CHAPTER III
RESEARCH METHOD

3.1 Research Design

The research method used in this research is the pre-experimental method. This method aims to determine whether the production of development influences a small group (Creswell, 2012). This method is suitable for the purpose of this research, which is investigating the influence of the integration of STEM-ESD into Project-based Learning based on learning styles on students' multiliteracy. In this research, a one-group pre-post-test experimental design was used. The researcher studies a single group and provides an intervention during the experiment (Cresswell, 2012). The pre-test will be given before the treatment to measure the characteristics of the student before receiving treatment. Meanwhile, the post-test will be given after the student gets the treatment. The treatment itself is given by implementing the integration of STEM-ESD into Project-based learning. The research design is defined in Table 3.1.

Table 3. 1

The one-group pre-posttest design

Pre-test	Treatment	Post-test
O_1	X	O_2

(Source: Fraenkel, Wallen et al. 2011)

Where:

O_1: Pre-test to measure students' scientific literacy and attitude toward science before treatment

X: Student was treated by implementing virtual lab activity with inquiry-based learning

O_2: Post-test to measure students' scientific literacy and attitude toward science after treatment

3.2 Participant

This research was conducted at Sekolah Quantum Inti Indonesia (SQI) in Bekasi, Indonesia. The school is using Bahasa Indonesia as the intermediate language. The curriculum used in the school is Kurikulum Merdeka. The population of this research consisted of 8th-grade students who have not learned alternative energy topics. There are 19 samples consisting of 5 males and 14 females. The sampling technique used is convenience sampling. According to Fraenkel (2013), convenience sampling is a sampling technique where a group or individuals who are (conveniently) available for study was taken as the research sample.

Table 3. 2 Sample Data

Population	Sample		Percentage (%)	Total (%)
^{7th} grade	Male	5	26	100
	Female	14	74	

3.3 Assumption

The assumption that can be defined as the basis of this research includes the following:

1. There is various type of students' learning style.
2. The integration of STEM-ESD into Project-based learning can improve students' multiliteracy
3. Integrated STEM-ESD in Project-based learning is designed to create meaningful learning that integrates knowledge, concepts, and student performance to equip students with the skills needed to adapt to the times.

3.4 Hypothesis

H_o: There is no significant difference in students' multiliteracy after the implementation of the integration of STEM-ESD into Project-based learning.

H_1: There is a significant difference in students' multiliteracy after the implementation of the integration of STEM-ESD into Project-based learning.

3.5 Research Instrument

To gain the data needed for this research, several types of research instrument is used. The data needed are the implementation of STEM-PjBL-ESD-based learning, and students' multiliteracy including STEM Literacy, Environmental literacy, sustainability literacy, and VARK Learning Style Questionnaire. Questionnaires have been commonly used to assess or explore students' knowledge, attitudes, and behaviours toward sustainability. The instrument used in this research to gain those data can be seen in Table 3.3.

Table 3. 3 The research instrument used to obtain the data

Data Required	Instrument Used	Main Reference/framework
Implementation of STEM-PjBL-ESD-based learning	Observation Sheet	STEM-PjBL learning syntax according to Laboy-Rush (2010)
Students' STEM Literacy	Objective Test on the alternative energy topic	PISA (2015), NAEP (2004)
Students' Environmental Literacy	Objective Test and Likert-Scale Questionnaire	NAAEE (2011)
Students' Sustainability Literacy	Likert-Scale Questionnaire	Gericke (2017)
Students' Learning Style	Questionnaire	Flemming and Mills (1995)

The instrument used in this research is described as follows.

3.5.1 The Implementation of STEM-ESD Integrated PjBL

Observation sheet was used to track the implementation of STEM-PjBL-ESD learning model throughout the learning process. Observation was done by home teacher as the observer. The observer has the obligation to observe and analyze the learning activity whether it was in line with the learning syntax used. An observation sheet was given in every meeting, and the observer need to give a checklist sign when the activity was done.

The learning activity was done by adopting the 5 syntaxes of STEM-PjBL learning by Laboy-Rush (2010), which consists of Reflection, Investigation, Discovery, Application, and Communication. It was conducted in 4 meetings with 2x40 minutes credit. The first meeting was in the stage of reflection and investigation, where the student reflects on real life problem regarding the transition energy issue and discusses the science concept laid behind the issue. The second meeting was discovery stage, where student design a project to solve the problem

discussed. In the third meeting, application stage was done by building and testing the prototype of the project they made by applying the science concept. The last stage was communication stage, in which student present their project and deliver the science concept behind the product they made. The observation sheet for meeting 1 can be seen in the Table 3.4, and the rest can be seen in the appendix.

Table 3. 4 The Observation Sheet of The Implementation of STEM-PjBL-ESD Learning

No.	***Syntax Pembelajaran STEM-PjBL***	***Langkah Implementasi Kegiatan Pembelajaran***	***Keterlaksanaan***	
			Ya	***Tidak***
Pendahuluan				
1.	**Reflection**	*Guru membuka pembelajaran dengan mengucapkan salam*		
2.		*Guru mengajukan pertanyaan pemantik mengenai kondisi bumi saat ini, adanya perubahan iklim, dan berlangsungnya pemanasan global*		
3.		*Guru memberikan apersepsi berupa isu ESD mengenai transisi energi di Indonesia*		
4.		*Siswa di bimbing untuk menganalisis penggunaan energi dalam kehidupan sehari-hari*		
5.		*Siswa di bimbing untuk menganalisis dampak penggunaan energi konvensional terhadap lingkungan*		
6.		*Siswa di bimbing untuk menemukan tujuan pembelajaran melalui proses tanya jawab*		
Inti				
7.	**Investigation**	*Siswa dibagi menjadi 4 kelompok diskusi*		
8.		*Guru membagikan LKPD Kegiatan 1 pada setiap kelompok*		
9.		*Siswa berdiskusi mengenai pengembangan energi baru di Indonesia dan faktor pemicu diperlukannya transisi energi di Indonesia berdasarkan aspek sosial, ekonomi, dan lingkungan*		
10.		*Siswa melakukan analisis mengenai jenis energi baru yang memiliki potensi paling tinggi untuk dikembangkan di Indonesia*		
11.		*Setiap kelompok menyampaikan pendapat hasil diskusi*		

No.	*Syntax Pembelajaran STEM-PjBL*	*Langkah Implementasi Kegiatan Pembelajaran*	*Keterlaksanaan*	
			Ya	*Tidak*
12.		*Guru menyampaikan potensi pengembangan energi alternatif di Indonesia, khususnya tenaga surya*		
13.		*Siswa ditugaskan untuk mencari contoh pemanfaatan tenaga surya dan menentukan satu proyek yang akan dikerjakan*		
Penutup				
14.		*Siswa mengumpulkan hasil LKPD Kegiatan 1*		
15.		*Siswa ditugaskan untuk mencari informasi perancangan proyek tenaga surya yang dapat dilakukan*		
16.		*Guru menyampaikan kesimpulan pembelajaran*		
17.		*Guru menutup pembelajaran dengan mengucapkan salam*		

3.5.2 Multiliteracy

In this research, the term multiliteracy refers to several literacies that build up ESD pillars which are STEM Literacy, Environmental Literacy, and Sustainability Literacy. The instrument used varied according to the needs of the type of data needed. Students' multiliteracy was measured before and after treatment to analyze the effect of the treatment given. Pretest was done before the treatment given to measure students' prior multiliteracy, and the posttest was done to measure students' multiliteracy after the treatment. The same test items were used in the pretest and posttest. There are two types of instruments used to measure students' multiliteracy, which are objective test and questionnaire. The detailed information about type of the instrument used can be seen in the Table 3.5.

Table 3. 5 Type of Instrument

Multiliteracy	Literacy Domain	Type of Instrument
STEM Literacy	Scientific Literacy	Objective Test
	Mathematic Literacy	Objective Test
	Technology and Engineering Literacy	Objective Test
Environmental Literacy	Knowledge	Objective Test
	Attitude	Questionnaire
	Behavior	Questionnaire
	Knowledge	Questionnaire

Multiliteracy	Literacy Domain	Type of Instrument
Sustainability Literacy	Attitude	Questionnaire
	Behavior	Questionnaire

3.5.2.1 STEM Literacy and Environmental Literacy (Knowledge)

The objective test was used to measure students' knowledge on STEM literacy and students' knowledge on environmental literacy. It was consisting of 24 questions, which divided into 18 questions STEM literacy and 6 questions environmental literacy. The blueprint of the objective test on STEM Literacy can be seen in the Table 3.6.

Table 3. 6 STEM Literacy Knowledge Objective Test Blueprint

No	STEM Literacy Component	Indicator	Question Number	Total
1	Scientific Literacy	Explain phenomena scientifically	1, 23	2
		Evaluate and design scientific enquiry	10, 12	2
		Interpret data and evidence scientifically	15, 22	2
2	Mathematics Literacy	Formulating situations mathematically	4, 11, 19, 20, 21	5
		Applying context, facts, procedures, and reasoning	6, 17, 18	3
3	Technology & Engineering Literacy	Understanding technological principles	9, 13	2
		Developing solutions and achieving goals	2, 7	2
			Total	18

The blueprint of the objective test on environmental literacy knowledge can be seen in the Table 3.7.

Table 3. 7 Objective Test Blueprint on Environmental Literacy Knowledge Domain

Environmental Literacy Domain	Topic	Question Number	Total
Knowledge	The effect of conventional energy pollutant towards the environment	3, 5, 16	3
	The effect of alternative energy usage	14, 24	2
	The knowledge of environmental problem	8	1

Total	6

The objective test was constructed based on energy alternative topic referred to *Kurikulum Merdeka*. Before the questions used as research instrument, a series of validation process took place. As a first step, the draft test was sent to two experts and one science teacher with more than 5 years teaching experience to complete expert validation. Critics and suggestion from the experts were then accepted, and the draft test was revised based on those experts' view. Furthermore, pilot test was conducted to 14 9th grader students. The data gathered was then analyzed by using WinStep Rasch Model to test the validity, reliability, and difficulty level.

1. Validity

According to (Kaplan, 2012), validity is the extent to which a test measures the quality it purposes to measure. In this research, the validity test is used to check the ability of the test item to measure students' knowledge on STEM Literacy and Environmental Literacy in Alternative Energy topic. The data can be gained by using menu "Table 13. Item Measure" on WinStep. The summary of the result can be seen in the Table 3.8.

Table 3. 8 Construct Validity Value Summary

Construct Validity	**Value**	**Category (Ideal value range)**
Raw variance by measure	37.8%	Ideal (>20%)
Unexplained variance	11% and 8.9%	Ideal (<15%)
Infit-outfit MNSQ Person	0.85	Ideal (0.5<MNSQ<1.50)
Infit-outfit MNSQ Item	0.99	Ideal (0.5<MNSQ<1.50)
Infit-outfit ZSTD Person	-0.27	Ideal (-2.0<ZSTD<2.00)
Infit-outfit ZSTD Item	0.08	Ideal (-2.0<ZSTD<2.00)

a. Construct Validity

Uni-dimensionalitas test measures the items' ability to measure respondents' ability, does the items measure one variable comprehensively. The ideal value of the instrument is when the Raw variance>20%, and Unexplained variance<15%. According to the result, the validity of the test item is ideal with the value of raw variance by measure is 37.8% and Unexplained variance is 11% and 8.9%.

1) Infit-outfit MNSQ

The result was MNSQ person 0.85, and MNSQ item 0.99 which indicates that the students' ability was lower than the difficulty level of the instrument. That means the instrument was good to be used.

2) Infit-Outfit ZSTD

The result was ZSTD person -0.27 and ZSTD item 0.08 which indicates that the students' ability was lower than the difficulty level of the instrument. It shows that the instrument was good to be used.

b. The Precision and The Quality

The data of the misfit can be seen in the menu "Table 10. Item: Fit Order" in the WinStep. The result of the data was shown in the Table 3.9.

Table 3. 9 Item Fit Order Result Summary

No.	Item Code	Logit	Standard Error Measurement	Outfit MNSQ	Outfit ZSTD	Point Measure Correlation
1.	E1	0.02	0.41	1.18	0.60	0.26
2.	M1	0.13	0.58	1.03	0.18	0.21
3.	T1	-1.98	**1.06**	1.21	0.54	**-0.02**
4.	T2	-0.64	0.68	0.6	-0.86	0.74
5.	M2	1.4	0.58	1.25	0.97	**-0.03**
6.	M3	2.75	0.61	0.89	-0.22	0.34
7.	E2	-0.49	0.38	**0.46**	-1.18	0.80
8.	E3	-0.23	0.35	**1.56**	1.21	0.15
9.	M4	-0.64	0.68	0.84	-0.23	0.38
10.	M5	3.45	**1.05**	**3.26**	1.7	**-0.52**
11.	M6	0.13	0.58	1.07	0.37	0.18
12.	E4	0.73	0.14	**0.45**	-0.02	0.68
13.	M7	-1.98	**1.06**	**0.43**	-0.34	0.52
14.	E5	-0.54	0.46	0.95	0.03	0.46
15.	E6	-0.35	0.37	0.63	-0.72	0.77
16.	M8	1.08	0.56	0.78	-1.12	0.56
17.	M9	1.08	0.56	1.32	1.55	**-0.21**
18.	E7	2.75	0.61	1.01	0.14	0.15
19.	T3	-3.26	**1.86**	**Minimum measure**		0.00
20.	T4	-0.64	0.68	1.27	0.69	**-0.13**
21.	T5	-0.22	0.62	1.28	0.89	**-0.13**
22.	M11	-0.64	0.68	0.63	-0.78	0.72
23.	M12	-0.64	0.68	0.88	-0.11	0.33
24.	E8	-2.56	**1.02**	1.21	0.56	**-0.02**

1) The Precision

How precise item can be seen from the Standard Error Measurement (SEM). The item can be categorized as precise when the SEM value is <1.0 logit. Therefore, Item number 10, 19, and 24 are not precise and several revisions were done to revise those items.

2) The Quality

How good the item in measuring the variable can be seen by its Outfit MNSQ, Outfit ZSTD, and Point measure correlation. The Ideal Category is shown in the Figure 3.1.

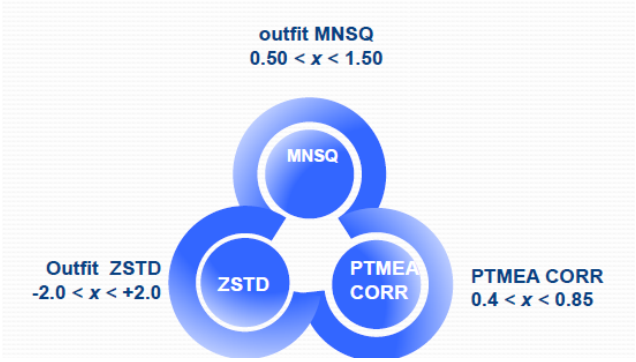

Figure 3. 1 Ideal Fit Order

Therefore, item number 3, 5, 7, 8, 10, 12. 13. 17, 20, 21, and 24 need revision. Several revisions were done to overcome this situation.

2. Reliability

The reliability of the item can be seen from its Alpha Cronbach value. Alpha Cronbach value indicates the reliability, which measures the interaction between the person and the test items as a unit. The category of the reliability value can be seen in the Table 3.10.

Table 3. 10 Reliability (Alpha Cronbach) Category

Value	Category
<0.50	Really Bad
0.50-0.60	Bad
0.60-0.70	Enough
0.70-0.80	Good
>0.80	Really Good

There are two types of reliability, which are person reliability and item reliability. Person reliability indicates the reliability of the person who takes the item. Meanwhile item reliability indicates the item reliability in measuring the

variable. The category of Person Reliability and Item Reliability value are shown in the Table 3.11.

Table 3. 11 Person and Item Reliability Category

Value	Category
<0.67	Weak
0.67-0.80	Enough
0.80-0.90	Strong
0.91-0.94	Really Strong
>0.94	Excellent

The data can be accessed through the menu "Table 3.1 Summary Statistics" in WinStep. The result of the reliability is shown in the Table 3.12.

Table 3. 12 The Objective Test Reliability Result

	Rata-rata Logit (SD)	Separation	Reliability	Alpha Cronbach
Person	0.76 (0.59)	1.26	0.61	0.52
Item	0.00 (1.32)	1.62	0.73	

From the person reliability score (0.61) and item reliability (0.73), it can be concluded that the consistency of students' answer is weak, but the quality of the questions in the instrument has good enough reliability.

3. Difficulty level

In Rasch Model, we can generate a Wright Map that can visualize the scatter plot of students' ability and the item difficulty level on the same scale. This map can be accessed from the menu "Table 1. Variable Maps" in WinStep. The left side of the wright map shows students' ability and the right side shows the item difficulty level. The Wright Map is shown in the Figure 3.2.

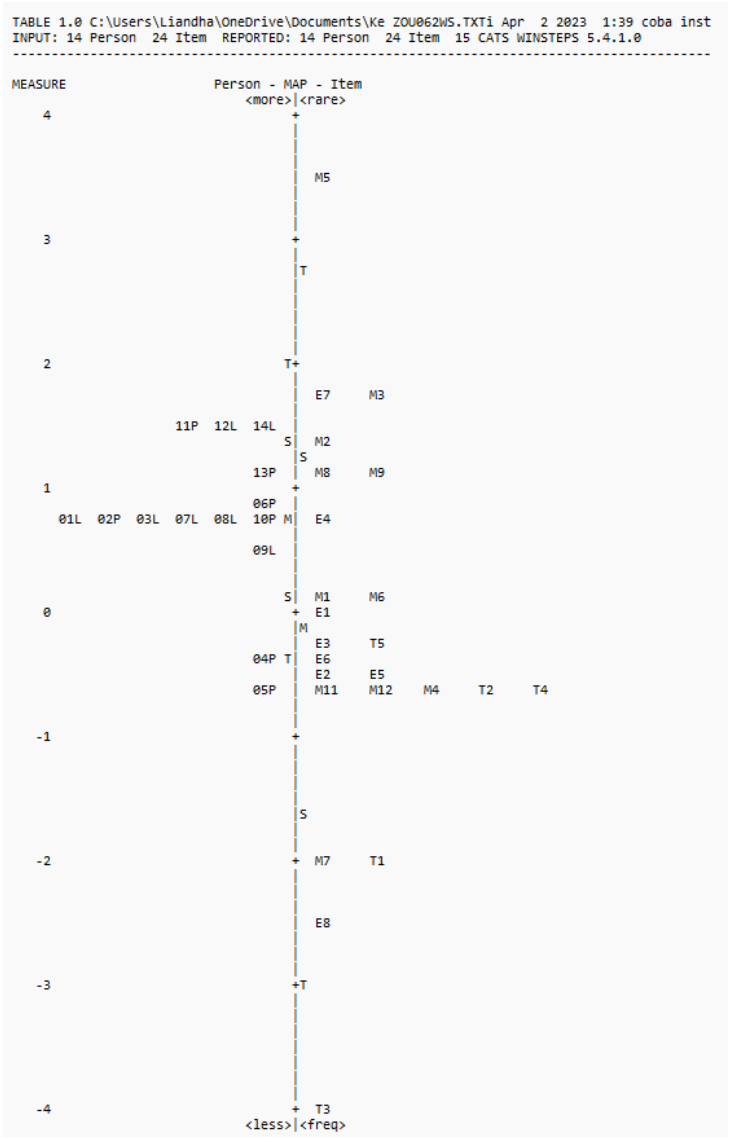

Figure 3. 2 Item Test Wright Map

The difficulty level category also can be categorized based on the standard deviation in the item measure as can be seen in the Table 3.13. In this research the standard deviation value is 1.45 logit.

Table 3. 13 The difficulty level category

Logit	Category
>+1SD	Very Difficult
0.00 logit +1SD	Difficult
0.00 logit -1SD	Easy
<-1SD	Very Easy

Based on the category given and the wright map shown, the test item difficulty level can be categorized as shown in the Table 3.14. There are 4 difficulty levels including very difficult, difficult, easy, and very easy.

Table 3. 14 Item Difficulty Level

Category	Item Number	Total
Very Difficult	10, 6, 18	3
Difficult	5, 16, 17	3
Easy	12, 2, 11, 1, 21, 8, 15, 7, 14, 4, 9, 20, 22, 23	14
Very Easy	3, 13, 24, 19	4

3.5.2.2 Environmental Literacy (Behavior and Attitude)

Students' environmental literacy on behavior and attitude domain was measured by using Likert-Scale questionnaire that was adopted from Szczytko et al. (2019). The framework used in constructing the questionnaire was from UNESCO. The original questionnaire supports a valid and reliable instrument to be adopted. The questionnaire was in English and translated to Bahasa Indonesia. The translated version was then undergoing proofreading by an expert. It was consisted of 15 questions for attitude domain and 16 questions for behavior domain. The example of the translated questionnaire is shown in the Table 3.15.

Table 3. 15 The Example of Environmnetal Literacy Translated Questionnaire

No.	Domain	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
1.	Attitude	*Menggunakan lampu ramah energi di rumah*				
2.		*Menggunakan listrik saat dibutuhkan saja*				
3.	Behavior	*Saya selalu membuang sampah pada tempatnya*				
4.		*Saya memisahkan sampah organik dan anorganik*				

3.5.2.3 Sustainability Literacy

The sustainability literacy in this research consisted of knowledge, attitude, and behavior domain. The questionnaire used was adopted from Gericke et al. (2019) and translated from English to Bahasa Indonesia. Gericke et al. (2019) constructed the questionnaire based on NAAEE's guidelines for Excellence: K-12 Learning Excellence. The original questionnaire supports a valid and reliable instrument to be adopted. Hence, the translated version has been acknowledged by expert for validation. It was in the form of Likert-Scale Questionnaire with four-degree judgement (SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree) and includes 3 themes of ESD (Environment, Social, and Economy) for each domain. There are 26 questions with 9 and 8 questions for each domain. The example of the translated questionnaire is shown in the Table 3.16.

Table 3. 16 The Example of Sustainability Literacy Questionnaire

Sustainability Literacy Domain	**Theme**	**Statement**	**SA**	**A**	**D**	**SD**
Knowledge	Environment	*Mengurangi penggunaan air diperlukan untuk pembangunan berkelanjutan*				
	Social	*Budaya penyelesaian konflik secara damai melalui diskusi di perlukan untuk pembangunan berkelanjutan*				
	Economy	*Pembangunan berkelanjutan mengharuskan perusahaan bertanggung jawab terhadap karyawan, pelanggan, dan pemasok mereka*				
Attitude	Environment	*Saya pikir menggunakan lebih banyak sumber daya alam daripada yang kita butuhkan tidak mengancam kesehatan dan kesejahteraan manusia di masa depan*				
	Social	*Saya pikir setiap orang harus diberi kesempatan untuk memperoleh pengetahuan, nilai, dan keterampilan yang diperlukan untuk hidup berkelanjutan*				
	Economy	*Menurut saya, perusahaan memiliki tanggung jawab untuk*				
Behavior	Environment	*Saya mendaur ulang apa saja sebanyak yang saya bisa*				

	Social	*Saya mendukung organisasi atau kelompok lingkungan*				
	Economy	*Saya membantu mereka yang membutuhkan*				

3.5.3 Learning Style

The VARK questionnaire was used to analyze students' learning styles in accordance with the perception of the learners. The questionnaire contains 16 questions with 4 multiple choices where each choices represent one learning style. The example of the question-and-answer choices can be seen in the Table 3.17.

Table 3. 17 Example of VARK Questionnaire

Question	You are going to prepare a surprise party for a friend. You will:	
Answer	A	Invites friends without planning anything
	B	Imagine how the party will be going
	C	Making list of things that needs to be prepared for the party
	D	Discussing with friends via telephone or chat

3.6 Data Analysis

3.6.1 The Implementation of STEM-PjBL-ESD Learning

The data on the implementation of STEM-PjBL-ESD learning was gained by using the observation sheet. After the observer filled up the observation sheet, the data gained was then calculated to determine the percentage of the implementation by using the following formula.

$$\%\ LI = \frac{\Sigma\ IA}{\Sigma\ \mathrm{TA}} \times 100\%$$

Description:

LI : Implementation of Learning Method (Virtual Lab Activity with Inquiry-Based Learning)

IA : Implemented Aspect

TA : Total Aspect

(Source: Riduwan M B A (Fitriani, 2017)*)*

After the calculation, the percentage obtained was then interpreted by using the interpretation in Table 3.18 to find out the degree of learning implementation criteria.

Table 3. 18 Interpretation of Learning Implementation Criteria

Percentage (%)	Criteria
LI = 0	Neither activity is executed
0 < LI < 25	There are a small number of activities that are executed
25 ≤ LI < 50	Almost half of the activity is executed
LI = 50	Half of the activity is executed
50 ≤ LI < 75	Most of the activity are executed
75 ≤ LI < 100	Nearly all the activity are executed
< 100	All the activity are executed

(Source: Riduwan M B A (Fitriani, 2017)*)*

3.6.2 Students' Learning Style

a. VARK Learning style Interpretation

The interpretation of VARK learning style questionnaire is done by collecting the answers from a student and interpreted into ability point of VARK learning style. To calculate the total score of VARK, the score of every component was formulated. The total score was then used to find the stepping distance by following the category shown in the Table 3.19.

Table 3. 19 VARK Learning styles stepping distance

The total score of VARK	Stepping distance
14-21	1
22-27	2
28-32	3
32+	4

Steps of learning style calculation (Khongpit et al., 2018):

1) Calculate the total scores of VARK to find the stepping distance from Table II. S is used for stepping distance.
2) Sort the VARK points in order from the maximum to minimum. Use n1, n2, n3, n4 respectively.
3) If n1-n2>s meaning the learner has single preference of learning style. If the result is less, follow step 4.
4) If n2-n3>s meaning the learner has bi-modal preference. If the result is less, follow step 5.
5) If n3-n4>s meaning the learner has tri-modal preference. If the result is less, it means the learner has four-modal preference.

b. Preference of Learning Style

An individual may have more than one learning style in acquiring knowledge. It is an advantage to anyone who has more than one type of learning style, because, those individuals possess more flexible views and acceptance of their learning environment (Fahim et al., 2021; Othman & Amiruddin, 2010).

1) Single Preference

   Student who has single preference learning style has one dominant preference.

2) Bi-modal Preference

   Student with bimodal preferences have two dominant learning styles, which can be the combination of two types of learning style. The type of the learning style can be determined by the highest score of the VARK score.

3) Tri-Modal Preference

   Student with trimodal preferences have three dominant learning styles, which can be the combination of three types of learning style. The type of the learning style can be determined by the highest score of the VARK score.

4) Four-Modal Preference

   Student with four modal preferences have a strong preference on each type of learning style, it can be mentioned that this student has VARK learning style.

3.6.3 Multiliteracy

The data processed by using WinStep Rasch Model, which can help to process the statistical data accurately. The explanation of the data analysis shown as follows:

1) Scoring of the test (for Objective test only)

To measure students' improvement, the data gained from the objective test was used. The score was calculated by adding the number of correct answers. Then it was divided by the maximal score, and multiplied by 100. The perfect score will be 100, and the smallest score is 0. Every sample's score was calculated.

2) Normality test

The normality test was measured to determine the following data calculation. Data can be called normally distributed when the sig. value is more than 0.05. If both data from pre-test and post-test are normally distributed, the data will be analyzed by using a parametric test. Meanwhile, if the data was not normally distributed, a non-parametric test will be used.

3) Homogeneity test

A homogeneity test was conducted in order to determine whether the data is homogeneous or not. The data is homogeneous when the sig. value is more than 0.05.

4) Stacking and Racking

The data was organized by stacking them according to the pre-test and post-test. Since there are 19 data, data number 1-19 was data for pre-test, and data number 20-38 was post-test data. Therefore, student in the data number 1 and 20 are the same person but number 1 stands for the pre-test score and data number 20 stands for post-test data. To measure students' multiliteracy, menu "Person Statistics: Entry Order" was used. Furthermore, scatter plot graph can be used to visualize which student has different score on pre-test and post-test. Student with positive value indicates that the student has increasing variable.

3.7 Research Procedures

The research procedure carried out in this research are explained as follows:

1. **Preparation Stage**

a. Problem investigation by reading journals and articles related to the problem happens in the science teaching-learning process.
b. Selecting the specific topic to be addressed in this research.
c. Analysing several aspects that support this research, which are STEM-PjBL, ESD, Multiliteracy, Alternative Energy, and Learning Style.
d. Doing preliminary research on STEM application in school
e. Constructing research instruments
f. Judgement of research instrument by expert
g. Revision of research instrument

h. Conducting trial test to measure the validity, reliability and other important aspects of the instrument.
i. Revision of research instrument
j. Determining the possible school, class, and time to conduct the research.

2. Implementation Stage

a. Conducting pre-test to investigate students' learning style and initial multiliteracy
b. Giving treatment by implementing STEM-PjBL-ESD learning.
c. Conducting post-test of multiliteracy

3. Completion Stage

a. Analysing the data gained by using WinStep Rasch Model.
b. Drawing discussion and conclusion from the data analysis
c. Report the finding