CHAPTER I
INTRODUCTION

This chapter presents an introductory part of this paper, which covers background, the scope of the study, research questions, aims of study, research method, classification of terms, and organization of the paper.

1.1 Background

Science is communicated using different modes. The modes in science can be in the form of verbal and visual modes. Science, especially those taught in Indonesia usually refers to four learning subjects, which are Mathematics, Physics, Chemistry, and Biology. Those four subjects are usually communicated using verbal and visual modes. The use of visual modes such as photographs, diagrams, etc., has been part of science for many years (Evagorou, Erduran & Mäntylä, 2015). They had become representations with a technical function in the scientific subject (Kress & Van Leeuwen, 2006). Therefore, as Lemke (1998) said, science is not only communicated through verbal modes alone, but it is a semiotics hybrid in which simultaneously and essentially combines verbal (typological) and mathematical (graphical) modes.

People in general and students in particular often consider science as a subject that is difficult to learn. The reason might be because high cognitive skills are needed to understand the scientific concept and to apply the knowledge to answer questions in abstract situations. Johnstone (1991) also confirms that science was used to be easy to learn and teach before modern scientific advancements. Thus, scientists use visualization to interact with the complex scientific phenomenon (Richards, 2003). The use of visual modes was also aimed to enable the scientists to convey important scientific evidence that cannot be observed in other ways (Evagorou, Erduran & Mäntylä, 2015).

There are studies that have investigated the use of visual modes in science communication. For example, Mogull & Stanfield (2015) identifies the frequency of visual modes of such as graphs, diagrams are “high-use” inscriptions in science, while photographs and instrument output are “medium-use” inscriptions in. Other studies

also show that in teaching science, the use of visual modes has greater benefits for the learners than using verbal modes (Evagorou, Erduran & Mäntylä, 2015; Bobek, 2016).

In understanding complex scientific concepts, it is necessary to use a particular learning media that can help the learners to have better comprehension. One of the learning media that can be used is the textbook. Lexically, textbook can be defined as a book that teaches a particular subject used in learning institutions such as school and college. Other than that, textbook can also be defined as an instructional material which consists of content and material of the subject that is well organized in written form and has a great contribution in teaching and learning process (Yulianti, 2011, as cited in Rynanta & Ruslan, 2013). Despite the rapid advances in technology, textbook has been considered one of the learning media that have a great influence on the learners' comprehension. It is because textbook has an important role and provide useful resources for both the educator and the learners (Richards, 2001). Therefore, the use of images in science textbooks can help learners have a better understanding of the materials.

Studies have been conducted to investigate the use of images in science textbooks. The studies identify the types of images used in communicating the scientific concept of the textbook. Dimopolous et al (2003) investigate the use of visual images in school science textbook and press articles about science and technology. One of their findings shows that science textbook uses ten times more images in order to familiarize the learners with specialized scientific content. Bungum (2008) also explores the changing character of visual images in Norwegian physics textbooks. Other than that, a recent study also conducted to investigate the ideational meaning of science by analyzing the types of images used in Indonesian science textbooks for grade 7,8,9 based on two curricula, which are KTSP 2006 and Kurikulum 2013 (Hermawan & Rahyono, 2019).

The images presented in the science textbook often accompanied by captions. They can be said as an inseparable part of the images presented in the textbook. Captions are the accompanying textual descriptions of images (Kim, 2010). They can be used to give more information about the images to the learners. Many studies have been conducted in analyzing the use of captions. Srihari (1995) conducted an early

work on connecting the information between photographs in a newspaper and the caption (as cited in Divoli, Wooldridge & Hearst, 2010). Other than that, the use of captions is also being analyzed in biomedical fields to discover the role of captions in describing the detailed experimental results portrayed through the images (Kim, Lamkint & Dunkant, 2010).

The studies on analyzing the use of images in the textbook have provided sufficient insights on how the images communicating the science. However, there is an urgency to discover the role of images used in the science textbook and the relation between the images and the captions accompanying them. Therefore, this study seeks to discover the types of images that are frequently used in a science textbook to communicate the scientific concept. The focus of this study is to investigate the images and the captions accompanying them, this study, then employs multimodal analysis as the procedure of the research.

1.2 Research Questions

The present study investigated the use of images and how they are ideationally related to the verbal text in the form of captions in the Chemistry textbook. The present study is geared towards answering the following research questions:

1. What types of images are used in the textbook?
2. What types of process do the pictures use to communicate the science in the textbook?
3. How do the pictures ideationally interact with their captions in communicating the science?

1.3 Purposes of Study

In relation to the research questions, the study aims to find the types of images that are used in the textbook and to discover the types of process that the pictures use to communicate science in the textbook. Other than that, this study investigates the ideational relation between the pictures and the verbal caption accompanying the pictures in communicating the science.

1.4 Scope of Study

This study investigated science textbook. For the purpose of this study, the science textbook that is used is a Chemistry textbook used by the students majoring in International Program in Science Education (IPSE) at UPI, as one of their learning sources. Specifically, this study investigates the images used in the Chemistry textbook and the captions that accompanying the images. The focus of this study is to investigate the visual and verbal modes of the textbook. For the visual modes, the analysis is limited only to find the types of images and the process used by the images in communicating the science. To achieve this, visual transitivity system based on theory of reading images proposed by Kress & Van Leeuwen (2006) has been used. Meanwhile, the analysis of the verbal modes is limited only to investigate the captions that accompanying the images. The verbal mode of the captions is analyzed using verbal transitivity based on Halliday's (1994) systemic functional grammar. The result of verbal and visual analysis is used as a base to uncover the ideational relation between the two modes. Additionally, multimodal analysis is conducted to find the relation between the images and the captions accompanying them in communicating the science.

1.5 Significance of the study

Theoretically, this study is expected to give new insight on multimodal analysis in the use of images presented in textbooks, specifically in a science textbook. For the society in general, the result of this research is expected to give new insights to the textbook's writers so that they can compose visual and verbal modes to communicate science effectively.

1.6 Clarification of Terms

There are several terms in this study that are important to define in order to avoid misunderstandings. The terms are as follows:

- **Science**

  Science can be defined as the observation, identification, description, experimental investigation, and theoretical explanation of natural phenomena (Wilson, 2009)

- **Textbook**

  Textbook is an instructional material which consists of content and material of the subject that is well organized in written form and has a great contribution in teaching and learning process (Yulianti, 2011, as cited in Rynanta & Ruslan, 2013).

- **Multimodality**

  The use of several semiotic modes in the design of a semiotic product or event, together with the particular way in which these modes are combined (Kress & Van Leeuwen, 2001).

- **Visual Grammar**

  A general grammar of contemporary visual design which describes the way on which depicted elements – people, places and things – combine in visual 'statements' of greater or lesser complexity and extension (Kress & Van Leeuwen, 2006).

- **Systemic Functional Grammar**

  A theory of language which is concerned with the function of linguistic structures in the text and how people choose those structures to make meaning in the given context of culture and situation (Emilia, 2014)

- **Verbal Transitivity**

  An analysis that offers a description of one of the structural strands of the clause, which can make clear how the action is performed, by whom and on what, and also emphasize the content of the language (Eggins, 2004, as cited in Nurhayati, 2016).

- **Visual Transitivity**

  A type of process which determines how represented participants are labelled, how many of them are involved, and what roles they play (Jamshidzadeh & Jam, 2017)

1.7 Organizational of The Paper

This study consists of five chapters. Each of the chapters presents different information about the idea of this study. The chapters of this study can be described as follows:

CHAPTER I: INTRODUCTION

This chapter consists of the background of the study, the statement of the problems, aims of the study, the scope of the study, the significance of the study, clarification of key terms, and organization of the study.

CHAPTER II: THEORETICAL FRAMEWORK

This chapter provides the theoretical framework used as the basis of the analysis of this study, also the previous studies that are relevant to this study.

CHAPTER III: RESEARCH METHODOLOGY

This chapter contains the explanation of the approach, the procedures and the steps in conducting this study. This chapter also includes the research design, data collection, and data analysis of this study.

CHAPTER IV: FINDINGS AND DISCUSSION

This chapter provides the explanation of the findings of this study. It explains the result of the data analysis based on theory of reading images proposed by Kress & Van Leeuwen (2006). Furthermore, the discussions of the findings are also presented in this chapter.

CHAPTER V: CONCLUSION AND SUGGESTIONS

This last chapter of the study discusses the conclusion and the result of this study based on the findings and discussion section. This chapter also provides the suggestion for further study.