CHAPTER III
METHODOLOGY

This chapter provides a delineation of the research methodology of the present study. The first discussion as shown in Section 3.1 starts with describing the research design which was used in the study. It is then followed by a description of the source of data and data in Section 3.2, research technique in Section 3.3 and research instruments in Section 3.4.

3.1 Research design

The study employed a qualitative approach to seek types of knowledge which are constructed in chemistry textbooks in Indonesian secondary education context through an analysis of SFL discourse semantic resources. The study considered the knowledge or field types as the central phenomenon which requires exploration and understanding (Creswell, 2011; see also Croker, 2009; Edmonds & Kennedy, 2010). Considering the nature of target phenomena (e.g., types of knowledge or field), this study follows Croker (2009, p. 10) who stated that "qualitative research also requires you … to see links and patterns in the data, and to build these into themes". Therefore, qualitative research enables the writer to identify 'themes' in Crokers' term or the types of knowledge in the present study by looking at the linguistics pattern of the texts or the ways of building knowledge.

In terms of qualitative approach designs, the study has a similar characteristic to a case study. A case study has a purpose to present a deep and detailed picture of a particular phenomenon within its context (Duff, 2008; Yin, 2003). In this study, the phenomenon is a type of knowledge or field in chemistry textbooks in Indonesian secondary education context. A qualitative case study also involves a textual analysis (Freebody, 2003; Travers, 2001). This study thus used a detailed discourse semantic analysis of a small text to get a clear picture of such a phenomenon. The detailed analysis of discourse semantics of individual texts enables the exploration of multiple

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aspects of meaning which are realised dynamically across grammatical choice or discourse semantic choice such as taxonomy and activity sequences. Therefore, the close analysis of whole texts can shed light into the description of the logogenesis of the discourse, that is, how language evolves progressively throughout a text (Martin & Rose, 2007).

3.2 Source of data and data

This section provides information about source of data and data which are used in the present study.

3.2.1 Source of data

For achieving the purpose of the current study, a set of data, that is, chemistry pedagogic texts for junior high school and senior high school in Indonesian education context was selected. The pedagogic texts include science textbooks for junior high school students and chemistry textbooks for senior high school students. The rationale for the selection of those textbooks as data is two-fold. First, textbooks play a role in providing teaching materials and guidelines for teachers' classroom teaching in Indonesian secondary education contexts and making science accessible for learners. Second, as Bernstein points out, textbooks have become a bridge between knowledge production by scientists and knowledge production in classrooms. Therefore, the analysis of knowledge building in textbooks will make textbooks knowledge more accessible to learners.

3.2.2 Data

The science textbook is written by Wahono Widodo, Fida Rachmadiarti, and Siti Nurul Hidayati while the chemistry textbook is written by Suwardi, Subiyanto, and Th. Eka widiasih. The information related to the data is presented in Table 3.1. Both of these books contain the descriptions and explanations of acid and base, which were a focus of the present study. Following Drechsler and Schmidt (2005), the study assumes that the concept of acid and base is central for chemistry subject since it is the basic principles of chemistry curricula. Besides, the chapters are assumed to represent

chemistry knowledge building in Indonesian secondary education level. Therefore, the topic of acid and base was purposively chosen to be analysed in the current study.

Table 3.1
The information of the pedagogic texts or textbooks used as data

Writer(s)	Level of Education	Title	Year	Chapter	Word count
Wahono Widodo, Fida Rachmadiarti, and Siti Nurul Hidayati	year 7 or secondary 1	*Ilmu Pengetahuan Alam*	2017	1	940
Suwardi, Soebiyanto, and Th. Eka Widiasih	year 11 or secondary 5	*Panduan Pembelajaran Kimia XI: Untuk SMA & MA*	2009	2	3040

3.3 Research technique

This section presents the descriptions of data collecting technique and data analysis used in the study.

3.3.1 Data collecting technique

The present study relied on available information on the internet. In this case, the available information is school textbooks provided by the government. In an Indonesian education context, the textbooks are known as *Buku Sekolah Elektronik (BSE).* They are provided by the Indonesian government. The pedagogic texts are available on the internet. Therefore, they can be downloaded easily through various sites. The internet search such as google can be used to download books.

3.3.2 Data analysis

To be able to construe knowledge or field instantiated in the pedagogic texts, the data were analysed in stages using discourse semantic analytical tools (Martin & Rose, 2007, 2008) which are developed in Systemic Functional Linguistics. Following Martin (1992; Martin & Rose, 2007), the analysis of each stage focused on the elements of IDEATION, including taxonomic relation and activity sequence in language, image, and chemical symbols. Therefore, there would be four stages in analysing data. In

order, the stages include the analyses of language, images, and chemical symbols to find out the patterns which construe fields or knowledge instantiated in the pedagogic texts.

The first stage focused on analysing language. This stage consisted of several steps. First, clause complexes were identified prior to the analysis. It was then followed by breaking down texts into clause simplexes, following Halliday and Matthiessen (2004, 2014). Then, the clauses were put them into the table as shown below to be analysed and numbered. The next step was analyses of grammatical choice by investigating transitivity. It was then followed by identifying discourse semantic choice, including taxonomy and activity sequences. The taxonomic relations were identified by investigating at entities used in the texts and dimensionality of entity (see Hao, 2015; Hao & Humphrey, 2019). Meanwhile, the activity sequences were identified by investigating figure and connexion, as suggested by Hao (2015) and Martin (1992; Martin & Rose, 2007). The findings were further interpreted with reference to Legitimation Code theory (Maton, 2014; See also Martin & Christie, 2007; Christie & Maton, 2011).

The second stage focused on analysing images. The images were analysed with reference to Kress and van Leuween's (2006) and Martin and Rose's (2008) works. The analyses of images started with identifying processes and participants involved in the images, as suggested by Kress and van Leuween (2006). It was then followed by determining entity and activity in images as it did in language. The next step was categorised the images in terms of phenomena focus. This category is construed through either entity or activity. In addition, the analyses focused upon the meanings of the images which can be explicitly or implicitly identified and their representation, that is, iconic, indexical, or symbolic images.

The third stage focused on analysing chemical symbolisms. In this stage, the chemical reactions and symbolisms were analysed with reference to Liu's (2009; Liu & Taber, 2016) works. The analyses of chemical reactions started with identifying elements of reactions. It was then followed by determining activity by investigating the

process and figure represented symbolically through chemical reactions. The last step was to interpret the findings.

The last stage was determined the level of readability of textbooks. In this stage, the level of readability was checked online. The pedagogic texts were inserted into software. The software would check the data automatically and showed the results. These results were then identified and interpreted with reference to the indicator or level of readability. It was then followed by the interpretation with reference to LCT's semantic concept.

3.4 Research instrument

This section presents the information of data collecting instrument and the instrument of data analysis used in the present study.

3.4.1 Data collecting Instrument

As mentioned previously in data collecting technique, the present study employed available information, that is, textbooks provided by the government from the internet. Therefore, to collect the data, the present study used checklist documents as shown in Table 3.2 and data compilation forms which are commonly used for document analysis.

3.4.2 Data analysis Instrument

This study used tables available in Ms. Excel to analyse data and to make the calculation of occurrences. By doing this, the simple statistic such as total number and percentage are possible to present in this study. In addition, the use of the table makes the analytical process easier. The study used the following formats to analyse data.

Table 3.2
Checklist Document

Criteria	Yes	No
Texts contains description of acid and base		
Texts contains explanation of acid and base		
Texts contains images		
Text contains chemical symbols		

Table 3.3
Form to analyse discourse semantic resources in language

NO	CLAUSES	ENTITY									FIGURE			SEQUENCE
		Things		Activity		Place	Time	Semiotic	Source		Pos/Dim.	State	Event	
		Obs.	Ins.	Enacted.	Obs.				Peo.	Pub.				
1.														
2.														
…														
	Total													

Table 3.4
Form to analyse discourse semantic resources in language

No	Images	Ideational Elements		
		Phenomena Focus	Categories	Representation
1.		Classifying	Simple	Iconic
2.				