

CHAPTER III

RESEARCH METHODOLOGY

This chapter contains the comprehensive description of the methodology used in the study. It provides the description of the research approach and method, research design, population and sample, types and sources of data, data collection procedures, treatments, validity and reliability of the research instrument, data analysis techniques, and research ethics. The methodological framework describes the operational procedure and statistical approach adopted in the study in order to answer the research question objectively.

A. Research Approach and Method

1. Research Approach

Following Creswell (2014), quantitative research can be considered as a research approach based on testing of objective theories with the help of relationships between variables. In the current research, the quantitative approach was used with the presentation of the results in quantitative data.

2. Research Method

According to Fraenkel (2012), experimental research can be defined as a research method involving manipulation of at least one independent variable, control of other relevant variables and observation of their influence on one or more dependent variables. Thus, in the current research, the experimental method was used since the treatments were applied and measurements were conducted. The obtained quantitative data were analyzed to estimate the proposed hypothesis.

3. Rationale for Method Selection

The reason for choosing the experimental method lies in the assumption about obtaining more precise and reliable data compared to the other methods.

B. Research Design

In this research, the experimental research design within the framework of the quantitative approach was used. The justification of using the quantitative approach in this research lies in the intention to test hypotheses and explore objectively cause-and-effect relationships between variables using statistics (Creswell & Creswell, 2018). According to Arib et al. (2024), the experimental research is one of the most precise and reliable methods of exploring the effect of treatment. This research uses the quasi-experimental design with a non-equivalent control group. There are two groups in this design, namely, the experimental group receiving the treatment with the help of 360-degree VR videos in reading instruction, and the control group taught traditionally.

The selection of *quasi-experimental designs* is based on real conditions in the field where it is not always possible for researchers to fully randomize subjects (Fraenkel et al., 2012). This is in line with the characteristics of real-world educational research that often faces classroom administrative limitations, so that the use of existing control groups (nonequivalent) is the most flexible and relevant alternative (Anantasia & Rindrayani, 2025). Through this experimental design, researchers can test the effectiveness of treatment on dependent variables, namely students' *reading comprehension* skills. By comparing the learning outcomes of the experimental group and the control group, this study is expected to provide robust empirical evidence regarding the effect of using 360-degree VR video media (Arib et al., 2024).

C. Population and Sample

The population of this study includes all the students of grade eleven at SMA Darul Hikmah Bojongsoang, consisting of 52 subjects in two classes, XI IPA and XI IPS. According to Sugiyono (2021), a population is an aggregate of subjects or people having characteristics pertinent to the aims of the research. Total sampling technique was adopted in which the whole population is used as the research

sample. This sampling technique was chosen because, during the conduct of this research, Grade XI had only two intact classes of XI IPA and XI IPS and there were no other sections available to use. Hence, all students from both classes were selected as the sample, rather than selecting a sample from the population through random sampling since the number of intact classes was limited (Creswell & Creswell, 2018).

As stated by Sekaran and Bougie (2016), a large enough sample is required in educational research to provide enough representation for statistics. Since the initial number of the population was 52, 10 subjects could not go through the whole research process which included pretest, treatment and posttest. Therefore, their data was not analyzed in the study and the final sample size of the study became 42 subjects in which 18 subjects of Class XI IPA were experimental group and 24 subjects of Class XI IPS were control group.

D. Types and Sources of Data

In the current study, two types of data were collected which include primary data and secondary data. The primary data were collected directly from the participants through reading comprehension test conducted before and after the treatment, i.e., pretest and posttest scores. The primary data served as the empirical basis to assess the effect of 360-degree VR video media on improving students' reading comprehension skills. The secondary data were collected from the scholarly resources including textbooks and journals concerning the topic of the study.

E. Data Collection Techniques

Achievement test was employed as the data collection method in this study. Achievement test instrument included the Reading Comprehension test in multiple-choice form built on four main indicators including identification of main ideas, acquisition of detailed information, vocabulary in context and inference skills (Brown, 2004; Grabe & Stoller, 2020). Adoption of multiple-choice as the test

format was aimed at ensuring objectivity in scoring as well as facilitating standardization of research instrument. The process of developing research instrument was done through a series of steps in order to maintain quality of data.

The first stage involved preparing a test blueprint aligned with the learning objectives and descriptive text competency indicators for Grade XI students. The second stage focused on constructing test items based on the developed blueprint by considering text readability and appropriate item-writing principles. The third stage involved assessing content validity through expert judgment conducted by an English education expert lecturer who also served as the research supervisor (Fraenkel et al., 2012). This process was conducted to ensure that the test items adequately represented the reading comprehension construct being measured and were consistent with the intended learning objectives.

After establishment of content validity of the instrument by the expert, the test was implemented during the process of conducting the study. Due to practical difficulties, there was no external pilot test conducted and thus, empirical validity and reliability were generated based on data collected during the study. Both pre-test and post-test instruments were analyzed separately in order to determine item validity and internal consistency. On basis of empirical analysis, nine items in pre-test instrument and nine items in post-test instrument met the required statistical requirements and were used in final data analysis. Empirically invalid items were not used in analysis. Further, Cronbach's Alpha was used in order to establish the internal consistency of retained items before using them in measuring reading comprehension achievement.

In the implementation of the quasi-experimental intervention, the data collection procedure was conducted through two systematic measurement stages: pre-test and post-test. The pre-test was administered to both the experimental group consisting of 18 students and the control group consisting of 24 students before the instructional treatments were provided. The pre-test utilized a descriptive text

entitled “Borobudur Temple” and aimed to identify students’ initial reading comprehension abilities before receiving different instructional approaches.

Following the pre-test, the experimental group received instruction using 360-degree VR videos, whereas the control group received instruction through conventional teaching methods. In the experimental class, the 360-degree VR videos were presented through a Smartboard screen to provide students with an immersive visual learning experience. The instructional materials consisted of three 360-degree VR videos obtained from the AirPano VR YouTube channel. The use of 360-degree VR videos was based on multimedia learning principles, which emphasize the integration of visual and verbal information to support students’ learning processes (Mayer, 2009).

The selected VR videos were integrated with descriptive texts as learning materials during the treatment sessions. The first treatment used the text entitled “Angel Falls, Venezuela”, the second treatment used “Antarctica”, and the third treatment applied “Lake Hibara, Fukushima, Japan”. The selection of these materials was based on several considerations, including topic relevance, language difficulty level, and alignment with the English learning objectives for Grade XI students.

After the study period, post-test was carried out among both classes using descriptive text “Raja Ampat”. The post-test was meant to measure the improvement in reading comprehension achievement among students after the instructional interventions that were provided. The scores obtained from the post-test were analyzed and processed to find out if there is any difference in the improvement of reading comprehension achievement among the experimental group and the control group.

F. Treatment Procedure

The treatment procedure in this study was conducted in two meetings for both the experimental and control groups. The experimental group received

instruction using 360-degree VR videos, while the control group received conventional instruction assisted by printed texts. Each meeting was systematically designed to support students' reading comprehension skills in descriptive texts.

The first meeting consisted of the pre-test, Treatment 1, and Treatment 2. The activity began with administering the pre-test using the descriptive text entitled "Borobudur Temple" consisting of 10 multiple-choice questions to both groups to measure students' initial reading comprehension abilities. After completing the pre-test, the researcher provided an explanation of descriptive texts, including their definition, purpose, generic structure, and language features.

During the treatment stage, the experimental group explored the objects "Angel Falls, Venezuela" and "Antarctica" through 360-degree VR videos from the AirPano VR channel, followed by reading the related descriptive texts and answering five comprehension questions for each text. Meanwhile, the control group learned the same materials using conventional methods through printed handouts without the use of VR videos.

The second meeting consisted of Treatment 3 and the post-test. In this session, the experimental group received the third treatment using a 360-degree VR video entitled "Lake Hibara, Fukushima, Japan", followed by reading the related descriptive text and completing five comprehension questions focusing on the main idea, detailed information, vocabulary, and inference. The control group studied the same material using conventional teaching methods. At the end of the meeting, both groups completed the post-test using the descriptive text entitled "Raja Ampat", consisting of 10 multiple-choice questions, to measure the changes in students' reading comprehension achievement after the instructional treatments.

G. Instrument Validity and Reliability

In order to increase the accuracy and consistency of the measurement, validity and reliability test of the instrument used in the research were conducted. Validity was conducted through the help of expert judgment while empirical

validity and reliability test was conducted based on responses obtained from the research. The pre-test and post-test instruments were analyzed independently.

The empirical validity of the test items was done using Pearson Product Moment correlation analysis. This analysis was aimed at finding the relationship between the score of each item and the total score of the test. If the value of r -calculated exceeded the value of r -table at 5% significance level then the item was considered valid (Sugiyono, 2021). Items that did not meet the criteria of validity were not included in further analyses. Therefore, nine valid items from the pre-test instrument and nine valid items from the post-test instrument were included in the analysis.

Cronbach's Alpha was used to conduct reliability test among the valid items. According to Hair et al. (2021), if Cronbach's Alpha exceeds 0.70 it means that the instrument has acceptable reliability although this should take into consideration the number of test items and other characteristics of the sample. Reliability analysis showed that the Cronbach's Alpha value for the pre-test instrument is 0.630 while for the post-test instrument is 0.533. Although these values are below the acceptable range, they indicated moderate internal consistency.

H. Data Analysis Techniques

1. Descriptive Statistical Analysis

Descriptive statistics were applied in order to describe the overall characteristics of the dataset and give a picture of students' reading comprehension performance in both experimental and control groups. Descriptive statistics included the computation of mean, standard deviation, minimum and maximum scores, median, and interquartile range (IQR). It should be noted that the inclusion of the median and IQR was necessary because of the use of nonparametric statistics

for data analysis, which is focused on comparison of distributions and ranks instead of mean differences (Nahm, 2016).

It allowed describing the students' reading comprehension performance in descriptive texts before and after instruction in a comprehensive manner. Descriptive statistics represented students' performance based on pre-test, post-test, and gain scores for both experimental and control groups.

2. Prerequisite Analysis Testing

Pre-requisite analyses were carried out before hypotheses testing in order to choose the appropriate statistical methods for data analysis. In order to determine whether the distribution of students' gain scores was normally distributed, the Shapiro-Wilk test was used with the assistance of SPSS software (Field, 2018). Based on the results of the normality test, the appropriate statistical analytic method could be chosen. Normality of the distribution of scores was indicated when p-value was greater than 0.05; otherwise the distribution was non-normal. As the data distribution was not normally distributed, nonparametric analysis by means of the Mann-Whitney U test was applied for evaluation of reading comprehension improvement difference between experimental and control groups (Nahm, 2016).

a. Hypothesis Testing

Hypothesis Testing in this study was done using Non Parametric Statistics in particular the Mann-Whitney U Test using the SPSS Software. The Mann-Whitney U Test was chosen as the replacement of the Independent Samples t-test because the normal distribution was violated. The Mann-Whitney U Test was utilized to find out if there is any significant difference in the improvement of the students' reading comprehension between the experimental and control groups where the experimental group received instruction through 360-degree VR video media and the control group received traditional teaching method.

Mann-Whitney U Test is the nonparametric equivalent of the independent samples t-test and tests the hypothesis about the equality of two population medians on a single, dependent variable. The Mann-Whitney U Test was used in this study in comparing the gain scores of students' reading comprehension achievement between the experimental and control groups after the treatment interventions.

Statistical decision making involved determining whether the p-value (Asymp. Sig. 2-tailed) is less than the predetermined alpha value ($\alpha = 0.05$). If the significance value was less than 0.05, the null hypothesis (H_0) was rejected for (H_a). Otherwise, the null hypothesis is retained since the significance value was greater than 0.05.

In order to interpret the result of the statistical analysis more comprehensively, the effect size was estimated. The effect size (r) was derived using the Z value from the output of the Mann-Whitney U Test divided by the square root of the total number of participants (N). The formula used was:

$$r = \frac{Z}{\sqrt{N}}$$

Where:

- r = Effect size value
- Z = Z-score derived from the *Mann-Whitney U Test* output
- N = The total number of observations (overall sample size, $N = 42$)

The interpretation of the effect size values followed Cohen's (1988) classification, in which $r = 0.10$ indicates a small effect, $r = 0.30$ indicates a medium effect, and $r \geq 0.50$ indicates a large effect. Through this analysis, the researcher was able to determine not only the statistical significance of the difference between the experimental and control groups but also the practical magnitude of the effect of implementing 360-degree VR video media through a Smartboard screen on students' reading comprehension improvement.

I. Research Ethics

This research is fully committed to strictly applying the principles of research ethics in order to maintain academic integrity, data objectivity, and protect the basic rights of respondents. The first principle applied is the delivery of consent to action through *oral informed consent* to grade XI students before the data collection process begins. The researcher held a special meeting session before the study to introduce himself, explain the purpose and purpose of the arrival, explain the procedure to be passed, and affirm the respondent's right to participate voluntarily without any coercion or academic consequences. This oral approach was chosen to establish psychological comfort between researchers and students in their native classroom environment.

The second principle is to maintain the confidentiality of the identity (*anonymity* and *confidentiality*) of all respondents. The researcher did not include the student's real name in the instrument sheet, SPSS data processing, or final research report, but replaced it with a certain code or initial. The third principle is to uphold *academic integrity* by avoiding all forms of plagiarism in the preparation of reports, citing valid sources, and presenting raw data as it is objectively without manipulating or fabricating data for the benefit of research results (Creswell & Creswell, 2018). Through the application of this set of key principles, all stages of research can be accounted for ethically, transparently, and legally.