

CHAPTER I

INTRODUCTION

This chapter presents an introductory section of the present study. It covers the background of the study, research questions, aims of the study, significance of the study, limitation of the present study, and the organisation of the thesis.

1.1 Background of the study

Knowledge building has gained more interest among researchers in the fields of language and education. In the educational field, for instance, a growing body of research on knowledge building has been conducted by using various theoretical backgrounds such as cognitive and socio-cultural accounts. From cognitive accounts (e.g., Piaget, 1969; Schank & Abelson, 1977), knowledge building is closely related to the understanding of the concepts represented in long terms memory which are organised by taxonomic systems of categories, scripts, prototypes, and other schemes. The cognitive approach focuses upon how learners develop resources such as scripts, schemes, framework, and mental strategies to learn from engaging with material or symbolic tools (Piaget, 1969; Prain & Tytler, 2012). In other words, from this perspective, knowledge is constructed at the individual level (Hand, 2004).

Most studies in science education in general (and in chemistry education in particular) tend to adopt cognitive approaches to knowledge (e.g., Sawyer, 2014). Those studies focus on how students frame and conceptualise knowledge (e.g., Demircioğlu et al., 2005; Drechsler & Schmidt, 2005). Such educational research in science tends to emphasise the concepts related to knowledge rather than on the knowledge itself (Doran, 2018; Zhao, 2012) or tends to reduce knowledge to knowing and knower (Maton, 2014). As a result, the research tradition often obscures how knowledge is constructed or structured in a discipline in general (Doran, 2018; Maton, 2014). This “knowledge-blindness” fails to formulate the structuring principles of knowledge which need to be taught to students so that they can be successful in schools (Doran, 2018, p. 3).

On the other hand, some studies have proved that sociocultural approaches seem to be powerful in building knowledge in science. Within this perspective, knowledge is gained through participation in authentic activities (see Murphy & Iverson, 2003; Prain & Tytler, 2012). This approach focuses on learners' participation in authentic activities with material or cultural/symbolic tools such as writing, algebra, and diagram to learn effectively (Vygotsky, 1981) to become skilful in the diverse reasoning practices in science (Ford & Forman, 2006). In other words, learners should learn how to switch among mathematical, visual, and written language and organise the resources to test and justify scientific knowledge (Tytler et al., 2013). From this perspective, written language together with other semiotic resources can be valuable for various aspects of science literacy (Prain, 2006) as well as knowledge building. Therefore, it can be said here that the specialised knowledge of science can be identified by analysing contemporary instances of textually scientific examples through investigating specific resources (Tytler et al., 2013).

This idea has been further developed by the researchers working in Systemic Functional Linguistic tradition (hereafter SFL; see Doran 2016, 2018; Hao, 2015). SFL scholars interpret knowledge from a linguistic perspective. They assume that knowledge is encoded in language. Halliday (2004, p. 25) describes that “all forms of human knowledge are capable of being construed as text. Knowledge is prototypically made of language”. In similar veins, Halliday (2007) also states that knowledge is not something which is mediated through language, but it is made of language. Therefore, SFL offers a theoretical framework for exploring the discursive construction of knowledge through language and other semiotic resources. In this framework, the construction of knowledge is associated with one of the register variables, that is, field since it concerns with what is going on or activity sequences.

Research on knowledge building in science from linguistic perspectives has been conducted by researchers. To mention some of them, Hao (2015, 2018) investigated knowledge building in undergraduate biology. She was able to identify various specialised fields or practical knowledge projected in this area. Meanwhile, Doran (2017, 2018) and Zhao (2012) focused on physic discourse. Doran showed

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that knowledge in physics is built through mathematics, writings, and images. Zhao focused on building knowledge through images and writings in physics textbooks in primary and secondary education. He found that language and images used in the texts become more complex across three levels of physics books. In the chemistry field, Liu (2009, 2011) investigated chemistry discourse by focusing on verbal and multimodal representations to construe experimental meanings.

Some studies have focused on analysing scientific knowledge in pedagogic texts or textbooks. These studies assume that textbooks are pedagogic devices to apprentice students into the science world (Koulaidis & Dimopoulos, 2007). In other words, textbooks are resources to understand scientific phenomena and guide students to be able to manipulate the substance of scientific knowledge which is commonly stated in Science curriculum guidelines published by the ministries of education. At school, the world of science is manifested in textbooks which are used by teachers and students. Commonly, teachers will use them as resources for teaching and students will use them as guidance to conduct experiments and resources to understand how to solve the scientific problems found at the end of each chapter (Souque, 1987). Thus, research in this area stresses on investigating the content of science such as facts, laws, and theories and scientific practices in textbooks. This argument shows that knowledge of science can be traced and understood by analysing school textbooks, particularly focusing on the analysis of their language and other semiotic resources. Some studies (e.g. Koulaidis et al., 2002; Dimopoulos et al., 2003; Koulaidis & Dimopoulos, 2007; Milanovic et al., 2015) have investigated how scientific knowledge is constructed in school science textbooks of primary and secondary schools through written language and other semiotic resources. They found that scientific knowledge is recontextualised through various strategies.

Regarding the background above, this study attempts to investigate knowledge building to add to the existing studies on textbooks particularly chemistry textbooks used in an Indonesian secondary education context.

1.2 Research question(s)

It should be noted again here that the concept of knowledge in this thesis refers to the field in SFL tradition. The current study is geared towards answering the following research questions:

- 1) What types of knowledge are constructed in chemistry textbooks in an Indonesian secondary education context?
- 2) How are the types of knowledge constructed in chemistry textbooks in an Indonesian secondary education context?
- 3) To what extent is the level of readability of knowledge constructed in chemistry textbooks in an Indonesian secondary education context?

1.3 The purposes of the study

The purposes that want to be achieved by the present study are as follows:

- 1) To examine types of knowledge which are constructed in chemistry textbooks in an Indonesian secondary education context.
- 2) To investigate how the types of knowledge are constructed in chemistry textbooks in an Indonesian secondary education context.
- 3) To investigate the level of readability of knowledge constructed in chemistry textbooks in an Indonesian secondary education context.

1.4 Significance of the study

This thesis makes a number of contributions in terms of theoretical and practical contributions. Theoretically, it contributes specifically to the literature of ideational discourse semantics. By focusing on exploring knowledge building in chemistry textbooks in an Indonesian secondary education context, this study provides a further understanding of knowledge building in chemistry from multimodal perspectives. Specifically, this study presents the construal of the chemistry knowledge in junior and senior textbooks in an Indonesian secondary education context. In terms of practical contributions, the findings in this study have potential pedagogic implications for teaching science, particularly chemistry subject. The analysis of knowledge building in textbooks will make textbooks knowledge more accessible to teachers and learners.

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1.5 Limitation of the study

The present study focuses on investigating the construal of knowledge or field in chemistry in an Indonesian secondary education context. Specifically, it focuses on identifying knowledge or field types and the ways of building knowledge limited in written language or texts, images, and chemical symbolisms, although there are mathematical resources in the texts. Therefore, the analyses of mathematical recourses and chemistry diagrams (see Liu, 2011) are beyond the scope of the present study.

1.6 Definition of terms

This section presents a brief description of the term used in the present study to avoid misunderstanding. The following terms are as follows.

1) Knowledge

In the study, the concept of knowledge will be associated with the ones discussed in SFL and Indonesian science Curriculum. Linguistically, the concept of knowledge refers to the field in SFL. Field is defined as a set of activities determining global institutional purposes including a local domestic and broader societal institution. Martin then divided field into four types of fields including domestic, specialised, administration, and exploration (1992; Martin & Rose, 2008). In the Indonesian science curriculum, the concept of knowledge is divided into several types of knowledge that should be mastered by students such as conceptual and procedural knowledge. This knowledge is reflected in *Kompetensi Inti (KI)*.

2) Textbooks

The definition of textbooks in this thesis refers to the definition in Collins dictionary. Textbooks here are defined as the books containing facts about a particular subject that is used by people studying that subject.

3) Legitimation code theory

LCT is a sociological framework which investigates the underlying principles that generate different forms of knowledge practices. LCT research has particularly concentrated on how different legitimation codes enable knowledge-building (see Maton, 2014).

4) Systemic Functional Linguistics

SFL is a school of linguistics which is established by M.A.K. Halliday. This school emphasis on the meaning in context. Thus, SFL focuses on investigating and explaining the language in terms of the context of culture and context of situation.

1.7 Organisation of the thesis

This thesis is organised into five chapters. The following points are the description of each chapter.

- 1) Chapter I presents the background of the present study. It is then followed by the research questions which frame the study and the aims of the study. Besides, this chapter also presents significance of the study, limitation of the study, definition of terms and the organisation of the thesis.
- 2) Chapter II provides a review of literature which is used as a point of departure for the analysis. It covers the discussion of Systemic Functional Linguistics including context: genre and register, instantiation in SFL, field in SFL, discourse semantic resources, and transitivity as grammatical resources. It also presents the description of Systemic Functional Multimodal Discourse Analysis (SF-MDA) for visual images and chemical symbolisms, the review of knowledge concept including definition, Bernstein's knowledge structure, and Legitimation Code Theory's (LCT) semantics. This chapter ends with the description of textbooks together with their level of readability and previous studies.
- 3) Chapter III presents a research design which is used in the current study. It also informs source of data and data, research techniques, and research instruments.
- 4) Chapter IV reports the findings and their discussion. It presents the detailed descriptions of types of knowledge instantiated in the pedagogic texts, ways of building knowledge of fields in written language or texts, images, and chemical symbolisms. Besides, this chapter provides a description of the level of readability of textbooks under investigation.

- 5) Chapter V presents the conclusions and suggestions. Specifically, this chapter presents a summary of the findings which have presented in Chapter IV and provides some suggestion for future studies.