

Summary

Production of Teaching Materials Using Scientific Papers of Students

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When the Japanese course of study was revised in 2008, the number of hours devoted to science classes increased in both elementary and junior high schools to improve STEM teaching and learning. Because the development of inquiry for students is very important, it was encouraged that inquiry-based observations and experiments should be conducted in the science classes. In addition, analysis of observations and experiments, as well as discussions, should be required for improving inquiry skills (Hoshino, 2009). Scientific research by students during their summer vacation was recommended in order to develop their scientific understanding, skills and attitudes (Ogura, 2005; Ando, 2007a). Furthermore, students undertaking scientific research were more motivated to learn science (Ogura, 2005). However, many children cannot propose good research questions. They are not good at conducting research. Thus, the role of teachers is important in the scientific exploration activities of children (Tsukada, 1992; Shiragami, 1994; Ando, 2007b) even though teachers have difficulties in teaching procedures and methods in various fields (Murakami, 2007). If scientific papers written by students can be classified into the fields (units) of the Japanese course of study, it will be easier for teachers to utilize scientific papers as teaching materials. Although some reports classify scientific papers written by students according to the titles of the papers, the classification according to the contents of the papers has not been carried out.

Now, a case study of inquiry-based teaching is introduced in science textbooks (Un-no and Ando, 2009). In addition, a textbook written by a skilled teacher has been used (Koizumi, 2010). However, it was difficult for teachers to use scientific papers written by students as teaching materials in their classes because there was no literature retrieval system for scientific papers of students. In addition, teachers' beliefs about searching papers had not been studied.

In this study, I have classified scientific papers written by students into the related science fields and units, and analyzed the trend of papers to develop teaching materials. Furthermore, I have investigated teachers' beliefs about the use of a literature retrieval system for scientific papers written by students before and after use of "the database of science

independent studies”.

Classification of Scientific Papers Written by Students from a Japanese Science Contest

To classify scientific papers written by students, I determined whether the scientific knowledge or concepts in units of the science section of the Japanese course of study were (1) used or (2) identified by students in their scientific papers. In addition, I determined whether the significance and usefulness of science to be learned in the science section of the Japanese course of study were (3) found in the scientific papers written by students.

Using 102 papers from a Japanese science contest (Shizekon), most papers were classified to be related to the field of life (life > energy > matter (particle) > earth). In addition, many papers contained multiple fields and units, indicating that students conducted their studies to answer various questions. Because classes emphasizing the relationship between units improved comprehension and memory (Inoue, 2010; Kudo, 2005), scientific papers may be beneficial for teachers to develop their teaching materials. The least number of papers were related to the earth, and no papers contained units such as “change of weather”, “moon and sun”, and “moon and star”. It is interesting that teachers in elementary schools and junior high schools had difficulties in teaching the field of the earth (JST, 2009).

Teachers' Beliefs about the Use of a Literature Retrieval System for Scientific Papers of Students

Semi-structured interviews were conducted among nine teachers in elementary, junior high, and high schools, before and after their use of a literature retrieval system for students' scientific papers on a website at an educational institution in Japan. The results of the interviews were analyzed qualitatively by the KJ (Kawakita Jiro) method.

The teachers reported that the system was useful for them to construct teaching materials for regular classes as well as for scientific research. In addition, high school teachers believed that the students' motivation to learn science increased when they used the system. Some teachers in elementary or junior high schools believed that reading papers decreased the power of creative thinking in children, and these teachers were afraid that plagiarism in students' papers increased, when students used the internet. They thought that the students' motivation to learn science decreased when the papers written by other children were better.

Further studies are required to clarify the relationship between activities of reading papers and development of inquiry for students during each developmental stage.