

## A COMPARISON STUDY ON ILLUSTRATIONS OF ELEMENTARY SCIENCE TEXTBOOKS IN KOREA AND USA

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### Abstract

The purpose of this study was to compare the illustrations used in elementary science textbooks of Korea and BSCS in USA, and analyze the types, role, and characteristics of the illustrations. We discussed the desirable direction for using the illustrations in the future science textbooks. For the analysis, we used 8 elementary science textbooks of the 7<sup>th</sup> curriculum of science education in Korea from 3<sup>rd</sup> through 6<sup>th</sup> grade, and 16 volumes (stage 2 to stage 5) used in BSCS in USA. We examined the illustrations' 5 types, including photograph, picture, graphic, cartoon, chart, and their 4 roles such as, motivation, introducing the lesson activity, providing the materials, and presenting the learning result. The results were as follows: First, textbooks in Korea had more illustrations, but Korean textbooks seemed to contain too much information in each illustration. Second, in Korean textbooks, there were less graphics and charts used compared to BSCS. Third, Korean textbooks have more photograph type of illustration than BSCS. Finally, there were many illustrations to describe students working together with the disabled children. Considering the findings in this study, we propose for desirable orientation for illustrations in our elementary science textbooks. First, types of illustration need to be more diverse. Second, the roles of illustration need to act as an effective motivator in a way of stimulating children's thoughts. Finally, when we construct the illustrations, it needs to pay attention to the alienated social class, attempting to consider all of the students.

Key words: science textbooks, illustrations, elementary science, Korea, BSCS

### 1. Introduction

For decades, researches have discussed that science textbooks play a significant roles to enhance the quality of instruction and learning. Given the situation that most teachers heavily rely on the textbook materials, researchers have studied effective ways to support the teachers' and students' instructional activities in the classroom. Among those efforts to develop better ways to help teachers and students effectively use the textbook materials, illustrations in the science textbook have been focused as the meaningful tools to help students' learning activities in terms of students' motivation as well as their scientific understanding.

In this study, we look at and compare the illustrations in Korea and USA science textbook materials at the elementary level. We report the main features and roles of the illustrations, and similarities and differences in the illustration appeared in the textbooks to suggest the effective ways to develop and use the illustrations in the science classrooms.

### 2. Theoretical Background

Many studies have reported both teachers' and students' heavy dependence on science textbooks in their various instructional activities (Abruscato, 1988; Cho & Park, 1987; Han, 1982; Harms & Yager, 1981; Yager, 1984). Teachers show strong inclination to rely on the textbooks in their whole instructional process, including planning lessons, elaborating the activities, classroom teaching practice, formulating and asking questions, and informal/formal evaluation of students' learning. With the textbook, students get motivated to study science, learn the important science knowledge and information, and have guidance to follow science experiments steps.

Given the importance of the textbook use in the science classroom, there have been various efforts to study effective ways to develop high quality textbooks, which can enhance students' scientific understanding and teachers' instructional performance. Those efforts involve studying ways to help students' inquiry activities, apply the instructional models to teach science concepts, and analyze letters, symbols, or various illustrations. We, in this study, particularly focus on illustrations used in science textbooks.

In spite of few researches done on the area of illustration in science textbooks, several studies have found out students' perceptions of illustrations in various formats in science textbooks. Myatte and Carter (1979) found that students tend to like the photographs most and illustrations, which include the real images. They also discussed that students hardly like the exclusive use of few illustrations. Instead, they suggested the use of the various illustrations

would be helpful for their motivation to study the ideas in the textbook. Kim(1998) found that textbook illustrations tend to make less relevance to students' interests in science than their developmental level and content difficulties. The study concludes that as a result, their science learning with the illustrations was not effective due to their negative evaluation.

Several researchers studied the role of the illustration in science textbooks (Duchastel, 1983; Park, 1993). Duchastel (1983) discussed that illustrations in textbooks need to be selected and used through careful decision-making process, which avoids simply listing the pictures and illustrations. He pointed out the importance of considering the connection between what to teach and how/where to use the illustrations. Duchastel also analyzed the three roles of illustrations: attentive role, explicative role, and retention role. Attentive role means that illustrations help students feel attractive and motivated to learn through interesting drawings and pictures. Explicative role involves the illustrations' explanation about the important content by including the core information to deliver for students. Retention role includes that students tend to remember the important information they learned when they use images or drawings, than languages or writings as a form of text.

From different perspective, Park (1993) also studied the role of illustrations in science textbooks. He discussed four particular roles: motivating students, guiding classroom activities, providing students with information about inaccessible learning objects, and providing results of the difficult science experiments.

In this study, we compare two sets of elementary science textbooks in order to better understand the major features, types, and roles of illustrations. To meet our purpose to know the features of the illustrations used and suggest the important role of the illustrations for the future science textbooks, we particularly compared Korea textbook and BSCS in USA, which reflect the national reform goals in science education in each country.

### 3. Research Questions

The detailed research questions are as follows:

1. What are the types and roles of illustrations in Korea and USA elementary textbooks in the different grade level and?
2. What are the major features of illustrations in the two textbooks in the different grade level?

### 4. Research Methods

#### 4.1. Selecting Textbooks

For this study, we chose and compared Korea and USA textbooks, because each textbook material describe that they reflect the national reform goals from each country. We were interested in investigating how those textbooks from each country address the goals of the national reform, particularly looking at their illustrations. For Korea, national level textbook was selected, since it was developed by the national curriculum committee, which plays a single role to lead the science curriculum decision at the elementary level. For USA, BSCS Science T.R.A.C.S. (BSCS, 2004) was selected for the study, since BSCS was considered as one of the good quality textbook materials, based on USA national curriculum standards (BSCS, 2004).

#### 4.2. The Data Analysis

To compare the illustrations used in elementary science textbooks of Korea and BSCS in USA, we analyzed the types, role, and characteristics of the illustrations. We used 8 elementary science textbooks of the 7<sup>th</sup> curriculum of science education in Korea from 3<sup>rd</sup> through 6<sup>th</sup> grade, and 16 volumes (stage 2 to stage 5) used in BSCS in USA.

We particularly used Choi (2002)'s methods to analyze the illustrations. Firstly, we examined the illustrations' 5 types, including photograph, picture, graphic, cartoon, chart. Secondly, we looked at their 4 roles, such as motivation, introducing the lesson activity, providing materials, presenting the learning result.

### 5. Results

#### 5.1. Comparisons of the types of illustrations

The types of illustrations in Korean science textbook and BSCS were compared by grade level. Figure 1 shows the percentage of each type of illustrations in Korean science textbooks. It shows that the photographs have the most frequent types of illustrations of Korean textbooks. Cartoons are the second major type, and pictures are the third major type of illustrations. Graphics and charts had few percentages.

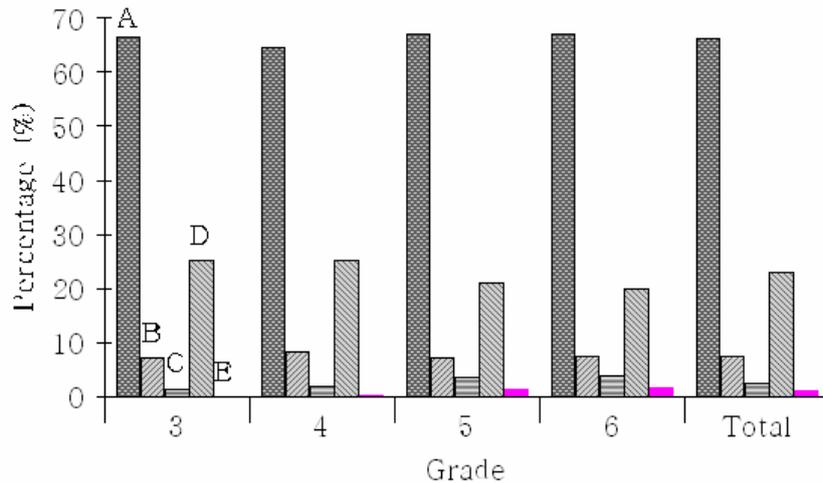


Figure 1. Types of illustrations of Korean science textbook (A: photograph, B: picture, C: graphic, D: cartoon, E: chart)

Figure 2 shows the percentages of each type of illustrations of BSCS textbook. Different from Korean textbook, BSCS contains the pictures most in grade 3, 4, and 6, except for grade 5. The photograph and cartoon are the next frequent illustration. In grade 5, the order of photograph and picture appeared changed. It seems that this change in order happens in the case of the real illustration. Graphics and charts were used in low rates, because it seems that it might be difficult for young students to use them.

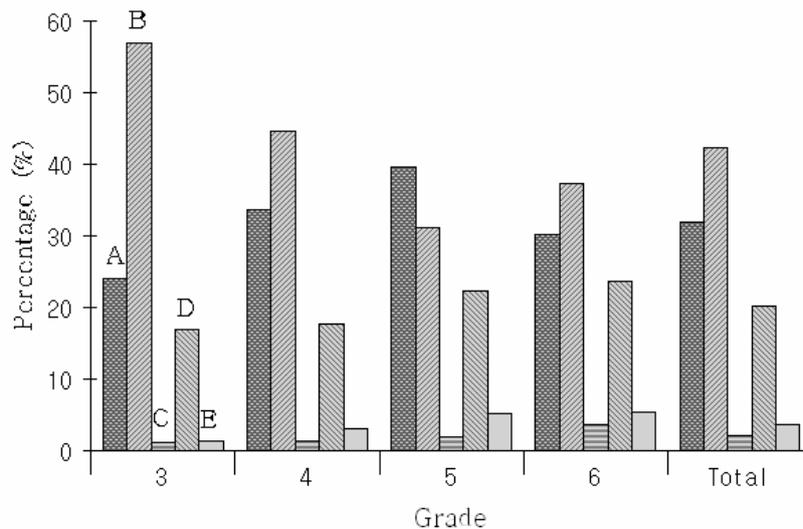


Figure 2. Types of illustrations of BSCS science textbook (A: photograph, B: picture, C: graphic, D: cartoon, E: chart)

When we compared illustrations in grade level between Korea and BSCS textbook, we found that the big difference. In Korea textbook, the highest rate was the photograph (66.3%). the next was cartoons (22.9%). In BSCS, the order was picture (42.3%), photograph (31.8%), and cartoon (20.2%). It means that whereas Korea textbook relied on photographs, BSCS relied on photographs, pictures, and cartoons as almost equal rate.

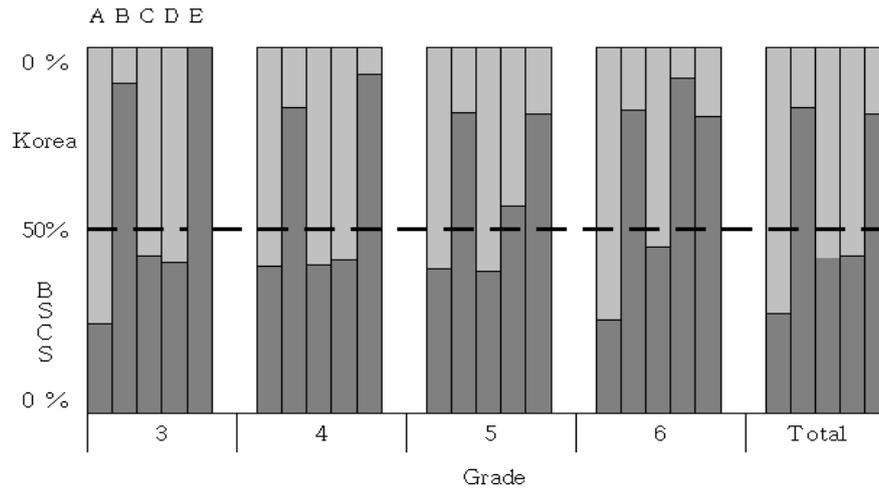


Figure 3. Comparisons of the types of illustrations in grade between Korea textbook and BSCS. (A: photograph, B: picture, C: graphic, D: cartoon, E: chart)

And, for relative comparisons of the types of illustrations, in Korea, photograph, cartoon, and graphic were relatively high in the frequency in all grade level. In the case of graphic and chart, it seems difficult to find the important pattern because there were very low rate in the two country's textbooks: In graphic, Korea (2.5%) and BSCS (2.0%). In charts, Korea (0.9%) and BSCS (2.7%). Thus, we consider that Korean textbook use the photograph, real illustration, and BSCS used the picture, so that young children could feel attractive to them.

### 5.2. Comparisons of the roles of illustrations

In Korean textbook, the order of the rates was providing materials (47.9%), introducing the lesson activity (28.2%), motivating (19.6%), and presenting the learning result (Figure 4).

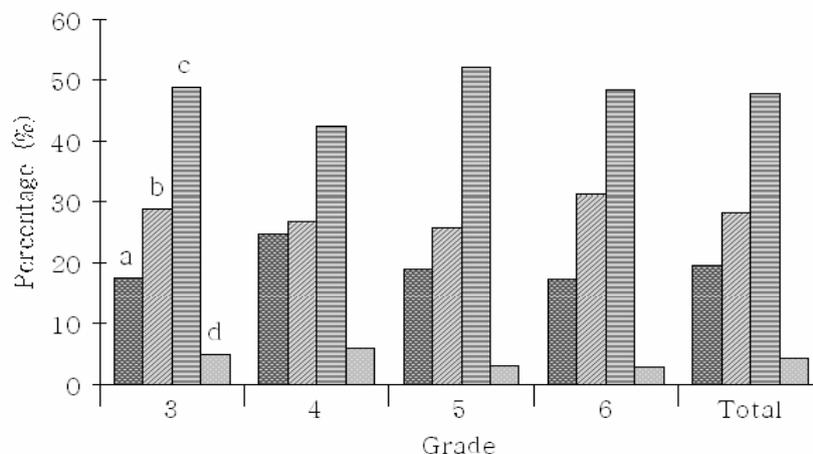


Figure 4. The role of illustrations in grade in Korean textbook (a: motivating, b: introducing the lesson activity, c: providing materials, d: presenting the learning result)

The role of presenting the learning results was 4.3%, which was very low compared to other roles. This also shows that the sum of providing the materials and introducing the lesson activity was three times bigger than the sum of motivating and presenting the results. This means that providing the materials and introducing the lesson activity were the major role of illustration in Korean textbooks.

Figure 5 shows the role of illustrations in grade in BSCS textbook in USA. Introducing lesson activity was 34.1%, which was the highest rate. Providing materials and motivating were 33.9% and 31.9%, respectively.

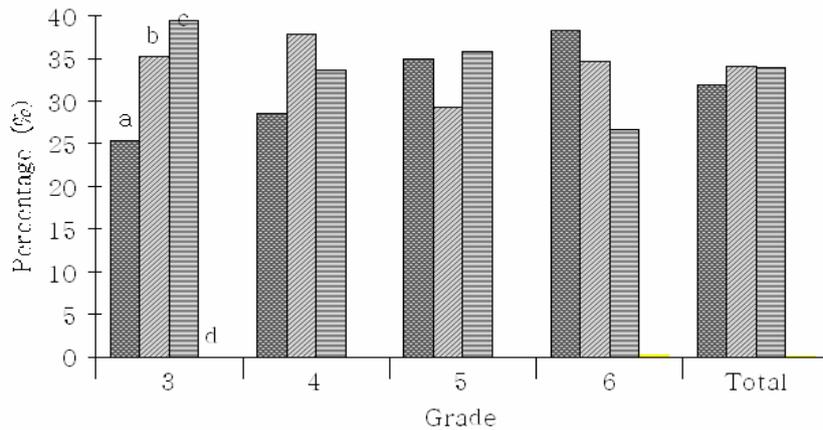


Figure 5. The role of illustrations in grade in Korean textbook (a: motivating, b: introducing the lesson activity, c: providing materials, d: presenting the learning result)

The very low rate of illustrations was presented in presenting the learning results. As the grade level was high, the role of motivation was emphasized. So, we understand that providing materials and introducing the lesson activity were important in the lower grade level, although motivating and introducing the lesson activity were the major component in the higher grade level.

Figure 6 shows our comparisons of the role of illustrations in grade level between Korea textbook and BSCS. Both Korean textbook (47.9%) and BSCS (33.9%) show that they represent the role of introducing the lesson activity as the highest rate. Whereas providing the materials and introducing the lesson activity (28.2%) were the major role, motivating (19.6 %) and presenting the learning results (4.3%) had the low rate.

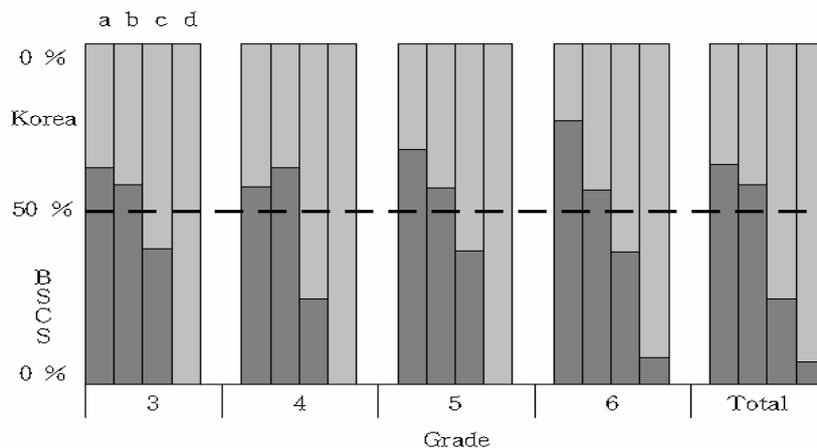


Figure 6. Comparisons of the role of illustrations in grade level between Korea textbook and BSCS (a: motivating, b: introducing the lesson activity, c: providing materials, d: presenting the learning result)

BSCS showed that all roles, introducing the lesson activity (34.1%), motivating (31.9%), and providing materials (33.9%), had the almost equivalent rate in the low rate.

On the other hand, when we compared Korean textbook and BSCS, BSCS showed the high rate in motivating, whereas Korean textbook showed the high rate in providing materials and introducing the lesson activity. However, in the area of presenting learning results, both Korea (4.3%) and USA (0.1%) held the very low rate. This means that BSCS emphasized more inquiry activities than Korean textbook, since presenting the learning results can give students a clue for the classroom experiments and results.

## 6. Discussions

In this study, we compared elementary science textbooks of Korea and BSCS in USA in order to better understand the major features and roles of illustrations used in the textbooks. The results of this research give us important implications about elementary science textbook materials in Korea.

Given the fact that textbooks in Korea had more illustrations, containing too much information in each illustration, we need to re-consider the organization of the textbook. Korean textbook contains factual knowledge-based information

instead of inquiry or activity-based guidance. This might be good for acquiring factual knowledge or linear type of knowledge, but this might not be helpful for young students to understand scientific ideas. On the other hand, it turns out that BSCS had more inquiry type activities instead of forcing students to gain a lot of facts and knowledge through the textbook. We think that this structure of illustration in BSCS can be effective to help the students to explore a variety of ideas through the illustrations.

Considering that Korean textbooks contain more "introducing the lesson activity" and "providing the materials" than other roles of illustrations, we need to think about the role of textbook in the science classroom. Korean textbooks seem to focus more on guiding students' activities, instead of having students explore on their own, implying that students have less choice to make decision of what to do and how to do.

Knowing that Korean textbooks have more "photograph" type of illustration than BSCS, we also need to think that using the textbooks with a lot of photographs might not be helpful to give students the feeling of intimacy to science or the subject of science. Using more pictures, which can give students more feeling of closeness to the contents to learn from the book, might be a good way to motivate students to learn the science contents in the book. Further, BSCS showed efforts to include all students, including dependent children. There were many illustrations to describe students working together with the disabled children, although Korean textbook did not show any illustration on this.

For the future textbooks in Korea, we suggest that first, types of illustration need to be more diverse. Further, the roles of illustration need to act as an effective motivator in a way of stimulating children's thoughts. Second, when we construct the illustrations, it needs to pay attention to the alienated social class.

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