

CHAPTER III

RESEARCH METHODOLOGY

A. Research Method

This research used a quantitative approach, because the phenomena of the observations were converted into numbers so that statistical techniques could be used to analyze the results. According to Leavy “quantitative research is characterized by deductive approaches to the research process aimed at proving, disproving, or lending credence to existing theories. This type of research involves measuring variables and testing relationships between variables in order to reveal patterns, correlations, or causal relationships.”¹ Quantitative research rested very strongly on data collection. The data in question was in the form of measurement results. Therefore, in this study, statistics had a very important role as a tool to analyze the answer to a problem.

This research used correlation technique to determine the direction and data collection was carried out in this research using the test method. According Wiersma and Stephen “correlational research or ex-post facto research focuses on the connection between variables as they take place in natural setting.”² This research was an Ex-Post Facto research because the independent variables in this study was not controlled or specially treated but only revealed facts based on the measurement of phenomena that have existed in the respondent before this research was carried out.

¹ Patricia Leavy. *Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches*. (New York: The Guilford Press, 2017) p.9

²William Wiersma and Stephen G. Jurs, *Research Methods in Education: An Introduction*, (New York: Pearson Education, 2009), 190.

After the research data collection was completed, the next step was data processing. In this process, statistical analysis techniques were used. The thing that needed to be considered before statistical analysis as that all conditions must be good, therefore all data must meet statistical requirements.

B. Research Variables

This research consisted of two variables are: critical thinking as (X) variable while reading comprehension of analytical exposition text as (Y) variable. For the variable design of the research was represented as follows:



Note:

X : Critical Thinking

Y : Reading Comprehension of Analytical exposition text

C. The Place and Time of Research

a. Place

The research was conducted for critical thinking and reading comprehension of analytical exposition text. The place of the study was at SMAN 2 Serang which is located at KM 5 Serang, Kec. Karundang, Serang City – Banten. The consideration of conducting the study at this site was because of the accessibility and familiarity of the situation and the participants. During this pandemic, the researcher carried out the research online due to following online learning procedures.

b. Time

The time that researcher spent for this research in order to develop scientific papers begun from preliminary observation, it was started from March 2021 to September 2021, the first was preparing the proposal, next the proposal seminar, then arrange chapter I, chapter II, chapter III, chapter IV and V.

D. Population and Sample

a. Population

Population was the whole object to be studied. Leavy stated that “Population is the group of elements from which you actually draw your sample.”³ The size of the population was the total number that includes all members studied. Therefore, in collecting data and analyzing data, determining the population was an important step. The population of this research was all students of class XI SMAN 2 Serang City which had 530 students.

b. Sample

The sample was part of the population that is the object of research. According to Cohen, taking the larger sample is better to give greater reliability and facilitate more sophisticated statistics to be used.⁴ Arikunto stated that “if the population is lack of 100, it is better to take the entire population, and the research is named research population. However, if the population is more than 100, the sample can be taken 10-15% or 20-25%”.⁵ The researcher took 15% of the population (530

³ Patricia Leavy. *Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches*. p.76

⁴ Louise Cohen, *et al.*, *Research Method in Education* (6th Ed.), (New York: Routledge, 2007), p. 101.

⁵Suharsimi Arikunto, *Prosedure Penelitian Suatu Pendekata Praktik*, (Jakarta: Rineka Cipta, 1998), 130

students), it meant $15 \times 530 / 100 = 79.5$ students, and accomplished become 80 students.

E. Technique of Data Collecting

a. Critical Thinking Test

The researcher used critical thinking test based on Watson Glaser Critical Thinking Question (W-GCTA) assessment⁶. This test was used to obtain the data on students' critical thinking. In this test, the students were asked to make an inference, assumptions, deductions, interpretations and evaluation of the arguments.

Table 3.1
Critical Thinking Instrument

The Critical Thinking Aspect	Indicators	Number of question	Total
Inference	Evaluating whether the inference given correct or not	1, 2, 3, 4, 5, 6, 7	7
Assumption	Deciding which assumptions given are logically justified based on the evidence in the statement, and is therefore logically justified	8, 9, 10, 11, 12, 13, 14	7
Deduction	Reading each conclusion underneath the statement, they must decide whether they think it follows from	15, 16, 17, 18, 19, 20, 21, 22	8

⁶ Watson and Glaser, *The Watson-Glaser Critical Thinking Appraisal (W-GCTA)*, (London: Pearson Education Ltd., 2012), p. 1-10.

	the statement provided		
Interpreting information	Interpreting a passage of information	23, 24, 25, 26, 27, 28, 29	7
Analyzing arguments	Distinguishing the argument whether it is strong argument or weak argument	30, 31, 32, 33, 34, 35,	6
Total number of questions			35

1) Validity Test

Validity was a standard or criterion which will reveal whether the instrument of critical thinking was valid or not. Ary et al. suggested that a test was valid to the extent what it should be measured.⁷ To test the validity of multiple-choice test, the researcher used the Point Biserial correlation (rpb) test used the Point-Biserial Correlation formula by the help of SPSS 26. The formula for the Point-Biserial Correlation coefficient as:

$$r_{pbi} = \frac{M_p - M_t}{S_t} \sqrt{\frac{p}{q}}$$

M_p = Mean (for the entire test) of the group that received the positive binary variable (i.e. the — “1”).

⁷ Donald Ary, et al. *Introduction to Research in Education*. (Wadsworth: Cengage Learning, 2010) p.293

Mt = Mean (for the entire test) of the group that received the negative binary variable (i.e. the — “0”).

St = Standard deviation for the entire test.

p = Proportion of cases in the — “0” group.

q = Proportion of cases in the — “1” group.

Table 3.2

Valdity of Critical Thinking Test

No.	r_{pb}	Status	No.	r_{pb}	Status
1	0.140	Drop	26	-0.069	Drop
2	0.437	Valid	27	0.595	Valid
3	0.686	Valid	28	0.519	Valid
4	0.500	Valid	29	0.095	Drop
5	0.519	Valid	30	0.595	Valid
6	0.686	Valid	31	0.742	Valid
7	0.059	Drop	32	-0.037	Drop
8	0.791	Valid	33	0.311	Valid
9	0.437	Valid	34	0.858	Valid
10	0.040	Drop	35	0.658	Valid
11	0.791	Valid			
12	0.631	Valid			
13	0.033	Drop			
14	0.613	Valid			
15	-0.037	Drop			
16	0.724	Valid			
17	0.5191	Valid			
18	0.6576	Valid			
19	0.195	Drop			
20	0.791	Valid			
21	0.657	Valid			
22	0.595	Valid			
23	0.742	Valid			

No.	r _{pb}	Status	No.	r _{pb}	Status
24	-0.267	Drop			
25	0.508	Valid			

Refer to the statistical data from SPSS 26.0 that showed in Table 3.2, from 35 items of multiple choices test, there were 25 valid items with r_{table} 0.220 (see appendix 6). The remaining items 10 were declared invalid so that these items were not used in the study. The drop items were 1, 7, 10, 13, 15, 19, 24, 26, 29, and 32. And the valid numbers were 2, 2, 3, 4, 5, 6, 8, 9, 11, 12, 14, 16, 17, 18, 20, 21, 22, 23, 25, 27, 28, 30, 31, 33, 34, and 35.

2) Reliability Test

Reliability discovered that whether the instrument was reliable and could be used as a device to collect the data. To measure the reliability of the critical thinking test, the researcher used Kuder–Richardson formula 20 (K–R 20) by the help of SPSS 26. The formula Kuder–Richardson was:

$$\rho_{KR20} = \frac{k}{k-1} \left(1 - \frac{\sum_{j=1}^k p_j q_j}{\sigma^2} \right)$$

k = number of questions

p_j = number of people in the sample who answered question j correctly

q_j = number of people in the sample who didn't answer question j correctly

σ^2 = variance of the total scores of all the people taking the test

The researcher used SPSS 26.0 to find the reliability of the test. From the calculation the level of reliability for multiple choices test was $r_{11} = 0,906$ which this level of reliability for the critical thinking test was categorized as very strong reliable. It means that the research instruments were reliable and can be used in the research. The criterion was:

Table 3.3

Reliability Criterion

Coefficient (r_{11})	Criterion
$R_{11} < 0,199$	Very low reliability
0,20-0,399	Low reliability
0,40-599	Medium reliability
0,60-0,799	Strong reliability
0,80-1,00	Very strong reliability

b. Reading Comprehension of Analytical exposition text Test

The researcher used multiple choice test on students' reading comprehension of analytical exposition text. According to Nuttal "reading comprehension aspects consist of: (1) determining main idea, (2) locating reference, (3) making inference, (4) finding out

detail information, and (5) the understanding vocabulary.”⁸ Those aspect was reference on this instrument.

Table 3.4

Reading Comprehension of Analytical exposition text Instrument

Indicators	Number of questions	Total
Finding out detail information	1, 2, 6, 13, 14, 15, 18, 19, 21, 24, 26, 29,	12
The understanding vocabulary	4, 8, 11, 20, 30, 34	6
Locating reference	12, 16, 22, 31, 35	5
Determining main idea	3, 10, 17, 23, 25, 28,	6
Making inference	5, 7, 9, 27, 32, 33	6
Total number of questions		35

1) Validity Test

Validity was a standard or criterion which revealed whether the instrument of critical thinking was valid or not. Ary et al. suggested that a test was valid to the extent what it should be measured.⁹ To test the validity of multiple-choice test, the researcher used the Point Biserial correlation (rpb) test used the Point-Biserial Correlation formula by the help of

⁸ Christine Nuttal. *Teaching Reading Skill in a Foreign Language*, (London: Heinemann Educational Books, 1982)p. 20

⁹ Ary, et al. *Introduction to Research in Education*. (Wadsworth: Cengage Learning, 2010) p.293

SPSS 26.0 . The formula for the Point-Biserial Correlation coefficient was:

$$r_{pbi} = \frac{M_p - M_t}{St} \sqrt{\frac{p}{q}}$$

M_p = Mean (for the entire test) of the group that received the positive binary variable (i.e. the — “1”).

M_t = Mean (for the entire test) of the group that received the negative binary variable (i.e. the — “0”).

St = Standard deviation for the entire test.

p = Proportion of cases in the — “0” group.

q = Proportion of cases in the — “1” group.

Table 3.5

Valdity of Reading Comprehension Test

No.	r_{pb}	Status	No.	r_{pb}	Status
1	0.585	Valid	26	0.562	Valid
2	0.788	Valid	27	0.299	Valid
3	0.648	Valid	28	-0.09	Drop
4	0.165	Drop	29	0.529	Valid
5	0.553	Valid	30	0.355	Valid
6	0.549	Valid	31	0.518	Valid
7	0.824	Valid	32	0.091	Drop
8	-0.09	Drop	33	0.505	Valid
9	0.414	Valid	34	0.050	Drop
10	0.355	Valid	35	0.549	Valid
11	-0.03	Drop			
12	0.484	Valid			
13	0.084	Drop			

No.	r_{pb}	Status	No.	r_{pb}	Status
14	0.585	Valid			
15	0.549	Valid			
16	0.165	Drop			
17	0.346	Valid			
18	0.643	Valid			
19	0.117	Drop			
20	0.484	Valid			
21	0.288	Valid			
22	0.562	Valid			
23	0.648	Valid			
24	-0.015	Drop			
25	0.553	Valid			

Refer to the statistical data from SPSS 26.0 that showed in Table 3.3, from 35 items of multiple choices test, there were 25 valid items with r_{table} 0.220 (see appendix 6). The remaining items 10 were declared invalid so that these items were not used in the study. The drop items were 4, 8, 11, 13, 16, 19, 24, 28, 32, and 34. And the valid numbers were 1, 2, 3, 5, 6, 7, 9, 10, 12, 14, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 29, 30, 31, 33, and 35.

2) Reliability Test

Reliability discovered that whether the instrument was reliable and could be used as a device to collect the data. To measure the reliability of the reading comprehension of explanation test, the researcher used Kuder–Richardson formula 20 (K–R 20) by the help of SPSS 26. The formula Kuder–Richardson is:

$$\rho_{KR20} = \frac{k}{k-1} \left(1 - \frac{\sum_{j=1}^k p_j q_j}{\sigma^2} \right)$$

k = number of questions

p_j = number of people in the sample who answered question j correctly

q_j = number of people in the sample who didn't answer question j correctly

σ^2 = variance of the total scores of all the people taking the test

The researcher used SPSS 26.0 to find the reliability of the test. From the calculation the level of reliability for multiple choices test was $r_{11} = 0,853$ which this level of reliability for the reading comprehension test was categorized as very strong reliable. It means that the research instruments were reliable and can be used in the research. The criterion was:

Table 3.6

Reliability Criterion

Coefficient (r_{11})	Criterion
$R_{11} < 0,199$	Very low reliability
0,20-0,399	Low reliability
0,40-599	Medium reliability

0,60-0,799	Strong reliability
0,80-1,00	Very strong reliability

F. The Technique of Analyzing Data

a. Normality Test

Before testing the hypothesis, the data collected from the results of the study was tested for data analysis requirements, namely the normality test. The normality test in this study was a "parametric normality test" using the Lilliefors test. The normality test was carried out to determine whether the population data is normally distributed or not based on the sample data obtained. The formula used for the lilliefors test was:

$$L_o = F(Z_i) - S(Z_i)$$

Where :

L_o : L (observation) or the largest absolute price

$F(Z_i)$: Standard number odds

$S(Z_i)$: Proportion of standard numbers

The Liliefors test steps are:

a) Determine whether the data is normal or not, namely:

H_o : The data are normally distributed

H_1 : The data are not normally distributed

Rejected H_o if $L_o > L_{table}$

Accepted H_o if $L_o < L_{table}$

- b) Conduct observations on $X_1, X_2, X_3, \dots, X_n$ then used as standard numbers $Z_1, Z_2, Z_3, \dots, Z_n$ using the formula:

$$Z_i = \frac{(X_i - X)}{S}$$

- c) For each standard number, the probability of F (Z_1) can be calculated using the normal distribution list, provided that:
- For Z_1 which is (+) then $F(Z_1) = 0.5 + Z_{table}$
 - For Z_1 which is (-) then $F(Z_1) = 0.5 - Z_{table}$
- d) The proportion of $Z_1, Z_2, Z_3, \dots, Z_n/S(Z_i)$ is $S(Z_i) = X_n/N$
- e) After $F(Z_1) - S(Z_1)$ is calculated, the absolute value is determined.
- f) Determine L_o , which is the largest price of the absolute price $F(Z_1) - S(Z_1)$

Test the normality of the data by comparing the L_o with the L table in accordance with the test criteria. This data normality test is carried out both on variables X and on variable Y. In practice, the SPSS 26.0 program assistance will be used to calculate the normality test.

b. Linearity Test

Linearity was a condition in which the relationship between the dependent variable and the independent variable is linear. The regression line linearity test in this study used the F test, the formula is as follows:

$$F = \frac{S_{TC}^2}{S_E^2} = \frac{\frac{JK(TC)}{k-2}}{\frac{JK(E)}{n-k}}$$

In practice, the SPSS 26.0 program assistance was used to calculate the linearity test, namely by looking at the value of the sig coefficient on Deviation from Linearity.

The linearity testing criteria are as follows:

If sig > 0.05 then the regression line is linear and,

If sig ≤ 0.05 then the regression line is not linear.

c. Hypothesis Test

After testing the data analysis requirements and it was known that the data was suitable for further processing, the next step was to test each hypothesis that has been proposed. Hypothesis testing used correlational techniques. In practice, the SPSS 26 program was used to calculate and test the correlation. Then, to find out the result of this study, the researcher used the *Pearson Product Moment Correlation formula*, as follow:¹⁰

The formula is:

$$r_{xy} = \frac{N \cdot \Sigma xy - (\Sigma X) \cdot (\Sigma Y)}{\sqrt{(N \cdot \Sigma x^2 - (\Sigma x)^2)(N \cdot \Sigma y^2 - (\Sigma y)^2)}}$$

¹⁰Budi Susetyo, *Statistika untuk Analisis Data Penelitian dilengkapi cara Perhitungan dengan SPSS dan Office Excel*, (Bandung: PT Refika Aditama, 2010), p. 180.

Note:

r_{xy} : Correlation coefficient between the students' critical thinking and reading comprehension of analytical exposition text scores at the XI grade of SMAN 2 Serang City.

N : Number of respondents

X : Distribution of students' critical thinking scores

Y : Distribution of Students' reading comprehension of analytical exposition text scores

ΣX : Total score of students' critical thinking scores distribution

ΣY : Total score of students' reading comprehension of analytical exposition text scores distribution

ΣXY : Total number of multiply between X scores and Y scores

(X^2) : Total multiply of X score multiplies X score

(Y^2) : Total multiply of Y score multiplies Y score

Significant critical value : 0.05

Criteria:

Rejected H_a when $r_{xy} < r_t$

Accepted H_a when $r_{xy} > r_t$

With that formula, the researcher got r coefficient that can describe the correlation between X variable and Y variable, as below:

Table 3.7

The Interpretation of Correlation 'r' Product Moment¹¹

r_{xy}	Interpretation
0.00 – 0.199	The correlation between X variable and Y variable is very weak or can be interpreted there is no correlation between the variables.
0.20 – 0.399	There is weak correlation between X variable and Y variable.
0.40 – 0.699	There is medium correlation between X variable and Y variable.
0.70 – 0.899	There is strong correlation between X variable and Y variable.
0.90 – 1.00	There is very strong correlation between X variable and Y variable.

The researcher also used coefficient determination to know contribution of the independent variable (X), critical thinking towards the dependent variable (Y), reading comprehension of analytical exposition text. The calculation of the data to the determination coefficient (r^2) is presented as follows:

¹¹Sugiyono, *Statistika Untuk Penelitian*, (Bandung, Alfabeta, 2007), 231

Formula:

$$R^2 = \frac{(N \cdot \Sigma xy - (\Sigma X) \cdot (\Sigma y))^2}{(N \cdot \Sigma x^2) - (\Sigma x)^2 (N \cdot \Sigma y^2) - (\Sigma y)^2}$$

R^2 : The calculation of the data to the determination coefficient of the contribution critical thinking toward reading comprehension of analytical exposition text scores at the XI grade of SMAN 2 Serang City.

N : Number of respondents

X : Distribution of students' critical thinking scores

Y : Distribution of Students' reading comprehension of analytical exposition text scores

ΣX : Total score of students' critical thinking scores distribution

ΣY : Total score of students' reading comprehension of analytical exposition text scores distribution

ΣXY : Total number of multiply between X scores and Y scores

(X^2) : Total multiply of X score multiplies X score

(Y^2) : Total multiply of Y score multiplies Y score

Then to find out the significant between two variables, the formula of significant test is as follow:

$$t = \frac{r_{xy} \sqrt{n-2}}{\sqrt{(1-r^2)}}$$

Note:

t_{count} : t value.

r_{xy} : value of correlation coefficient

n : Number of respondents

G. Statistical Hypothesis

- a. If $r_o > r_t = H_a$ is accepted and H_o is rejected. It means that there is a correlation between students' critical thinking skill and their reading comprehension of analytical exposition text
- b. If $r_o > r_t = H_a$ is rejected and H_o is accepted. It means that there is a no a correlation between students' critical thinking skill and their reading comprehension of analytical exposition text.