

5. Study on the Development of Teaching Materials for Cultivating Scientific Outlooks in Secondary Education using Topics in Sustainable Development

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(1) Purpose and Aim of Study

A number of surveys to date have identified changing perceptions toward science, including a diminished appreciation of the importance and usefulness of studying science. On the other hand, 70% to 80% of schoolchildren recognize the necessity of studying science for the purpose of conserving nature and the environment overall.

“Sustainable development” has been a key concept in environmental discourse ever since 1987. This study seeks to develop new science-related teaching materials on sustainable development. These materials will apply the idea of green sustainable chemistry, a set of principles and methods for bringing the actual generation of pollutants to a complete halt, rather than simply processing substances causing environmental pollution after the pollution has occurred. The materials will not only provide comparisons of the benefits and detriments of science and technology, but also demonstrate through a review of historical developments that the way in which scientists deal with the environment is shifting away from the ex post management of problems and towards sustainable processes in which problems do not occur in the first place.

These teaching materials will be suitable for cultivating the kinds of attitudes to science that are needed in order to solve problems surrounding scientific phenomena in our society, such as the capacity to explore issues scientifically and adjust one’s judgment in light of new revelations, trust in scientific values, and the will to reach conclusions in a careful manner and deliver judgments that are fair and equitable. The effectiveness of these materials will be tested in pilot schools using techniques such as the one-page portfolio method.

(2) Outline of Research Results

- The goals of education on sustainable development in the lower and upper secondary school science curriculum were defined around a three-point framework of objectives: (1) to comprehend the duality of benefits and detriments in the relationship between science and technology and the environment and address the task of achieving improvements to the quality of life, (2) to understand the efforts being made by those engaged in the fields of science and technology and thereby develop a more positive awareness of science and technology, and (3) to gain the motivation to assess and make autonomous decisions, and take action concerning science and technology related issues.
- Electronic teaching materials on sustainable development that make extensive use of illustrations and diagrams were developed and revised.
- These teaching materials were used in practice, and learning record sheets completed in accordance with the one-page portfolio method. These sheets were reviewed and opinions solicited in order to identify content corresponding to each of the objectives stated above. This revealed that learning had taken place in line with the framework established.
- It was found that a wide variety of class formats could be developed using the electronic materials, such as role-playing the three characters that appear in the materials.
- Teaching materials on measures to address air pollution through green sustainable chemistry, considered to be the chemistry-oriented approach to sustainable development, were produced in English. Opportunities to use these materials in practice were found in the Philippines, Malaysia, and Indonesia.
- Students in each of these countries took a serious approach to learning, but some of the techniques used in the materials, such as inquiry-based learning, were not practiced locally. It was thus concluded that full discussion and consultation in advance is essential when using the materials outside Japan.

- Learning record sheets were produced and used in evaluating all materials. The reviews and opinions obtained revealed positive responses to both science and technology and the materials themselves.
- A checklist consisting of 12 points to make summaries of scientific articles was produced and used for evaluation of the outlines entered on the learning record sheets. It was found that if time is taken to guide and encourage students to think about the summaries, there is likely to be significant difference in the content and method of entries thereafter.