

# STRATEGIES FOR THE IMPROVEMENT OF K-8 SCIENCE EDUCATION A REPORT FROM THE UNITED STATES

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The National Science Resources Center (NSRC), operated jointly by the National Academy of Sciences and the Smithsonian Institution, works to improve the quality of science education in elementary and secondary schools. The NSRC advocates an inquiry-centered approach to science education that challenges students to expand their understanding of science concepts, skills, and attitudes through hands-on explorations. Through its science materials development, information dissemination, and leadership development programs, the NSRC assists science education reform efforts in school districts across the United States. Scientists and engineers from universities and industry, as well as teachers and school district leaders, collaborate in the development and implementation of NSRC programs.

Building on fifteen years of experience working to improve science education, the NSRC has developed a model to guide school districts that are seeking to establish an inquiry-centered science education program. The NSRC model involves five complementary elements that are needed to create and sustain an inquiry-centered science program:

## *I. Research-Based Curriculum Materials*

Carefully crafted, comprehensive, inquiry-centered curriculum materials lie at the heart of an effective science education program. Such curriculum materials should be developed collaboratively by teachers and scientists, field tested with students, and carefully evaluated before being published. The learning materials must provide developmentally appro-

priate opportunities for children to expand their understanding of science concepts, acquire skills, and develop positive attitudes toward science. Lessons must challenge students with a variety of learning styles and give them opportunities to apply what they have learned to real-life situations. The lessons must also offer opportunities for teachers to integrate science learning with other areas of the curriculum.

## *II. Professional Development*

Carefully designed professional development programs are needed to prepare teachers to teach inquiry-centered science. These professional development programs need to focus initially on helping teachers become familiar with fundamental science concepts, learn how to use inquiry-centered science materials, and develop effective classroom-management techniques. Later, attention can turn to helping teachers acquire in-depth science content knowledge, perfect an inquiry-centered approach to teaching and learning, develop appropriate methods for student assessment, and integrate science with other subject areas.

## *III. Materials Support*

Students who engage in inquiry-centered science need a variety of science materials – from hand lenses to magnets to organisms. A materials support system is needed to ensure that science materials are ready for classroom use throughout the year. Materials support staff take charge of ordering new supplies, refurbishing science kits, and ensuring that they are delivered to teachers when needed. Centralizing these materials support functions for an entire school district can make materials support more efficient and cost effective.

## *IV. Student and Program Assessment*

Inquiry-centered science requires teachers to use new assessment strategies. Pre-assessment activities to assess students' knowledge before beginning a learning sequence can provide information to help teachers plan learning activities. Additional assessments need to be integrated throughout the learning process to provide both teachers and students with a way to evaluate their progress. Final assessments should be designed to assess what students know and are able to do as a result of their inquiries.

In addition, periodic program assessments are needed to determine whether the science program is meeting its goals and to guide curriculum selection, professional development, and other activities.

#### *V. Administrative and Community Support*

Planning and implementing an inquiry-centered science program require the support of a broad range of stakeholders. These individuals should share a vision of what is needed to create an effective inquiry science program. Equally important is the need to establish an infrastructure that will support this shared vision.

To be effective, science education reform efforts needed to enlist the support of school and community leaders. A broad range of community organizations can become effectively involved in the reform of K-8 science education. They include colleges and university faculty, business and industry, museums, philanthropic foundations, parent-teacher organizations, and other educational organizations. Scientists, engineers, and corporate leaders can be especially effective in building support for science education reform. Scientists can also team with teachers to lead professional development programs and parents may volunteer time to help replenish science kits in science materials centers.

Working together, these individuals can form partnerships that will ensure a sustained commitment to science education reform.

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The NSRC has developed a book and a videotape to assist those who are working to improve science education in the schools. *Science for All Children: A Guide to Improving Elementary Science Education in Your School District* provides concise and practical guidelines for bringing about science education reform. Designed for school leaders, scientists, teachers, and community leaders who are committed to improving science education for all children, the book and videotape explain the philosophy and research underlying inquiry-centered science teaching and describes in detail the five elements that are essential to science education reform. The book also provides information on how to organize, plan and implement a new science program. *Science for All Children* is available from the National Academy Press (Telephone 1-800-624-6242), or can be accessed online over the internet at <http://www.nap.edu>.