

9. Development of Evaluation Methods in a Curriculum Focused on the Cultivation of Capacity for Scientific Inquiry

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(1) Purpose and Aim of Study

This study is part of a five-year project, commenced in fiscal 2002, supported by an open-application MEXT Grant-in-Aid for Scientific Research on Priority Areas in the area of Developmental Research for Science Education in the New Millennium. The aim is to integrate the findings of this project and propose a framework for a science education curriculum for the new millennium that fosters logical thinking and creativity in children. The key terms chosen for the study were scientific literacy, capacity for scientific inquiry, ability to resolve technical problems, cultivation of human resources in science and technology, scientific communication, and motivation to study science. While approaching each of these key terms in its own right, the relationships between them were also clarified gradually, eventually enabling them to be integrated into a cohesive whole. Efforts were made to ensure that the findings could contribute to discussions concerning cultivation of human resources in science and technology and raising the level of scientific literacy among the general public, both of which are crucial policy issues today. Care was also taken to provide information for reference by science teachers, universities, community education institutions, and other parties engaged in science education and scientific communication.

(2) Outline of Research Results

- In order to address the dual challenges of cultivating human resources in science and technology and raising the level of scientific literacy among the general public, science education in Japan needs to be re-oriented toward the goals of fostering high-level capacities for logical thinking and creativity. This can be achieved by equipping children with the basis for more creative action, expanding learning opportunities that enable children to develop specialized and individual qualities, improving the skills they need to function as active producers rather than simple functionaries, and provide them with ongoing experiences in scientific inquiry and resolution of technical problems. This kind of reform would help students to understand

the personal value of studying science, and raise their motivation to do so. Our study produced specific guiding principles and an overall framework for reform of the science education system to achieve these goals.

- The status of initiatives outside Japan (in the U.S., Canada, the UK, and the OECD) concerning scientific literacy for all children were reviewed from the perspective of cultivating the capacity for scientific inquiry. The curriculum reforms that took place in Japan after 1945 were also reassessed, and matters for attention when reforming the curriculum today identified.
- The current position and issues of creative education in Japan's science and technology curriculum were examined.
- The extent of schoolchildren's motivation to study science across Japan and the educational initiatives that are effective in raising motivation were examined. The degree and distinguishing features of motivation to study science among students involved in Super Science High Schools and other special projects were assessed through comparison with nationwide trends.
- Case studies were presented on how scientific communication can expand the number of students with a liking for science and extend high-performing students, and on notable initiatives in scientific communication.
- Information was compiled on current trends in the cultivation of science-stream students, effective national programs, and future challenges in developed nations by reference to discussions taking place in the OECD.
- Reports were produced on the features of three leading science curricula for expanding the number of students with a liking for science and extending high-performing students: CASE (UK), FOSS (U.S.), and Twenty First Century Science (UK).
- The latest framework for assessing scientific literacy under OECD's PISA study was explained.

- The basic content of a teacher training program developed in order to cultivate a capacity for scientific inquiry was presented.
- Information was presented on the kinds of initiatives practiced by science teachers who are proficient at expanding the number of students with a liking for science and extending high-performing students, and what these teachers believe must be done in the future.