CHAPTER III
RESEARCH METHOD

3.1 Research Method

Research method used in this research is poor experimental designs (J. R. Fraenkel et al., 2012). In situations with limited resources or ethical constraints, poor experimental designs can allow researchers to gather preliminary data, identify potential relationships between variables, and generate hypotheses for future, more rigorous investigations. Additionally, they can be useful for studying complex real-world phenomena where strict experimental control is difficult to achieve.

3.2 Research Design

Based on research problem stated in chapter I to investigate effects of Nature-based learning through students' research skill and environmental awareness, design that is used in this research is one-group pretest-posttest design. In the one-group pretest-posttest design, a single group is measured before and after being exposed to a treatment (Fraenkel et al., 2012). There is one experimental group that exposed by nature-based learning without any control classroom. Pretest and posttest of research skill and environmental awareness are given to experimental group. Pretest is aimed to identify students' initial knowledge before treatment. Meanwhile, posttest is aimed to identify students' final knowledge after treatment.

Table 3.1 Research Design

Class	Pretest	Treatment	Posttest
Experimental	O_1	X	O_2

In the pretest, students were given research skills test and environmental awareness questionnaire. After that, students were given treatment consisted of three meetings of nature-based learning. Lastly, students given research skills test and environmental awareness questionnaire as posttest.

3.3 Population and Sample of Research

Participants of this research was students of 7th grade of one Junior Highschool in Purwakarta which implemented *kurikulum merdeka*. This research was implemented in the first semester of 2024/2025. Total of participants was 34 students in one class. Age of participant is around 11-13 years old.

The sampling method used is Convenience Sampling because the class being researched is convenience for researcher and available to be studied (Creswell, 2012). Students learnt by using nature-based worksheet developed by researcher.

3.4 Operational Definition

Operational definition that was used in this research framework had been defined as followed:

1. Nature-based Learning

Nature-based learning is an educational approach that integrates the natural environment into the learning process. It uses outdoor environments and natural materials to teach a variety of subjects and promotes hands-on, experiential learning. This approach encourages students to explore and interact with nature, creating a deeper connection with the environment and improving their understanding of academic concepts through real-world experiences.

Nature-based learning consisted of one outdoor activity at minimum. In this research, nature-based learning attempted into three meetings consists of observation, planning experiment and experiment. Observation conducted in nature, while planning experiment and experiment conducted in classroom by using sample from nature. In order to ascertain teaching and learning activity stays on corridor of nature-based learning, researcher used students' worksheet consisted of three main activities which are observation; preparation and experimentation. Learning objectives was developed according to *capaian pembelajaran kurikulum merdeka* for ecosystem chapter, focused on river ecosystem. This worksheet has been validated by experts in three category, which are conformity with learning objective aspect, content and grammar aspect, and conformity of nature-based learning aspect. This worksheet is developed to increase students' research skill and environmental awareness.

2. Students' Research Skill

Research skill is a set of skill that students need in conducting a research. It consists of several activities of research stages which are planning, implementing and reporting. Students are considered able to plan a research when they are able to respond and generate a research question and hypotheses, clarifiy needed knowledge, difine research variable, tools and materials and research procedure. After the planning has done, students implement a research then organize and manage the data. The last stage in reporting, data gathered from experiment is analyzed and synthesized. The result then communicated and applied as a form of students' understanding of the research. During the three stages mentioned, students also expected to evaluate and reflect the credibility of sources, information and data.

Characteristics of students' research skill targetted in this research was adapted from Willison et al. (2018). It consisted of six aspects which are: (1) Embark and clarify; (2) Find and generate; (3) Evaluate and reflect; (4) Organise and manage; (5) Analyse and synthesise; (6) Communicate and apply. Instrument used to test students' research skill was a written test consisted of 18 questions. Improvement of students' research skill was analyzed through N-gain score. The N-gain was calculated to compare students' score of pre-test and post-test.

3. Students' Environmental Awareness

Environmental awareness is the level of students' awareness toward condition of environment. It consists of three aspects which are 1) their understanding and perception of environment; 2) their feelings and emotional connection to the environment; and 3) their daily behaviors that affect the environment.

Environmental awareness focused on three factors group adapted from Novotný et al. (2021) which are: (1) cognitive factor; (2) emotional factor; (3) behavioral factor. Instrument used to test students' environmental awareness was a likert-scale questionnaire with scale ranging from 1-4. Improvement of students' research skill

was analyzed through N-gain score. The N-gain was calculated to compare students' score of pre-test and post-test.

3.5 Research Procedure

The procedure of this research was divided into three main parts, which are preparation, implementation and completion stage. The whole procedure was illustrated as a research flow in Figure 3.1.

1. Preparation stage

In this stage, researcher conducted several steps that were needed in implementation of research. The steps were:

a) Conducted literature review of nature-based learning, student' research skill, and students' environmental awareness.

b) Conducted preliminary study regarding students' environmental awareness to 106 students consisted of 52 male and 54 female students. The result is presented in Table 3.2. Highest respons of students are bold

Table 3.2 Result of preliminary study

No	Statements	Number of Respons (%)			
		1	**2**	**3**	**4**
1.	Cognitive 1	1	4	**85**	15
2.	Cognitive 2	18	**51**	20	16
3.	Cognitive 3	16	**59**	30	0
4.	Cognitive 4	10	18	**47**	30
5.	Emotional 1	12	20	**48**	25
6.	Emotional 2	4	14	**53**	35
7.	Emotional 3	26	**52**	27	0
8.	Emotional 4	5	19	**42**	39
9.	Emotional 5	23	**56**	26	0
10.	Emotional 6	9	15	**48**	33
11.	Emotional 7	4	6	**48**	47
12.	Emotional 8	15	10	**46**	35
13.	Behavioral 1	4	11	**53**	37
14.	Behavioral 2	1	27	**56**	21

15.	Behavioral 3	11	**61**	33	0
16.	Behavioral 4	3	22	**54**	26
17.	Behavioral 5	22	21	27	**35**

c) Arranged the research design by consultation to lecturer;

d) Developed framework of nature-based learning activities and expected improvement of research skill and environmental awareness as presented in Table 3.3.

Table 3.3 Framework of Nature-based learning

| Activity | Targetted aspect | |
	Research skill	Environmental awareness
OBSERVATION STAGE		
a. Observation of abiotic component condition	Embark And Clarify, Find And Generate, Organize And Manage	Cognitive, Emotional, Behavior
b. Conclusion	Analyze And Synthesize	Cognitive
c. Observation of biotic component condition	Embark And Clarify, Find And Generate, Organize And Manage	Cognitive, Emotional, Behavior
d. Conclusion	Analyze And Synthesize	Cognitive
e. Observation of human activity around river ecosystem	Embark And Clarify, Find And Generate, Organize And Manage	Cognitive, Emotional, Behavior
f. Survey of human behavior that affect river ecosystem	Embark And Clarify, Find And Generate, Organize And Manage	Behavior
g. Conclusion	Analyze And Synthesize	Cognitive
h. *Ayo Diskusi* Feature	Communication And Apply	Cognitive
i. *Ayo Evaluasi* Feature	Evaluate And Reflect	

Activity	Targetted aspect	
	Research skill	**Environmental awareness**
PLANNING STAGE		
a. Choose research objective	Embark And Clarify	
b. Formulate research question	Embark And Clarify	
c. Formulate hypotheses	Embark And Clarify	
d. Formulate research variable	Find And Generate	
e. Define materials and tools	Find And Generate	
f. Organize research steps	Find And Generate	
g. Create data collection instruments	Organize And Manage	
EXPERIMENTATION STAGE		
a. Collect data information	Organize And Manage	Cognitive
b. Organize data into table and graph	Organize And Manage	
c. Conclude research data	Analyze And Synthesize	Cognitive
d. *Ayo Diskusi* Feature	Communication And Apply	Cognitive
e. *Ayo Evaluasi* Feature	Evaluate And Reflect	

e) Arranged lesson plan and students' worksheets;

Expert validation results of students' worksheet shown excellent interpretation in all aspects. Therefore, this instruments are elligible to be used in nature-based learning. However, there are minor revision given by experts to enhance quality of students' worksheet.

Table 3.4 Expert Validation Results of Students' Worksheet

No	Aspect	Score	Interpretation
1.	Relevancy with curriculum objectives	83%	Excellent
2.	Suitability of content and grammar used	83%	Excellent
3.	Suitability with nature-based learning aspect	100%	Excellent

f) Developed research instruments which are research skill test, environmental awareness questionnaire, students' impression, observation sheet and students' interview;

g) Examined by expert judgement;

h) Revised research instrument that has been judged;

i) Checked the readability, validation and reliability of instruments to test students' research skill and environmental awareness;

j) Revise research instrument based on the result of expert and lecturer suggestion and instrument validation and reliability analysis.

k) Conducted a preliminary study about students' environmental awareness.

2. Implementation stage

At this stage, reseach focused on implementation of nature-based learning guided through students' worksheet developed by researcher to enhance students' research skill and environmental awareness. The details of implementation stages were as followed:

a) Quantitative data collection before intervention

Before learning with nature-based learning approach, students' research skill and environmental awareness is tested (pretest). The purpose was to gain information of initial condition of class. The result of pretest then being analyzed;

b) Intervention

The intervention is consisted of three meetings. Students conducted learning activity in a group consisted of seven students. The first meeting is conducted outdoor, while the rest two meetings conducted indoor. In the first meeting, students conducted observation of abiotic and biotic components of river, and also human activities around river. The second meeting, students planned experiment that they are going to implemented. In the last meeting, students implemented experiment they have planned. All the activities were guided by students' worksheet. During intervention, one observer was asked to observe

the implementation of nature-based learning. Learning implementation is explained further in Table 3.5.

Table 3.5 Learning Implementation

Meeting 1	
1)	Observation of abiotic components of river a) Students observe physical condition of river through direct observation b) Students make a conclusion whether the river water is polluted or not based on physical condition of river c) Students observe chemical condition (temperature and pH) of river by using appropriate measuring instruments d) Students make a conclusion whether the river water is polluted or not based on chemical condition of river
2)	Observation of biotic components of river a) Students observe biotic components of river b) Students make a conclusion whether the river water is polluted or not based on biotic components of river
3)	Observation of human behavior around the river a) Students observe human behavior around the river b) Students make a conclusion whether whether human behavior shows environmentally friendly behavior or not based on human behavior observed c) Students conduct survey on the use of detergent in their house d) Students make a conclusion whether whether human behavior shows environmentally friendly behavior or not based on result of survey
Meeting 2	
1)	Plan an experiment a) Students choose research objective that they are going to use b) Students generate research question and hypotheses based on research objective they choose. c) Students define research variable d) Students define tools and materials needed e) Students define experiment procedure f) Students design table and graph for the data they will obtain in the experiment g) Students consult every result to teacher and gain revision and suggestion h) Students revise the plan based on consultation result
Meeting 3	
1)	Implement an experiment a) Students prepare tools and materials they need b) Students conduct experiment c) Students analyze the result and make a conclusion d) Students communicate and apply the result of experiment

c) Qualitative data collection during intervention

During the nature-based learning intervention, qualitative data was collected in the form of observations of learning activities conducted by observers. Observation of learning activities contains a checklist of the implementation of learning activities and notes that occur in learning activities. Beside observation of learning, students' engagement to learning activity also observed through completeness of students' worksheet.

d) Quantitative data collection after intervention

After learning with nature-based learning approach, students' research skill and environmental awareness is tested (posttest). The purpose was to gain information of final condition of class. The result of posttest then being analyzed. Students' impression of learning activity also gathered through questionnaire.

e) Qualitative data collection after intervention

Qualitative data after implementation was collected through interviews. this interview was conducted to find out the things that were liked and disliked in nature-based learning. the interview was only conducted on several samples.

f) Qualitative data collection after intervention

After all quantitative and qualitative data were obtained, analysis and interpretation were carried out based on both types of data. Qualitative data in the form of advantages and disadvantages of learning are embedded in quantitative data to get a deeper meaning related to the effect of nature-based learning to students' research skill and environmental awareness.

3. **Completion stage**

The steps conducted in interpretation stage are:

a) Analyzed the result of the whole research.

b) Discussed and concluded the data analysis result.

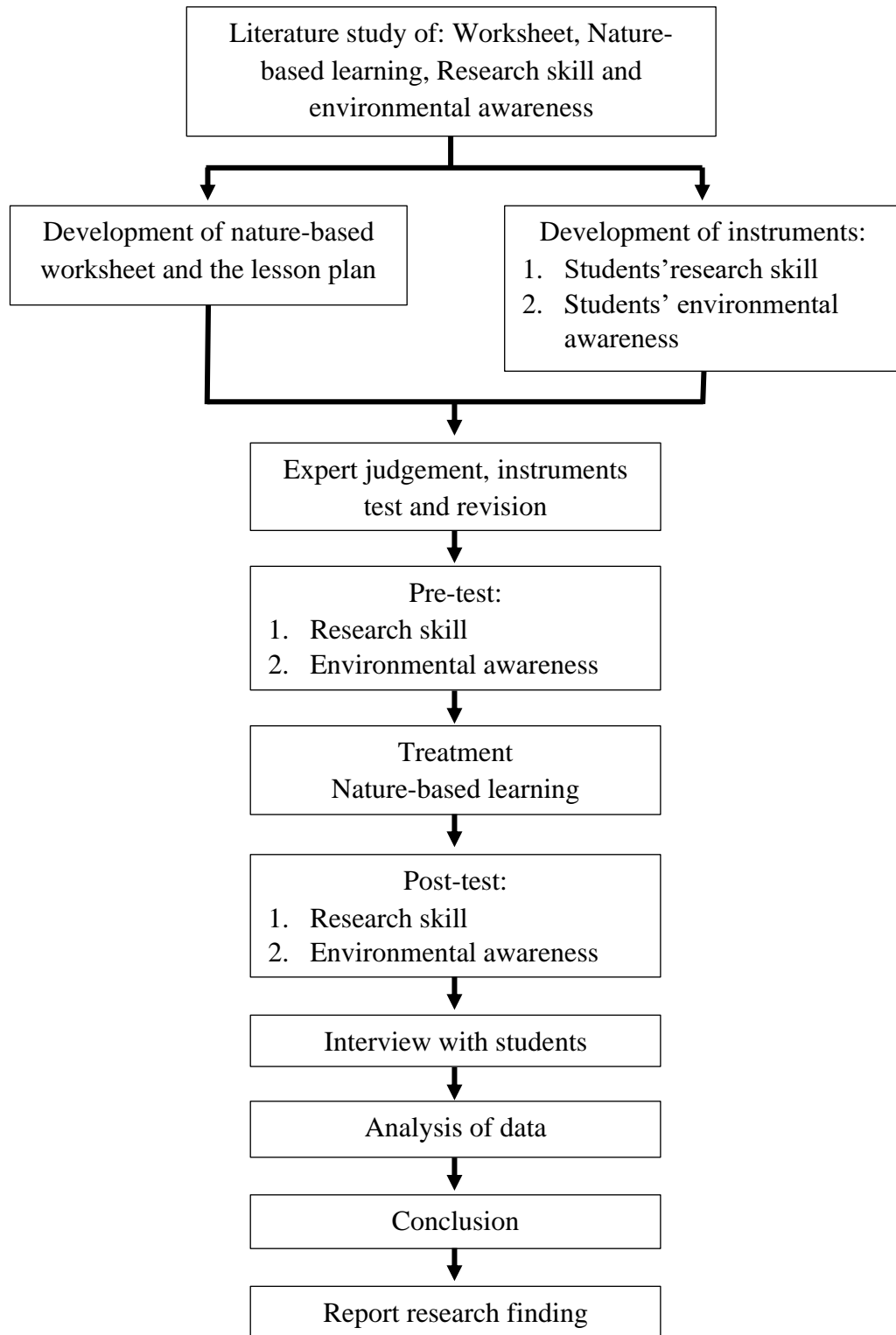c) Arrange the report of the research.

d) Report the result of research.

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┌─────────────────────────────────────────┐
│   Literature study of: Worksheet, Nature-│
│   based learning, Research skill and     │
│   environmental awareness                │
└─────────────────────────────────────────┘
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┌──────────────────────────┐      ┌──────────────────────────────┐
│ Development of nature-based│     │ Development of instruments:  │
│ worksheet and the lesson plan│   │ 1. Students'research skill   │
│                          │      │ 2. Students' environmental   │
│                          │      │    awareness                 │
└──────────────────────────┘      └──────────────────────────────┘
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┌──────────────────────────────┐
│   Expert judgement, instruments│
│   test and revision          │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Pre-test:                  │
│   1. Research skill          │
│   2. Environmental awareness │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Treatment                  │
│   Nature-based learning      │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Post-test:                 │
│   1. Research skill          │
│   2. Environmental awareness │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Interview with students    │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Analysis of data           │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Conclusion                 │
└──────────────────────────────┘
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┌──────────────────────────────┐
│   Report research finding    │
└──────────────────────────────┘
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Figure 3.1 Research Design

3.6 Research Instruments

Research instruments are tools used to measure, observe and record data collection in a study (Creswell, 2019). Instruments used in this research are as followed:

Table 4.6 Instruments of research

No	Data	Instruments	Source
1.	Quantitative	Research Skill Test	Students
2.	Quantitative	Environmental Awareness Questionnaire	Students
3.	Qualitative	Observation sheet	Observer
4.	Qualitative	Interview sheet	Students

Before being used, instruments of research was developed through certain steps, which were 1) blue print construction ; 2) expert judgement; 3) validity and reliability test. A "blueprint" in the context of research refers to a detailed plan or framework that guides the research process. It is crucial for structuring research effectively, ensuring that all necessary steps are taken to address the research question comprehensively (Grant & Osanloo, 2014). The blueprint of this research was developed to comprehend three instruments which were nature-based learning implementation, students' research skill and students' environmental awareness.

1. **Research Skill Instrument Test**

Research skill instrument test is an instrument to measure students' research skill before and after nature-based learning.

a. Blueprint

Blueprint of students' research skill instrument was adapted from research skill aspect and indicator explained by Willison et al. (2018). The blueprint of students' research skill instrument is presented in Table 3.7.

Table 3.7 Blueprint of Research Skill Instrument
(Adapted from Willison et al. (2018))

No	Aspect	Type of Question	Indicator	Number of Question	Total
1.	Embark and Clarify	Multiple Choice	Students respond to or initiate research	3	5

No	Aspect	Type of Question	Indicator	Number of Question	Total
	(What is our purpose?)			(1a, 2a, 2b)	
		Complex Multiple Choice	Students clarify what knowledge is required	2 (1b, 2c)	
2.	Find and Generate (What do we need?)	Complex Multiple Choice	Students find & generate needed information/data using appropriate methodology.	3 (3a, 3b, 3c)	3
3.	Evaluate and Reflect (What do we trust?)	Essay	Students determine the credibility of sources,information & data	1 (4)	4
		Essay	Students make own research processes visible.	3 (5a, 5b, 5c)	
4.	Organize and Manage (How do we arrange?)	Essay	Students organise information & data to reveal patterns/themes	2 (6a, 6b)	2
5.	Analyze and Synthesize (What does it mean?)	Multiple Choice	Students analyze information/data critically	2 (6c, 6d)	2
6.	Communicate and Apply (How will we relate?)	Essay	Students perform the processes and understanding of the research	1 (7a)	2
		Essay	Students perform the applications of the research	1 (7b)	
	TOTAL			18	

b. Instrument Development

1) Preparation of Questions Items

After defining research skills, determining the aspects of research skills studied, and determining the grid, the next stage is designing the format and compiling test questions. The questions consisted of 18 questions related to the concept of

river ecosystem. Each aspect of research skills such as embark and clarify consists of 5 questions, find and generate consists of 3 questions, evaluate and reflect consists of 4 questions, organize and manage consists of 2 questions, analyze and manage consists of 2 questions, and communicate and apply consists of 2 questions.

2) Expert Judgement

Research skill test has been validated by expert for its suitability with its suitability of the questions with the indicators of research skill; suitability of the questions with the discoure context with content; The accuracy of science content on questions and guidelines assessment; The use of words and terms or correct language; The question does not lead to multiple interpretations and The suitability and relevance of the criteria assessment score with questions and answers. The result show valid in most aspect, however there are suggestions from expert to improve this instruments quality.

3) Readability test

After being judged by expert, the instrument was tested to the students to check its readibility. Aspect observed in this test was students' understanding towards statements and instructions of instruments.

4) Instrument Trial

Instrument trials were conducted on participating students and then analyzed to obtain data on the level of difficulty, discriminating power, validity and reliability of the test. Question testing was conducted on 40 (N=40) ninth grade junior high school students in Purwakarta. The students had never previously completed a research skills test.

a) Level of difficulty

A good question is a question that is not too easy and not too difficult, besides that a good question has the number of easy, medium and difficult questions proportionally following a normal curve (most questions are in the medium category), easy and difficult balanced.

Table 3.8 Category of Difficulty Level

Value of Difficulty Index	Interpretation

0.00-0.30	Difficult
0.30-0.70	Moderate
0.70-1.00	Easy

b) Discriminating power

Item discriminability refers to the potential of the item in question to be answered correctly by those students who has particular quality and to be answered incorrectly by those students who has less particular quality in given field. It could be used to see differences between group of students, and discriminate between students' abilities in a given field (Cohen et al., 2007). If it shows significant different between group of students, so it is qualified as item with high discriminability. On the contrary, if it is not, so the item is qualified as item with low discriminability. Item with high discriminability is desirable, while the one with low discriminability should be discarded.

Table 3.9 Discrimination power according to their D value

D=	Quality	Recommendations
> 0.39	Excellent	Retain
0.30-0.39	Good	Possibilities for Improvement
0.20-0.29	Mediocre	Need to check/review
0.00-0.19	Poor	Discard or revies in depth
< -0.01	Worst	Definitely discard

c) Validity

Validity of a research instrument refers to the degree to which the instrument accurately measures what it is intended to measure. It is a crucial aspect of research quality, ensuring that the conclusions drawn from the data are sound and applicable (Heale & Twycross, 2015). The instrument of this research that analyzed through validity test were research skill test and environmental awareness. Validity test was examined by using formula for Pearson's Coefficient of Correlation (Fraenkel et al., 2012).

After the correlation coefficient value is generated, it will be adjusted to the validity of the items using the equation above. Then the resulting value of r product moment table. In seeing the value of r table, it is necessary to know in

advance degrees of freedom with the equation df = n-2 with n is the number of students. With significant correlation of 0.05.

d) Reliability

Reliability is defined differently in quantitative and qualitative research. Reliability in quantitative research could also be defined as dependability, consistency and replicability over time, over instruments and over groups of respondents. It is concerned with precision and accuracy (Cohen et al., 2007) ,There are three principal types of reliability. They are stability, equivalence and internal consistency. Instruments that were analyzed through reliability test were research skill test and environmental awareness questionnaire. Reliability coefficient is calculated by using Spearman-Brown prophecy (J. Fraenkel & Wallen, 2009).

Table 3.10 Interpretation Reliability Coefficient

Reliability Coefficient	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

5) Analysis of instrument test result

The results of the instrument trial to students were then analyzed using SPSS software. Reliability of the instrument is 0,88. Showing high reliability so instrument test can show consistency and replicability over time. Another result of item test validity, discriminationg power and difficulty level are shown in Table 3.11.

Table 3.11 Quantitative Analysis Result for Research Skill Test

Question Item	Validity		Discriminating Power		Difficulty Level		Action
	V	Int.	DP	Int.	T	Int.	
1a	0,52	Valid	0,47	Good	0,50	Medium	Accepted
1b	0,67	Valid	0,62	Good	0,57	Medium	Accepted
2a	0,52	Valid	0,43	Good	0,67	Medium	Accepted

Question Item	Validity		Discriminating Power		Difficulty Level		Action
	V	Int.	DP	Int.	T	Int.	
2b	0,75	Valid	0,73	Good	0,77	Easy	Accepted
2c	0,6	Valid	0,52	Good	0,56	Medium	Accepted
3	0,56	Valid	0,5	Good	0,55	Medium	Accepted
4	0,53	Valid	0,46	Good	0,71	Easy	Accepted
5a	0,74	Valid	0,69	Good	0,78	Easy	Accepted
5b	0,6	Valid	0,51	Good	0,64	Medium	Accepted
5c	0,53	Valid	0,5	Good	0,72	Easy	Accepted
5d	0,38	Valid	0,33	Enough	0,56	Medium	Accepted
6a	0,66	Valid	0,61	Good	0,74	Easy	Accepted
6b	0,64	Valid	0,57	Good	0,76	Easy	Accepted
7a	0,51	Valid	0,48	Good	0,69	Medium	Accepted
7b	0,44	Valid	0,38	Enough	0,75	Easy	Accepted
7c	0,51	Valid	0,45	Good	0,68	Medium	Accepted
8a	0,46	Valid	0,33	Enough	0,54	Medium	Accepted
8b	0,66	Valid	0,62	Good	0,79	Easy	Accepted
8c	0,75	Valid	0,68	Good	0,68	Medium	Accepted

All question item validity is categorized as valid item. Sixteen questions analyzed having good discriminating power, while the other three question showing enough discriminating power. In difficulty level, the questions analyzed as easy to medium difficulty level. Eleven questions have medium difficulty, while the other seven have easy difficulty.

2. Environmental Awareness Questionnaire

Environmental awareness questionnaire is an instrument to measure students' environmental awareness before and after nature-based learning.

a. Blueprint

Blueprint of students' environmental awareness instrument was developed by adapting aspect of environmental awareness explained by Novotný et al. (2021). The blueprint of students' environmental awareness test is presented in Table 3.12.

Table 3.12 Blueprint of Environmental Awareness Instrument Adapted from Novotný et al. (2021))

No	Aspect	Desciption	Number of Question
1.	Cognitive Factor	Represents the thinking, analyzing and searching for information regarding environmental problems.	5
2.	Emotional Factor	Represents an emotional response to environmental problems.	8
3.	Behavioral Factor	Represents an immediate behavioral responses.	5
TOTAL			18

b. Instrument Development

Environmental awareness questionnaire is developed through several steps, which are expert judgement, readability test, validity and reliability.

1) Expert Judgement

Environmental awareness questionnaire has been validated by expert for its suitability with aspect and use of words and grammar. The result show valid in most aspect, however there are suggestions from expert to improve this instruments quality.

2) Readability test

Students were asked to read the instruments and write down word or sentences that they do not understand. The result show that there are several word and sentences that students do not understand. Some of them are: *1) bahan kimia; 2) individu; 3) memadai; 4) sensitif; 5) rekreasi; 6) industri; 7) nuklir; 8) politisi; 9) memilah; 10) daur ulang.*

The mentioned word then changed into its synonim that most of students understand. However there is word can not be changed such as *nuklir.* Therefore, information regarding nuclear is added in questionnaire item to enhance students' understanding of instrument/

3) Validity and reliability

Environmental awareness questionnaire is tested into 30 students of junior high school. The answer is analyzed by using SPSS. The result shows reliability 0,834 which means high reliability. Further analysis of validity for each questionnaire item is presented in Table 3.13. There are code of questionnaire items. Each code

represent environmental awareness aspects. C represents cognitive, E represents emotional, and B represents behavior.

Table 3.13 Quantitative Analysis Result for Environmental Awareness Questionnaire

No	Code	Pearson Correlation	Sig.	Validity
1.	C1	0,419	0,019	Valid
2.	C2	0,501	0,04	Valid
3.	C3	0,478	0,006	Valid
4.	C4	0,356	0,049	Valid
5.	C5	0,529	0,002	Valid
6.	E1	0,595	0,001	Valid
7.	E2	0,385	0,033	Valid
8.	E3	0,432	0,015	Valid
9.	E4	0,436	0,014	Valid
10.	E5	0,512	0,003	Valid
11.	E6	0,587	0,001	Valid
12.	E7	0,395	0,028	Valid
13.	E8	0,475	0,007	Valid
14.	B1	0,473	0,007	Valid
15.	B2	0,475	0,007	Valid
16.	B3	0,456	0,010	Valid
17.	B4	0,395	0,028	Valid
18.	B5	0,530	0,002	Valid

3. Observation Sheet

Observation sheets help standardize the data collection process, reducing variability and bias in how data is recorded. This standardization is crucial for ensuring that the intervention's effects are accurately measured and compared across different settings or groups. This observation sheet is developed to check weather the step is implemented or not and description of each step. The blueprint of observation sheet of this research is presented in Table 3.14.

Table 3.14 Blueprint of observation sheet

Activity	Implementation		Description
	Yes	No	
Opening			
Main			

Closing			

4. Interview Sheet

Semi-structured interviews were conducted with students to find out students' opinions related to the advantages and disadvantages of the integration of metacognitive strategies in the student learning approach as a researcher to improve students' research and writing skills. This semi-structured interview used as supporting data used by researchers in order to obtain a more comprehensive understanding.

3.7 Data Analysis

Data analysis processing of the instruments carried out in this mixed methods research involved two data processing techniques, namely qualitative data analysis and quantitative data analysis. Qualitative data analysis techniques use qualitative data analysis techniques based on data. Data was collected before, during and after the learning process. Information comes from documents obtained from direct observation, suggestions and comments from material testers, language testers, media testers and educational practitioner validators which are explained in detail and in depth to get good research results. Analysis of quantitative data Information data in the form of quantitative data obtained through the results of improvement from pretest to posttest.

1. Research Skill Test

Data on students' research skills were obtained from the results of student answers to research skill questions. It is done by analyzing the raw score of cognitive abilities and posttest- pretest of students. Normality test is conducted to evaluate whether the research data follows a normal distribution. In this study, the normality test was conducted using the Shapiro-Wilk test. The selection of this method is based on the number of samples that are less than 50 participants and data processing is done with the help of SPSS 22 software. To determine whether the data character is normally distributed or not, it will be tested using the Shapiro-

Wilk test with a significance level of 0.05 with the basis for decision making as followed:

1) Significant number of Shapiro-Wilk test > 0.05 then the data is normally distributed

2) Significant number of Shapiro-Wilk test <0.05 then the data is not normally distributed.

Hypothesis testing in this study was conducted based on data on the improvement of students'research skill, obtained from the results of the pretest and posttest. If the data follows a normal distribution, the hypothesis test will use a t-test. However, if the data does not follow a normal distribution, the hypothesis test will use the Wilcoxon test. In this study, there are two hypotheses, namely the null hypothesis (H0) and the alternative hypothesis (Ha), which are always written in paired form. Hypothesis decision making is made using a significance level of 0.05 with the following decision-making basis:

1) If the significance < 0.05 then H0 is rejected and Ha is accepted

2) If the significance > 0.05 then H0 is accepted and Ha is rejected

Based on the decision to test the hypothesis, if Ha is accepted then there is a difference in the average value generated from before and after the learning is done. If H0 is rejected then there is no difference in the average of the pretest and posttest results. Furthermore, the increase in research skills of each student is described by calculating the normalized gain from the pretest and posttest results. To measure the improvement of students' cognitive abilities, the calculation of gain and N-gain was carried out on the results of research skills. N-gain is a normalized gain, used to avoid misinterpretation in measuring the gain (difference between pretest and posttest scores) of students. At this stage, the cognitive abilities of students will be calculated by calculating the normalized gain for all students. The calculation of N-gain according to Hake (1999) is as follows:

$$Ngain = \frac{posttest - pretest}{\max score - pretest}$$

Notes:

$Ngain$: normalized gain of student

$posttest$: posttest score of student

$pretest$: pretest score of student

$\max score$: maximum score of test

Score of N-gain then interpreted into three classification which were high, moderate and low. Interpretation of N-gain score is presented in Table 3.15.

Table 3.15 Normalized gain score interpretation

N-Gain score	Interpretation
$g > 0.7$	High
$0.3 < g \leq 0.7$	Moderate
$g \leq 0.3$	Low

Qualitative analysis coming from students' worksheet, observation sheet and students' interview was also deliberated in order to gain more coherence interpretation of factors influece level of improvement in students' research skill.

2. Environmental Awareness Questionnaire

Data on students' environmental awareness were obtained from the environmental awareness questionnaire of students and processed using a Likert scale with 4 (four) options. The Likert calculation scale is a psychometric scale that asks students to choose one of several options that have been provided. score calculations are carried out using a Likert scale with measurements as listed in the Table 3.16.

Table 3.16 Score of Questionnaire

No	Option	Score	
		Positive	Negative
1.	Strongly Disagree	1	4
2.	Disagree	2	3
3.	Agree	3	2
4.	Strongly Agree	4	1

The results obtained from the environmental awareness questionnaire will be made in the form of a percentage in the manner below:

$$Percentage = \frac{gained\ score}{maximum\ score} \times 100\%$$

The percentage calculation regarding the environmental awareness profile that has been calculated by the researcher will then be classified based on the criteria in the Table 3.17.

Table 3.17 Interpretation of Students' Environmental Awareness

Percentage	Criteria
86-100%	Very Good
76-85%	Good
60-75%	Enough
55-59%	Poor
<55%	Very Poor

Normality test is conducted to evaluate whether the research data follows a normal distribution. In this study, the normality test was conducted using the Shapiro-Wilk test. The selection of this method is based on the number of samples that are less than 50 participants and data processing is done with the help of SPSS 22 software. To determine whether the data character is normally distributed or not, it will be tested using the Shapiro-Wilk test with a significance level of 0.05 with the basis for decision making as followed:

1) Significant number of Shapiro-Wilk test > 0.05 then the data is normally distributed

2) Significant number of Shapiro-Wilk test <0.05 then the data is not normally distributed.

Hypothesis testing in this study was conducted based on data on the improvement of students'research skill, obtained from the results of the pretest and posttest. If the data follows a normal distribution, the hypothesis test will use a t-test. However, if the data does not follow a normal distribution, the hypothesis test will use the Wilcoxon test. In this study, there are two hypotheses, namely the null hypothesis (H0) and the alternative hypothesis (Ha), which are always written in paired form. Hypothesis decision making is made using a significance level of 0.05 with the following decision-making basis:

1) If the significance < 0.05 then H0 is rejected and Ha is accepted

2) If the significance > 0.05 then H0 is accepted and Ha is rejected

Based on the decision to test the hypothesis, if Ha is accepted then there is a difference in the average value generated from before and after the learning is done. If H0 is rejected then there is no difference in the average of the pretest and posttest results. Furthermore, the increase in research skills of each student is described by calculating the normalized gain from the pretest and posttest results. To measure the improvement of students' cognitive abilities, the calculation of gain and N-gain was carried out on the results of research skills. N-gain is a normalized gain, used to avoid misinterpretation in measuring the gain (difference between pretest and posttest scores) of students. At this stage, the cognitive abilities of students will be calculated by calculating the normalized gain for all students.

Qualitative analysis coming from students' worksheet, observation sheet and students' interview was also deliberated in order to gain more coherence interpretation of factors influece level of improvement in students' environmental awareness.

3. Students' impression toward implementationof nature-based learning

The questionnaire is using the likert scale. It is calculated into score then converted into percentage. The percentage becomes the review and evaluation for the next research. The scoring guideline is shown in the Table 3.18. The percentage of likert scale in each indicator determines the students' impression toward nature-Based learning implementation

Table 3.18 Score of Questionnaire

No	Option	Score	
		Positive	Negative
1.	Strongly Disagree	1	4
2.	Disagree	2	3
3.	Agree	3	2
4.	Strongly Agree	4	1