SEMIOTICS OF CHEMISTRY POSTERS

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Abstract

The posters are the tools to communicate authors' idea with others by visual image and a little word. The Korean Chemical Society had held the feast of drawing chemistry posters by students nationwide in 2004 and 2005. In two years, more than three thousands of posters were submitted, and about one hundred and fifty posters were selected as the prize winners. The award was divided by the grade levels of elementary, middle, and high school. Every discipline has its own sign with specific meaning shared by the members of the discipline. Chemist and students learning chemistry, therefore, will communicate with each other by specific chemical signs (codes). This study explores the codes of chemistry used in students' posters. The visual and verbal elements of posters were analyzed in a semiotic perspective. The "chemistry" is depicted with experiment apparatus (such as a flask and a beaker), structural formula, the symbols of chemical elements, the graduations (as in a graduate cylinder), and the liquid (such as water or oil). The topics of posters were environment, life, development, future, etc. There were some differences in the elements of posters by the year (e.g., 2004 vs. 2005) and by the grade level.

Keywords: Chemistry poster, Semiotics

1. Introduction

The Korean Chemical Society (http://www.kcsnet.or.kr/) had held the feast of drawing chemistry posters by students nationwide in 2004 and 2005. In two years, more than three thousands of posters were submitted, and one hundred and fifty-one posters were selected as the prize winners. The award was divided by the grade level of elementary, middle, and high school. This feast of drawing chemistry posters might be held this year also in Korea, where the 19th International Conference on Chemical Education (ICCE, August 12-17, 2006) is held. In addition, this year is the Year of Chemistry in Korea. The international chemistry educators might have accessed to the "Science across the World" (http://www.scienceacross.org) where hosts another, maybe the original, poster competition among students (10-16 years) all over the world. It seems, therefore, that it's time to look back to the posters that won prizes. Yet, I cannot find any attempt to analyze chemistry posters. The analysis of students' posters will provide chemistry educators with insight to read students' mental image for chemistry.

Every discipline has its own sign with specific meaning shared by the members of the discipline. Chemist and students learning chemistry, therefore, will communicate with each other by specific chemical signs (codes). This study explores the codes of chemistry used in students' posters. The visual and verbal elements of posters were analyzed in a semiotic perspective. Some changes or differences in the elements of posters by the years of 2004 and 2005 and by the grade levels were searched and discussed.

2. Method

I gathered the 151 posters from the website of Korean Chemical Society. In 2004, the numbers of winners were 11 for high school, 9 for middle school, and 20 for elementary school level. In 2005, the numbers of the winners were increased to 38 for high school, 40 for middle school, and 33 for elementary school level. All the posters were in the format of jpeg. The actual sizes of the original posters cannot be identified. However, when I need to enlarge a part of a poster to check what is drawn in detail, I have no difficulty in discerning the figures or words (that is, the verbal and visual elements) because the posters were scanned in a high resolution.

The first step of the analysis was to make myself familiar with the posters to be analyzed. I browsed the posters through my computer screen one by one. In doing this, I made a list of elements that attract my attention. For example, I identified many posters had experimental apparatus, structural formula, and/or the symbols of chemical elements. Then, I subdivided the list; for the case of apparatus, I can see a beaker, a flask, a cylinder, a test tube, etc. With this fine-grained list, I check every poster whether it has the elements. All the elements identified were coded and put in a worksheet of Excel program. Whenever I found additional (fine-grained) list, I added it to the worksheet, and analyzed the former posters again and again. This data-file (excel file) provided me with the statistics of whatever I want to compile or to compare by the year and by the grade level.

3. Results and Findings

The elements can be thought as “codes of chemistry” in a sense that they are used in the poster by students and read as such by the reader (myself). Therefore, the results are presented in the order of codes of chemistry.

3.1 Chemical Code 1: Liquid

Forty seven posters (31% of 151 posters) have shown a kind of liquid on a part of them. The liquid is sometimes in a form of droplets, and sometimes in a form of fluid inside an experimental apparatus. Figure 1 shows some kind of liquid inside a beaker or a cylinder. The reader can identify that part (inside of apparatus) represent “liquid” by the air-bubble-like circles on that part. Or, one can infer that part represent “liquid” when s/he looks the shape of the surface (meniscus) of the part. However, it is impossible that the surface is slanted, that is, not horizontal. Nevertheless, an initiate reader can assume this unrealistic drawing of liquid do not tell something important other than showing just “liquid.”

This image, when it is read as a kind of liquid, can be linked to the way how contemporary chemists do their experiments. It is most common that the chemical reactions occur in liquid state (of solution) than in gas or solid states. Thus, students who have used this “liquid” code seem to have adequate image of chemical process. Elementary students used this code less frequently (19%) than middle school students (39%) or high school students (37%) did. There was no difference in the use of this code by the year.

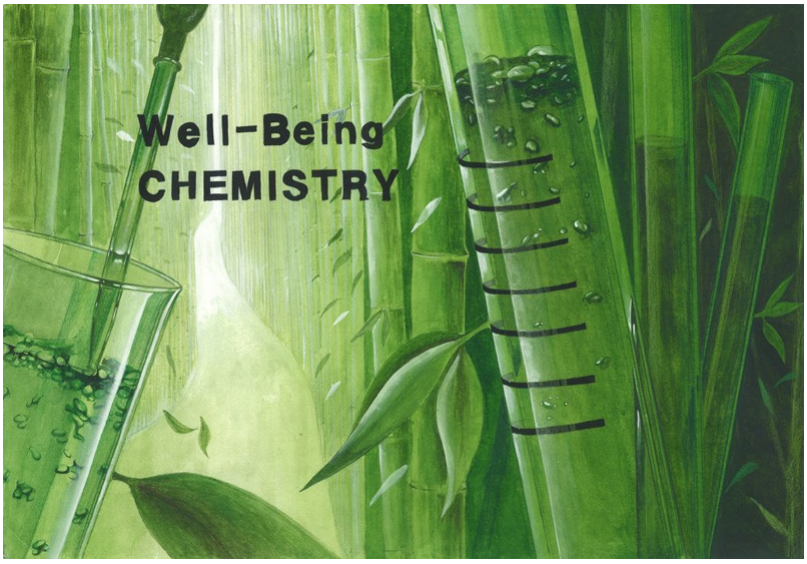

Figure 1. A poster drawn by a high school student. This contains three codes of “liquid,” “experimental apparatus,” and “graduations.”

3.2 Chemical Code 2: Experimental Apparatus

Nearly half of posters (48%) used one or more experimental apparatus like Figure 1. Most frequently used apparatus was a flask in 48 posters (32%), and then a beaker in 27 posters (18%), a test tube in 25 posters (17%), a cylinder in 20 posters (13%), and a spuit in 17 posters (11%). Other apparatus can be found such as a syringe, a microscope, an alcohol lamp, a funnel, a schale, a thermometer, a pincette, a glass rod, a burette, a condenser, a stand, and a spatula. These experimental apparatus can be found in the drawings on “scientist.” [1] That is, students seem to have stereotypic images of the scientist using experimental (mostly chemical) apparatus. [2] Middle school students used this code more frequently (60%) than elementary school students (40%) or high school students (41%) did. There was no difference in the use of experimental apparatus by the year.

3.3 Chemical Code 3: Graduations

It is interesting that more than half of apparatus used in the posters have graduations as the marks on a thermometer. (Forty-one posters, 27%, have graduations.) In Figure 1 the marks are drawn in the outside wall of slant cylinder. It is not clear, though, that the cylinder with marks in Figure 1 is the graduate cylinder which is used in measuring a volume of liquid, because the bottom or the top of it is not drawn. Is the cylinder same kind with the two cylinders in the right side? Then, the shape of mouth of the right most cylinder reminds a initiate reader of the shape of graduate cylinder; there is a dent protruded in one part of the mouth of cylinder to make it easy to decant the liquid inside. However, there are no graduations on the two cylinders in the right side. In addition, the graduations drawn on the middle cylinder is not exactly same with the graduation of “real” graduate cylinder. In this case, again, the initiate reader should think this non-realistic drawing of graduations does not mean something important. Elementary school students (30%) and middle school students (33%) used this code more frequently than high school students (18%) did. There was no big difference in the use of experimental apparatus by the year.

What does this code, the graduations, mean? It could be linked to the quantitative chemistry where the measurement is the crucial part of a research. The way of measuring a volume of liquid is emphasized to students from the elementary

school. For example, the eye level must be aligned with the surface or meniscus of a graduate cylinder. This emphasis on the exact measurement can be found on the science textbook of fourth grade of elementary school in Korea. The quantitative part of chemistry, however, does not represent all kind of chemistry field. Thus, students should be provided with various image of chemistry such as qualitative chemistry, organic chemistry, physical chemistry, etc.

3.4 Chemical Code 4: Chemical Language

Many posters show specific chemical language such as structural formula and/or the symbol of element. About one fourth of posters (35 posters, 23%) contain structural formula as the ball-and-stick model of a chemical in Figure 2, and nineteen posters (13%) used one or more symbols of elements. In addition, sixteen posters (11%) used both the structural formula and the symbol of element as Figure 2. In total, over 40% of posters used these specific language shared by chemists. While middle school students (31%) used the structural formula more frequently than elementary school students (19%) or high school students (20%) did, in the case of the symbol of element, middle school students (4%) used the symbol of element less frequently than elementary school students (15%) or high school students (18%) did. In addition, more posters in 2005 used chemical language than posters in 2004. Students seem to understand these chemical languages are tools to communicate with others on chemistry. A few posters (7 posters, 5%) used the structural formula even as a basic design of the whole poster image.

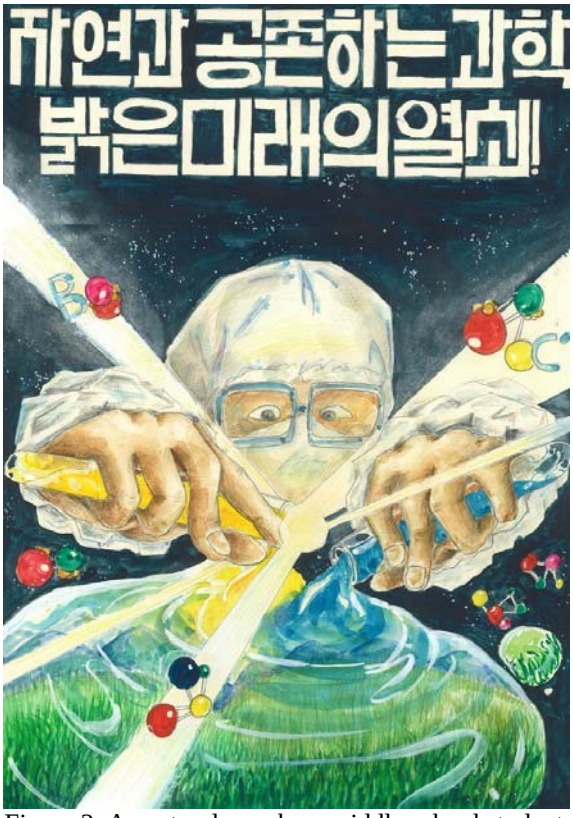

Figure 2. A poster drawn by a middle school student. The words inside read “science coexisting with nature, the key to prospective future.” This contains three codes of “chemical language,” “scientist,” and “earth/nature.”

3.5 Chemical Code 5: Scientist

Many students draw person in their posters (62 posters, 41%). The frequency of using person in their posters decreases from elementary school students (53%) to middle school students (47%) and to high school students (23%), and from the year 2004 (50%) to the year 2005 (39%). In few posters as the one in Figure 2, the person can be identified as a scientist. Scientists wear a white gown and glasses (goggles). [1] The gender of the scientist was biased a little on male (7 cases) than female (3 cases) as in another research. [2]

3.6 Chemical Code 6: Earth/Nature

Forth-one posters (27%) show the earth, and another/same forty-one posters (27%) show a scene of nature (see Figure 2). In the year 2004, only one poster (3%) shows a scene of nature, while in the year 2005 forty posters (36%) show it. In addition, seven posters (18%) show the earth in the year 2004, while thirty-three posters (31%) show it in the year 2005. These differences are due to the different topics of the feast of drawing chemistry posters by the year. The main topic was same as “chemistry and our life” in two years, but the sub-theme were “the effect of chemistry to our

life," "our world without chemistry," "(the life of) chemist," and "chemistry in our life" in the year 2004 while those were "chemistry and environment," "environment-friendly chemistry," and "chemistry make the earth green" in the year 2005. That is, because the sub topic of the year 2005 focused on the environmental issues, the posters of that year showed the scene of nature or the earth more than those of the year 2004.

3.7 Chemical Code 7: Things around Us

A lot of things around us were used in students' posters. Figure 3 shows typical poster that include things that is thought to be related to chemistry. The most frequent thing occurred in the posters was a medicine or a tablet (capsule) (17%). The followings are cosmetics (8%), paint or dyes (5%), gasoline (gas, 5%), a car (4%), detergent (4%), and clothes (4%). Students seem to understand well on the materials or goods from the chemistry industry.

Figure 3. A poster drawn by an elementary school student. The words inside read "chemistry in our life, which have coexisted and will coexist." This contains the code of "things around us."

4. Conclusion

I can identify the elements (codes) of chemistry posters drawn by Korean students. The chemistry educator should teach their students have contemporary images on chemistry. The chemical posters can be used as a method to communicate idea with each others. Students should be provided with the opportunities to express and read their ideas on chemistry in chemical posters every year on and on.

After I analyzed the chemical posters in Korean Chemical Society, I found that the "Science across the World" hosted the poster competition among students all over the world. It will be interesting to analyze, in follow-up studies, the posters from all over the world, and compare the result with the findings of this study on the posters from Korea.

5. References

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