CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Design

The type of research used in this study was descriptive-comparative research. In this research, there was no manipulation of the variables done by the researcher. According to Suharsimi Arikunto (2013), descriptive research aims to investigate the circumstance, condition, or anything else that's already mentioned, and the result is presented in the form of a research report. The aimed of this study was find the differences between the science textbook for junior high school of curriculum 2013 and curriculum Merdeka based on NOS content. According to Sugiyono (2021), the research conducted that aims to make comparisons can use the analysis technique that leads to find the difference or similarity in the subject of the research, which is called comparative analysis. The data were obtained from science textbooks in curriculum 2013 and curriculum Merdeka, which contains the nature of science (NOS) aspects. The data that had been collected were scored to know the status of each category of the data and compared descriptively.

3.2 Data Source

In this study, the data were only taken from one type of data source, which is the primary data source. The researcher used the primary data as a data source which had been selected directly from the source. The primary data for this research were taken from grade 7 and grade 8 junior high school science textbooks according to curriculum 2013 and curriculum Merdeka.

3.3 Data Collection Technique

The data collection technique used in this research was a documentary study. In the documentary method, the researcher observes a non-living thing instead of the living thing (Arikunto, 2002). The variable that has been defined to reach the research objectives can be found by analyzing the notes, transcript, magazine, book, newspaper, agenda, etc. In collecting the data, the researcher followed the steps introduced by Fraenkel & Wallen (2009) for content analysis as

follows: (1) The researcher decides the specific objectives to be achieved; (2) Defines important terms that must be explained in detail; (3) Specifies the unit tobe analyzed; (4) Find the data that will be analyzed related to the research objectives; (5) Establishing rational or conceptual relationships to explain how the data are related to the objectives of the research; (6) Developing the sampling plans; (7) Formulating category of coding; (8) The researcher can code either or both the manifest and the latent content of a communication.

In this research, the data was found by reading the junior high school science textbook in depth. The data based on the coding category that represents the nature of science aspect in the science textbook were collected by the researcher. After the data was collected, the researcher analyzed the data by giving the score to the unit analysis. The score assigned to a specific NOS aspect within a textbook was based on examining all materials relevant to that aspect within the examined textual materials (Abd. El-Khalick et al., 2008)

3.4 Materials

In this research, science textbooks for junior high school student that used curriculum 2013 and curriculum Merdeka were analyzed. The sampling technique used in this research was the purposive sampling technique. Purposive sampling is a sampling technique for data sources with particular considerations (Sugiyono, 2015).

The science textbooks analyzed are science textbooks based on the curriculum 2013 and curriculum Merdeka. The science textbook based on the curriculum 2013 was published in 2017 and passed the *Badan Standar Nasional Pendidikan (BSNP)* assessment. Meanwhile, the science textbook based on the Curriculum Merdeka was published in 2021 and passed the *Badan Standar Kurikulum dan Asesmen Pendidikan* assessment. The chapters were only taken from grade 7 and grade 8 junior high school science textbooks because the Indonesia Ministry of Education, Culture, Research, and Technology didn't release the science textbook for 9^{th} grade for Junior High School in curriculum Merdeka. The topic chapters analyzed from each science textbook must be the chapter that discusses the same topic. The researcher took the chapters from each book that

discuss the same topic. All chapters have the same opportunity to be chosen because the researcher randomly chose the chapters. The sample chapters that will be chosen to be analyzed are presented in Table 3.1.

Table 3.1 The list of sample chapters

Curriculum	Title	Author	Publisher	Sample Chapters
2013	*Ilmu Pengetahuan Alam SMP/MTs Kelas VII Semester 1 (Edisi Revisi 2017)*	Wahono Widodo Fida Rachmadiarti Siti Nurul Hidayati	*Pusat Kurikulum dan Perbukuan, Balitbang, Kemendikbud*	Chapter 1: Science object and its observations Chapter 2: Classification of living things Chapter 3: Classification of matter and its changes Chapter 4: Temperature and its changes Chapter 5: Heat and its transfer Chapter 6: Energy and living systems
	Ilmu Pengetahuan Alam SMP/MTs Kelas VII Semester 2 (Edisi Revisi 2017)			Chapter 1: Organization of living things Chapter 2: The interaction of living things and the environment Chapter 5: Earth layers Chapter 6: Solar system
	Ilmu Pengetahuan Alam SMP/MTs Kelas VIII Semester 1 (Edisi Revisi 2017)	Siti Zubaidah Susriyati Mahanal Lia Yuliati I Wayan Dasna Ardian A. Pangestuti Dyne R. Puspitasari Hamim T. Mahfudhillah Alifa Robitah Zenia L. Kurniawati		Chapter 1: The motion of objects and living things in the surrounding environment Chapter 2: Work and simple machine in daily life Chapter 4: Human digestive system Chapter 5: Additive and addictive substances Chapter 6: Human circulation system

Curriculum	Title	Author	Publisher	Sample Chapters
	Ilmu Pengetahuan Alam SMP/MTs Kelas VIII Semester 2 (Edisi Revisi 2017)	Fatia Rosyida Mar'atus Sholihah		Chapter 8: Human respiratory system Chapter 9: Human excretion system Chapter 10: Vibration and waves in daily life Chapter 11: Light and optics
Merdeka	*Ilmu Pengetahuan Alam SMP Kelas VII*	Victoriani Inabuy Cece Sutia Okky Fajar Tri Maryana Budiyanti Dwi Hardanie Sri Handayani Lestari	*Pusat Perbukuan Badan Standar, Kurikulum dan Asesmen Pendidikan*	Chapter 1: Nature of science and scientific method Chapter 3: Temperature, heat, and expansion Chapter 4: Force and motion Chapter 5: Classification of living things Chapter 6: Ecology and diversity Chapter 7: Earth and solar system
	Ilmu Pengetahuan Alam SMP Kelas VIII	Okky Fajar Tri Maryana Victoriani Inabuy Cece Sutia Budiyanti Dwi Hardanie Sri Handayani Lestari		Chapter 1: Introduction to cell Chapter 2: Structure and function of living things Chapter 3: Work, energy, and simple machine Chapter 4: Vibration, waves, and light Chapter 5: Elements, compounds, and mixtures Chapter 6: The structure of the earth and its development

The researcher sorted out all of the chapters into twelve topics because both science textbooks of curriculum 2013 and curriculum Merdeka must consist of the same number of topics. Besides, not all materials included in these chapters from both science textbooks always discuss the same topic. The topics the researcher has sorted are as follows: (1) Observations and measurements; (2) Classification of

living things; (3) Elements, compounds, and mixtures; (4) Temperature, heat, and expansion; (5) Work, energy, and simple machine; (6) Organization of living things; (7) The interaction of living things and its development; (8) The structure of the earth and its development; (9) Earth and solar system; (10) Force and motion; (11) Structure and function of living things; (12) Vibration, waves, and light.

3.5 Operational Definition

In order to avoid misconceptions about this research, some operational are explained in this research. Those terminologies are explained as follows:

a. Nature of Science

   Nature of science is use to describe the intersection of issues addressed by the philosophy, history, sociology, and psychology of science as they apply to and potentially impact science teaching and learning (William F et al., 1998). NOS representation in the science textbook was scored using the scoring rubric adopted from Abd-El-Khalick et al. (2008). The scoring rubric was intended to analyze the representation of the NOS aspect based on how it was represented (informed or naïve way) and the manner (explicitly or implicitly, and consistent or inconsistent).

b. Science Textbook for Junior High School Student

   The science textbook for junior high school students that had passed the *BSNP* assessments is to support students in reaching the goal of Curriculum 2013. According to (Widiyatmoko & Shimizu, 2018), conceptual understanding is one of the basic competencies in science learning that the students need to achieve in Curriculum 2013. In curriculum Merdeka, the natural sciences are combined with the social sciences (Rosmiati et al., 2022). A person needs to be scientifically literate to have a conceptual understanding. Furthermore, an adequate understanding of the nature of science (NOS) is a central component of scientific literacy.

3.6 Research Instrument

The researcher needs to categorize all the unit analyses collected according to the occurrence of the NOS aspect in the science textbook. Those unit analyses

were categorized based on the NOS aspects described by Abd-El-Khalick et al. (2008). The coding on every unit analysis based on the occurrence of the NOS aspect was written on the coding sheet, which can be seen in Table 3.2

Table 3.2 Coding sheet of the unit analysis occurrence in the science textbook

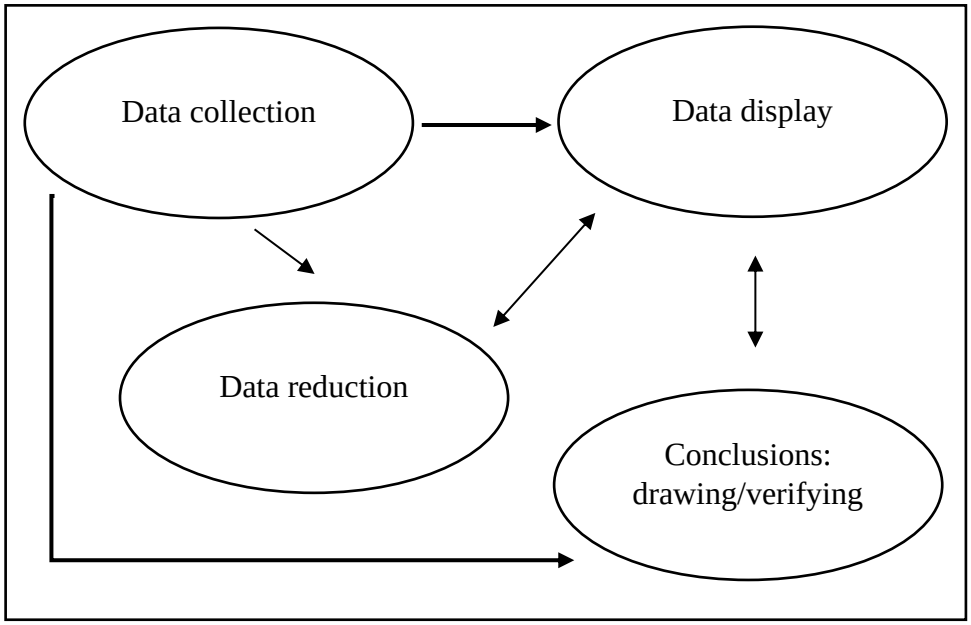
NOS Aspect	Topic	Unit Analysis	Description	Score
Empirical Inferential Creative Theory-driven Tentative Myth of "The Scientific Method" Nature of theories Nature of laws Social aspect of scientific enterprise Social and cultural embeddedness of science	- The name of the topic that addressed the NOS aspect	- The textual material/figure/ graph which addressed the NOS aspect - The page where the unit analysis in the science textbook was taken	- The name of chapter from the science textbook that addressed the NOS aspect - The grade of the science textbook where the chapter was taken	- The score is given to the unit analysis

The coding sheet was used by the researcher to code the occurrence of unit analysis from the science textbook based on the NOS aspects. The results of the analysis of the science textbook on the coding sheet can be seen in appendix A.1 and Appendix A.2. The score was also given to the unit analysis. The scoring was using the scoring rubric adopted by Abd-El-Khalick et al. (2008). After the score was given to all unit analyses, the amount of the score occurrence was categorized to know the portion of how the NOS was addressed in the science textbook.

3.7 Data Analysis Technique

The data need to be analyzed by the researcher in order to reach the objectives of the research. Data analysis is a process to find and modelling the data systematically in order to inform the result of the data to others. Data analysis means an effort done through working with the data, organizing the data, sorting the data out into manageable units, synthesizing the data, finding the pattern, finding what is important and what is learned, and deciding what to tell to others (Bogdan & Biklen, 1982). The data analysis used in this study is an interactive analysis model according to Miles et al. (2013) described as follows.

Figure 3.1 Interactive Model of Data Analysis Techniques



(Miles, Huberman, and Saldana, 2013)

a. Data Reduction

The data obtained in the research process are complex and complicated because the data keep adding the more the researcher does the research. Therefore, the researcher needs to carry out the data reduction. In data reduction, the researcher was summarized, chose the main points, focused on the important things, and looked for patterns.

b. Data Display

The data that had been reduced were displayed to make the data easy to

understand. In the data display stage, the data were presented in the graph, table, and narrative form to describe the findings from the overall analysis of the junior high school science textbook of curriculum 2013 and curriculum Merdeka.

c. Conclusions Drawing/Verification

The data display that has been described by the table and narrative form in the previous stage were arranged as a credible conclusion which supported by the solid data. The conclusion was presented in the narrative form along with the statement according to the final result of the research.

The analysis of nature of science aspects was through analyzing the text from science textbook and taking the sentence(s) or paragraph(s) that represent the nature of science aspects. The scoring rubric that was used to analyze the text that represents the NOS aspects in a science textbook was adopted from Abd-El-Khalick et al. (2008) as seen in Table 3.3.

Table 3.3 Scoring Rubric for NOS Representation in the Science Textbook

Score	Representation of Target NOS Aspect	Indicator
3	Explicit, informed, and consistent	Explicit statements that convey an informed representation Consistency across the selected chapters or sections in addressing the target NOS aspect Consistency in addressing other directly related NOS aspect (Representations could include supporting materials, such as accurate historical vignettes or other examples.)
2	Explicit, partially informed	Explicit statements that convey an informed, but incomplete representation, and Consistency across the selected chapters or sections in representing the target NOS aspect (Representations could include supporting materials, such as accurate historical vignettes or other examples.)
1	Implicit, informed, and consistent	An informed representation of the target NOS aspect could be inferred from the textbook materials Absence of other explicit or implicit messages that are inconsistent with the inferred implicit representation.

Score	Representation of Target NOS Aspect	Indicator
0	Aspect not addressed	No explicit or implicit treatment of the target NOS aspect Not enough materials to make an informed judgment or to convey to the textbook reader a sense about the target aspect of NOS one way or the other
-1	Implicit, misrepresentation	Implicit misrepresentation of the target of NOS could be inferred from the textbook materials in naïve statements
-2	Mixed explicit and/ or implicit	Implicit, informed representations that could be inferred from some parts of the textbook materials are countered by explicit, naïve statements in other parts, or Explicit statements that convey conflicting messages about the same NOS aspect
-3	Explicit, naïve	Explicit statement or statement(s) that clearly communicate a naïve representation of the target NOS aspect

(Fouad Abd-El-Khalick et al., 2008)

The scoring rubric used in this study significantly builds on a distinction between explicit and implicit attention to NOS aspects in the analyzed textbooks. All of the data of each aspect of NOS taken from the junior high school science textbook will be classified based on categories of the scoring rubric. The scoring rubric was intended to analyze the representation of each NOS aspect in each topic based on how it was represented, whether in an informed or naïve way, as well as the manner in which explicitly or implicitly, and consistent or inconsistent.

The score of NOS content included in one type of junior high school science textbook was accumulated in each topic to know the difference between NOS aspects contained in the science textbook of curriculum 2013 and curriculum Merdeka. The possible cumulative score for a textbook could range from -30 to +30 points with 10 NOS aspect targeted in the analysis. In content analysis, the data analysis process usually involves statistical analysis to figure out the characteristics of the data. The composition in each aspect among the ten NOS aspects needs to break down to know its differences between the science textbook of curriculum 2013 and curriculum Merdeka. According to Fraenkel et al. (2017), the common ways to interpret the data in content analysis are using frequency, percentage, and

proportion. In this research, the researcher was calculated the percentage of each NOS aspect consist in both of science textbooks of curriculum 2013 and curriculum Merdeka using the equation as seen below:

$$\% \text{ of NOS aspect} = \frac{number\ of\ NOS\ representation\ occur\ in\ one\ aspect}{total\ of\ NOS\ representations\ occur\ in\ all\ aspects} \times 100$$

3.8 Data Reliability Test

The data obtained in the process of research must be reliable so that the researcher's effort to gain the data can be accounted for in all the aspects. The data or findings can be valid if there is no difference between the data reported by the researcher and the reality occurs on the object of the study (Sugiyono, 2017). In this study, the interrater agreement will be used to measure the agreement between subjective ratings by multiple raters.

In this research, there were three raters who rated the result of the data. Fleiss' Kappa used to measure for assessing the reliability agreement between more than two raters when assigning categorical ratings to a classifying of items. According to (Fleiss, 1971), although there are a fixed number of raters (e.g., three), different items may be rated by different individuals. The Fleiss' Kappa coefficient is formulated as follows:

$$\kappa = \frac{(Po - Pe)}{(1 - Pe)}$$

Where:

κ = Fleiss's kappa coefficient

Po = Observed agreement

Pe = Expected agreement

The interpretation of the Coefficient Kappa values shows the reliability of this research. According to (Landis & Koch, 1977), the value of coefficient kappa is reliable between 0.61-1.00, so the result can be valid. The interpretation of kappa values reliability suggested by Landis and Koch (1977) can be seen in table 3.4.

Table 3.4 The Interpretation of Kappa Values

Kappa	Interpretation
<0.00	Poor
0.00 - 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0. 80	Substantial
0.81 – 1.00	Almost Perfect

(Landis & Koch, 1977)

3.9 Research Procedure

The research is conducted in systematic arrangement. The procedure of this research is consisted of three stages, which are preparation stage, implementation stage, and completion stage.

a. Preparation Stage

1) Identify the problems and objectives of the research
2) Review the literature which related to the research
3) Constructing the research instrument

b. Implementation Stage

1) Observing the contents of the science textbook.
2) Writing down the text from science textbook that represent nature of science aspect.
3) Analyzing the text that represent nature of science aspects in the science textbook that used curriculum 2013 and curriculum Merdeka by giving the score to the unit analysis in each topic.
4) Testing the reliability of data using the interrater agreement.
5) Calculating the percentage of each aspect of nature of science that appear from the science textbook in curriculum curriculum 2013 and curriculum Merdeka.
6) Find the differences between the science textbook that used curriculum 2013

and curriculum Merdeka based on NOS content.

7) Report and discussing with the supervisors.

c. Completion Stage

1) Analyze the final result of science textbook analysis based on nature of science.
2) Obtaining the result and discussion.
3) Make conclusions from the result of data analysis.
4) Finalize the report of research.

A flowchart procedure is made to describe how the flow of the study is conducted. The flowchart can be seen at Figure 3.2 as follows:

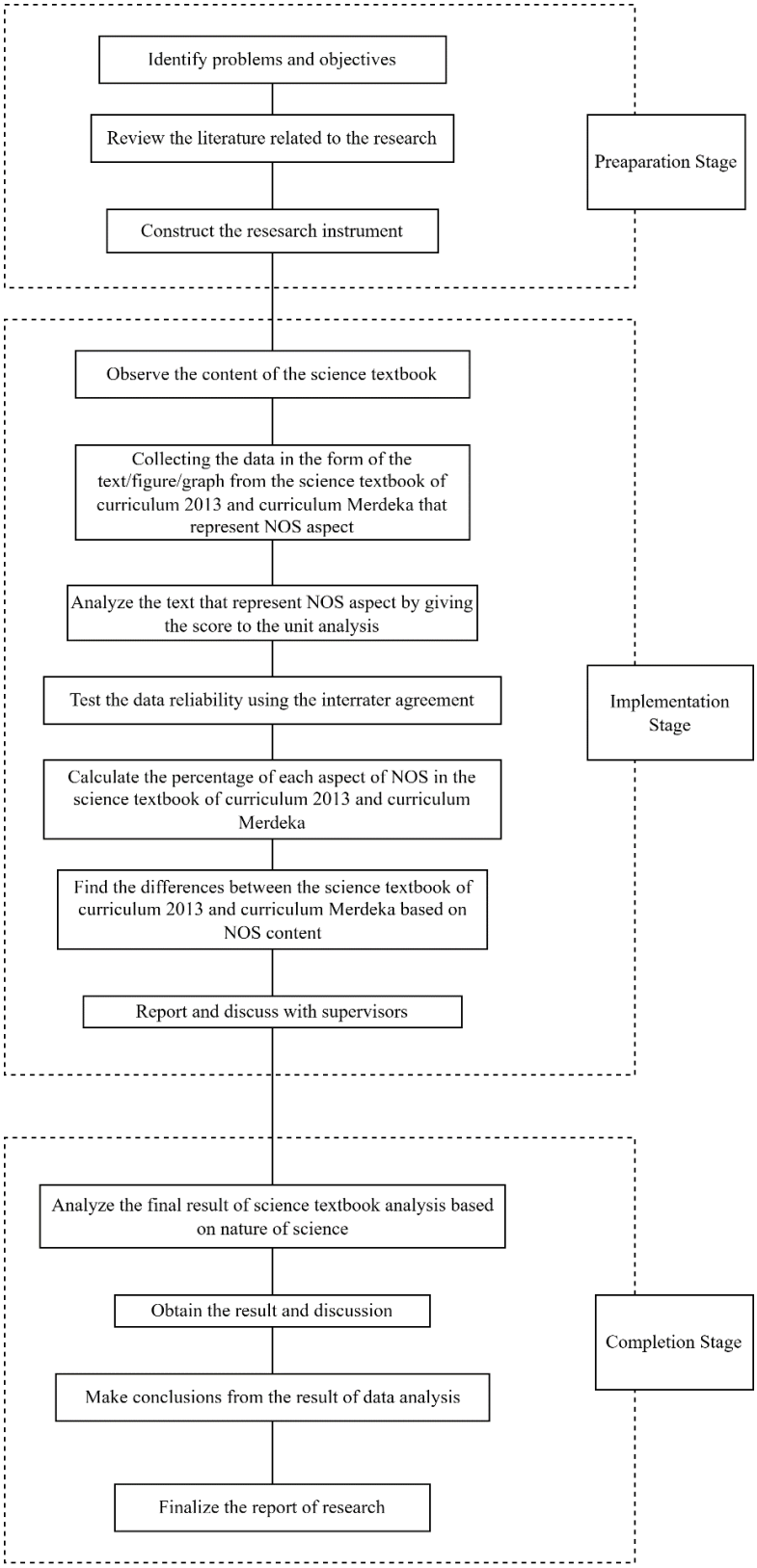


Figure 3.2 Flowchart of Research Procedure