Attention	A1 Incongruity, Conflict	Saya antusias ketika belajar menggunakan permainan monopoli				
2	Attention	A2 Concreteness	Saya tidak mengetahui perbedaan antara jaring-jaring makanan dengan rantai makanan pada materi yang terdapat dalam permainan monopoli				
3	Attention	A3 Variability	Ketika teman saya menanyakan pertanyaan yang sulit saat bermain monopoli, saya bisa menjawabnya dengan tepat				
4	Attention	A4 Humor	Peraturan yang diterapkan pada permainan monopoli sangatlah ketat sehingga saya tidak bisa mengikutinya sampai selesai				
5	Attention	A5 Inquiry	Melalui permainan ini, saya menjadi paham bahwa adanya hubungan antara prinsip simbiosis dengan kehidupan sehari-hari				
6	Attention	A6 Participation	Dalam aktivitas pembelajaran melalui metode permainan monopoli, saya berpartisipasi aktif dan melaksanakan peraturan yang diterapkan				
7	Relevance	R1 Experience	Saya merasa materi yang terdapat pada permainan monopoli tidak bermanfaat				
8	Relevance	R2 Present Worth	Melalui permainan monopoli, saya menjadi tahu bahwa lingkungan sekitar sangat berpengaruh untuk				

No	Condition	Specification	Statement	Likert scale			
				Strongly Dissagree	Disagree	Agree	Strongly Agree
			keseimbangan ekosistem				
9	Relevance	R3 Future Usefulness	Melalui permainan monopoli, saya menjadi semangat dalam menjaga lingkungan sekitar agar keseimbangan ekosistem tetap terjaga				
10	Relevance	R4 Need Matching	Permainan ini saling berhubungan antara materi yang terdapat pada permaian dengan kehidupan sehari-hari				
11	Relevance	R5 Modeling	Saya merasa bosan ketika permainan monopoli ini berlangsung				
12	Relevance	R6 Choice	Permainan monopoli ini tidak bermanfaat dan membuang-buang waktu				
13	Confidence	C1 Learning Requirements	Saya merasa tidak adanya keterkaitan antara tujuan pembelajaran dengan permainan monopoli				
14	Confidence	C2 Difficulty	Saya merasa tertantang untuk menyelesaikan permasalahan yang ada saat permainan berlangsung dan memenangkan permainan monopoli				
15	Confidence	C3 Expectations	Melalui perminan monopoli, saya menjadi belajar bagaimana cara menyelesaikan permasalahan yang terjadi sehingga saya dapat ilmu lebih banyak tentang diri saya sendiri				
16	Confid	C4	Melalui permainan ini saya				

No	Condition	Specification	Statement	Likert scale			
				Strongly Dissagree	Disagree	Agree	Strongly Agree
	ence	Attributions	belajar bahwa untuk mencapai kemenangan harus dengan usaha yang tekun dan teliti				
17	Confidence	C5 Self-Confidence	Saya merasa bangga, karena saya ikut berpartisipasi dalam permainan monopoli sampai dengan selesai				
18	Satisfaction	S1 Natural Consequence	Saya merasa senang, ketika membantu teman saya yang kesulitan dalam menjawab pertanyaan yang ada di kartu permainan monopoli				
19	Satisfaction	S2 Unexpected Rewards	Saya merasa termotivasi untuk belajar ekosistem dengan menggunakan metode pembelajaran permainan monopoli				
20	Satisfaction	S3 Positive Outcome	Permainan monopoli ini membuat saya lebih cepat memahami materi karena saya bisa menikmati pembelajaran sambil bermain				
21	Satisfaction	S4 Negative Influence	Dari permainan monopoli saya hanya bermain saja dan tidak mendapat banyak informasi yang bisa menambah pengetahuan tentang ekosistem				
22	Satisfaction	S5 Schedulling	Saya tidak akan menjaga keseimbangan lingkungan sekitar setelah mempelajari Ekosistem melalui permainan monopoli				

ARCS Motivational questionnaire by John Keller (1987) is consist of 22 statements in the form of Likert question which have negative statements and positive statements. Therefore, the questionnaire shown in Table 3.9

Table 3.9
Number of Questions of ARCS Motivational Questionnaire

No	Characteristic of ARCS Motivational Model	Number of Positive Statement	Number of Negative Statement
1	Attention	1,3,5,6	2,4
2	Relevance	9,10,11	7,8,12,13
3	Confidence	15,16,17,18	14
4	Satisfaction	19.20,21	22,23

3.7 Data Processing Judment

3.7.1 Objective Test Validation

The objective test will evaluate the enhancement in the pre-testand post-test type of the student concept mastery. It must be assessed by validity, reliability, difficulty level, discriminating power, and distracting power before implementing the treatment class. Therefore, the following 50 questions of different decisions will be validated in a lesson learned about the interaction of living things and its environment topic which is Secondary II class.

Table 3.11 shown the results of the validation by two evaluation experts to determine whether the test items are dismissed or accepted and can be used for the next study phase and the detailed presented in Appendix C.3

Table 3.10
Recapitulation of Test Items Validation by ANATES

No	Aspect	Intrepretation	Number of Test Item
1	Discriminating Power	Excellent	4, 14, 20, 30, 34, 38, 39, 42, 43, 44, 48, 50
		Good	1, 2, 9, 12, 15, 24, 26, 28, 29, 45, 49
		Medium	
		Poor	6, 7, 8, 10, 13, 16, 17, 19, 21,22,23, 25, 31, 32, 35, 36, 40, 41, 47,
		Worst	3, 5, 11, 18, 27, 33, 37, 46,
2	Difficulty Level	Very Difficult	18, 19, 35, 40,
		Difficult	7, 22, 25, 29, 30, 46, 49
		Medium	4, 5, 11,12,13, 15, 23, 24, 27, 28, 31, 32, 33, 36, 37, 38, 39, 41, 42, 43, 44, 45, 47, 48, 50
		Easy	1, 2, 8, 20, 26,

No	Aspect	Intrepretation	Number of Test Item
3	Validity	Very Easy	34, 3, 6, 9, 10, 14, 16, 17, 21,
		Very High	
		High	9, 10, 14, 43,
		Medium	1, 3, 15, 20, 34, 38, 39, 42, 48,
		Low	2, 6, 8, 13, 24, 26, 30, 44, 49, 50
		Very Low	5, 7, 12, 16, 23, 25, 28, 31, 33, 36, 45, 47,
4	Sign. Correlation	Very Significant	1, 4, 6, 9, 10, 14, 15, 20, 24, 26, 34,38, 39, 42, 43, 48 , 50
		Significant	44, 49
		NAN	17, 19, 21, 35,
5	Decision	Used	1, 2, 4, 6, 9, 10, 12, 15, 20, 24, 26, 28, 31, 33, 34, 38, 39, 42, 43, 44, 45, 47, 48, 49, 50
		Dropped	3, 5, 7, 8, 11, 13 14, 16, 17, 18, 19, 21, 22, 23, 25, 27, 29, 30, 32, 35, 36, 37, 40, 41, 46

Table 3.11 shows that is the result of validation from students 8th grade was analyze using ANATES. Based on the aspect that shows that the researcher decided 25 questions used and 25 questions dropped because researcher checks the aspect questions is a good question from another question. Based on this step, the researcher found that there is good validity of the question and prepared to be applied to the study class in treatment experimental and control class.

Table 3.11
Recapitulation of Test Items based on Cognitive Level

No	Cognitive Level	Total of Item Test	Consist of Item Test
1	C1 (Remembering)	4	1,2,9,10
2	C2 (Understanding)	8	3,5,6,7,11,12,17,18
3	C3 (Applying)	4	8,21,24,25
4	C4 (Analyzing)	4	13,14,19,23
5	C5 (Evaluating)	3	4,20,22
6	C6 (Creating)	2	15,16
	Total	**25**	

3.7.2 Data statistical analysis

The experimental research needs data statistical analysis to prove the findings are valid. IBM SPSS Statistic version 24 is a tool to process the data that later on be analyzed. Using Microsoft Excel, quantitative data analysis was calculated to determine the pre-test and post-test rating. The calculation method is described as follows:

a. Scoring of Test Item

The first step to process data was by scoring the test item which consists of 25 test questions.

b. Calculation of Gain Score and Normalized Gain

The information was then processed to discover the gain and Normalized Gain scores after scoring the test items. The gain is derived from the distinction between pre-test and post-test. It is also a supposition of the impact of the treatment provided. The impact of the therapy was presumed. (Hake, 1998). He suggested to following formula in determining the Gain Score:

$$G = S_f - S_i$$

Where,

G = Gain Score

= Posttest Score

S_i = Pretest Score

The effect of Monopoly Game-Based Learning on the student concept mastery in learning the interaction and living things and its environment was determined by the outcome of the standardized benefit that learners accomplished during the studying method. The formula used to calculate normalized gain regarding Hake (1998) is:

The normalized gain of each student <g> was determined by this formula:

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

Where,

<g>= Normalized gain

G= Actual gain

Gmax= Maximum gain possible

S_f=Post - test score

S_i=Pre - test score

Average of normalized gain (<g>) which is formulated as:

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

Where,

<g>= Normalized gain

<G>= Actual gain

<G>max= Maximum gain possible

<S_f>= Average of post test score

<S_i>= Average of pre test score

The value of Normalized gain that has been gained is interpreted using an interpretation shown in Table 3.15

Table 3.12
Interpretation of Normalized Gain

Value	Classification

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

(Hake, 1998)

c. Normality and Homogeneity Test

According to the parametric statistic which assumes that Each variable will only be analyzed from a normal distribution in this study. This implies that the information must be standardized in order to test for variance inhomogeneity. The normality test is used to determine if the sample is normally distributed. In this research, SPSS 17 was used to obtain the normality test. The normal distribution is determined by referring to **Shapiro-Wilk** significant value authorized for its efficacy in measuring normality even for a small sample (n<20) (Shapiro and Wilk, 1965). Once it achieves significance level (α) > 0.05, then H_0 is accepted while H_1 is rejected. If the significance level <0.05, so the H_0 is rejected. The hypotheses are:

H_0: Sample comes from the population that has a normal distribution.

H_1: Sample comes from the population that has not a normal distribution.

Homogeneity test was also gained from the SPSS result. The data is considered as homogeneous once the significance value is ≥ 0.05 (Sudjana, 2005).

d. Independent Sample T-Test

In this research, in order to determine whether the students have achieved the standard score after being treated with Monopoly Game, a Paired sample T-Test was done the post-test score. Data were then normalized and homogenised first In order to do the T-Test.in SPSS 24. H_0 is accepted if the significance level is ≤ 0.05 while it will be rejected if its significance level ≥ 0.05.

3.8 Research Procedure

In order for this study to be done for research procedures, there were three main stages. There is the preparation stage, the implementation stage and completion stages are explained below:

3.8.1 Preparation Stage

There were several steps that were done in the preparation stage as follows:

1. Analysis of National Curriculum 2013
2. Analysis the Students' Concept Mastery and Students' Motivation
3. Making the Research Instruments, including objectives test, questionnaire, and observation sheet instructional tools will be used are lesson plan
4. Making the design of Monopoly Game Based Learning
5. Judgment of instrument will be conducted by experts
6. Trail test of objective test instrument will be conducted to identify the quality of instrument.
7. Revision of instruments will be done based on judgment result and test item analysis

3.8.2 Implementation Stage

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

1. Determination the class to making it control class and experimental class
2. For the initial condition is conducted a pre-test to measure student prior knowledge
3. Analysis the pre-test results.
4. Conduct the game which is Monopoly Game Based Learning in the experiment class and guess word and quiz game in control class in learning interaction of living things with environment.
5. To measure the effect made by the treatment is conducted post-test.
6. Students fill the questionnaire to find out students' motivation towards the Monopoly Game Based Learning also guess word and quiz game.
7. Analyze the post-test and questionnaire

3.8.3 Completion Stage

This step will the researcher analyze the collected data gained during the implementation stage. This stage has also several steps:

1.   Analyze the results of the overall research.

2.   Discuss and conclude for the data analysis result.

3.   Arrange the report of the research.

3.9 Research Flowchart

The research flowchart shows the flow of how the study is performed. It begins with the preparation stage, the implementation stage and completion stages. More of the detail of the research flowchart will be present as a figure 3 at below.
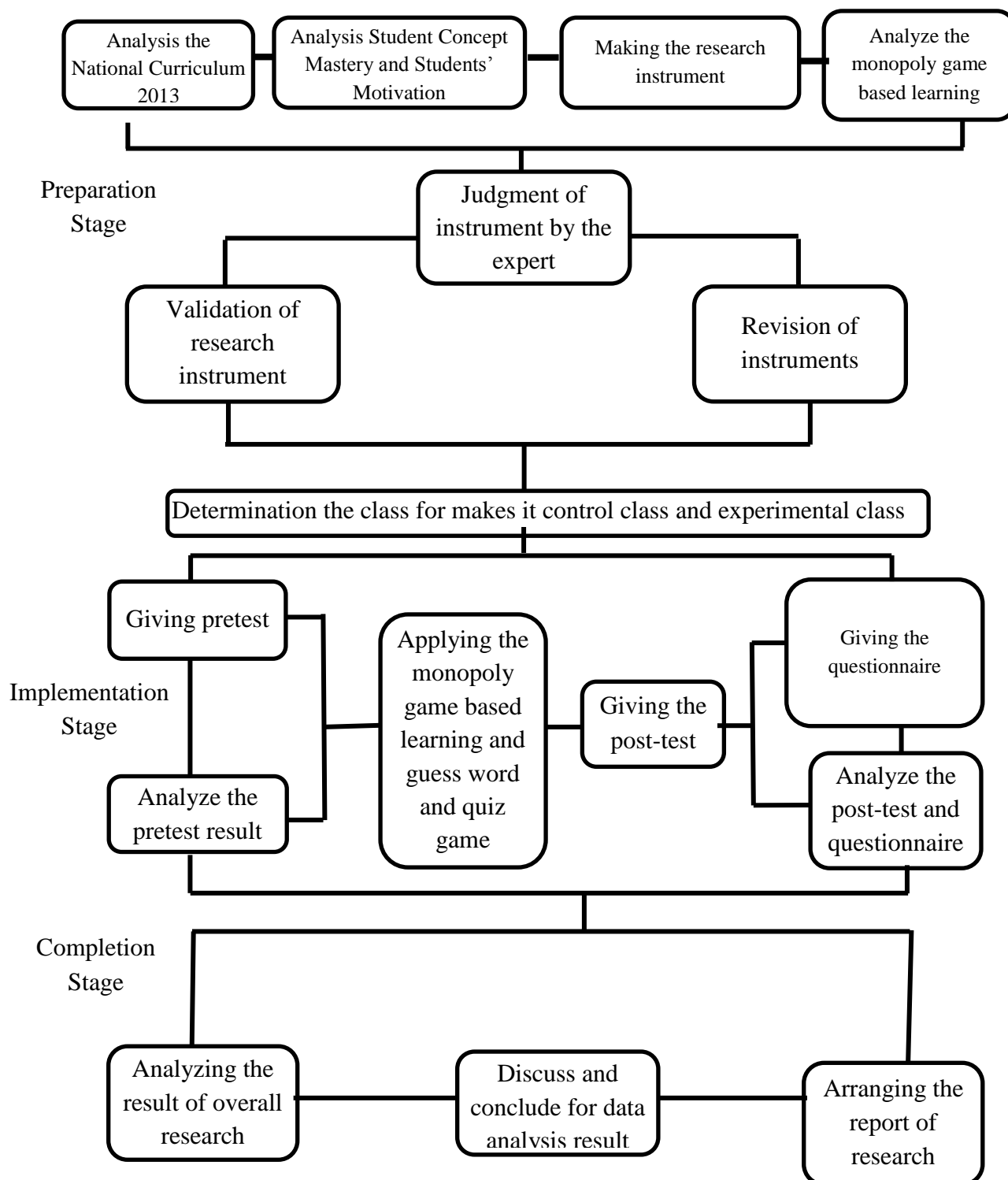
Figure 3. 1 Research
FlowChart