Science and Technology Concepts for Middle Schools™

Earth in Space

Student Guide and Source Book
NATIONAL SCIENCE RESOURCES CENTER
The National Science Resources Center (NSRC) is operated by the Smithsonian Institution and the National Academies to improve the teaching of science in the nation’s schools. The NSRC disseminates information about exemplary teaching resources, develops curriculum materials, and conducts outreach programs of leadership development and technical assistance to help school districts implement inquiry-centered science programs.

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The Smithsonian Institution was created by act of Congress in 1846 “for the increase and diffusion of knowledge. . . .” This independent federal establishment is the world’s largest museum complex and is responsible for public and scholarly activities, exhibitions, and research projects nationwide and overseas. Among the objectives of the Smithsonian is the application of its unique resources to enhance elementary and secondary education.

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The National Academies are nonprofit organizations that provide independent advice to the nation on matters of science, technology, and medicine. The National Academies consist of four organizations: the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council. The National Academy of Sciences was created in 1863 by a congressional charter. Under this charter, the National Research Council was established in 1916, the National Academy of Engineering in 1964, and the Institute of Medicine in 1970.

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Community leaders and state and local school officials across the country are recognizing the need to implement science education programs consistent with the National Science Education Standards as we strive to attain the important national goal of scientific literacy for all students in the 21st century. The Standards present a bold vision of science education. They identify what students at various levels should know and be able to do. They also emphasize the importance of transforming the science curriculum in a way that encourages students to engage actively in scientific inquiry—thereby developing conceptual understanding as well as problem-solving skills.

We believe that the development of effective, standards-based, inquiry-centered curriculum materials is a key step in achieving scientific literacy. The National Science Resources Center (NSRC) has responded to this challenge through the Science and Technology Concepts for Middle Schools (STC/MS) program. With the publication of the STC/MS modules, schools now have a rich set of curriculum resources for middle school students that embody scientific inquiry and hands-on learning.

Since its founding in 1985, the NSRC has made many contributions to the goal of achieving scientific literacy for all students. In addition to developing the Science and Technology for Children (STC) program—an inquiry-centered science curriculum for grades K through 6—the NSRC has been active in disseminating information on science teaching resources, in preparing school district leaders to spearhead science education reform, and in providing technical assistance to school districts. These programs have had an important impact on science education throughout the country.

The transformation of science education is a challenging task that will continue to require the kind of strategic thinking and insistence on excellence that the NSRC has demonstrated in all of its curriculum development and outreach programs. Its sponsoring organizations, the Smithsonian Institution and the National Academies, take great pride in the publication of this exciting new science program for middle schools.

J. DENNIS O’CONNOR
Former Under Secretary for Science
Smithsonian Institution

BRUCE M. ALBERTS
President
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Preface

The National Science Resources Center’s (NSRC) mission is to improve the learning and teaching of science for K-12 students. As an organization of two prestigious scientific institutions—the National Academies and the Smithsonian Institution—the NSRC is dedicated to the establishment of effective science programs for all students. To contribute to that goal, the NSRC has developed and published two comprehensive, research-based science curriculum programs: the Science and Technology for Children® (STC®) program for students in grades K-6, and the Science and Technology Concepts for Middle Schools™ (STC/MS™) program for students in grades 6-8.

The STC/MS curriculum project was launched in 1997. The overall design of the instructional materials and the process by which they were developed are based on a foundation of research. The STC/MS courses were informed by research on cognitive development, teaching, learning, assessment, and the culture of schools.

The STC/MS curriculum materials consist of eight courses. Through these courses, students build an understanding of important concepts in life, earth, and physical sciences and in technology; learn critical-thinking skills; and develop positive attitudes toward science and technology. The STC/MS program materials are designed to meet the challenge of the National Science Education Standards to place scientific inquiry at the core of science education programs. Specifically, the National Science Education Standards state that “...students in grades 5–8 should be provided opportunities to engage in full and partial inquiries.... With an appropriate curriculum and adequate instruction, middle school students can develop the skills of investigation and the understanding that scientific inquiry is guided by knowledge, observations, ideas, and questions.” STC/MS also addresses the national technology standards published by the International Technology Education Association.

Informed by research and guided by standards, the design of the STC/MS courses addresses four critical goals:

- Use of effective student and teacher assessment strategies to improve learning and teaching.
- Integration of literacy into the learning of science by giving students the lens of language to focus and clarify their thinking and activities.
- Enhanced learning using new technologies to help students visualize processes and relationships that are normally invisible or difficult to understand.
- Incorporation of strategies to actively engage parents to support the learning process.

The research and development process has included trial teaching and field-testing nationwide with geographically and ethnically diverse student populations, as well as the active involvement of the scientific and engineering communities. This process has ensured that the learning experiences contained in each module reflect current
scientific thinking, and are pedagogically sound and developmentally appropriate for students.

The NSRC is grateful to the Smithsonian Institution and the National Academies for their overall project support and for sharing their scientific expertise—critical for the development of world-class products. Support for project staff and the associated work to produce and publish these materials has been made possible by the National Science Foundation, our publisher Carolina Biological Supply Company, and numerous private foundations and corporations, including Bristol-Myers Squibb Foundation, The Dow Chemical Company Foundation, DuPont, the Hewlett-Packard Company, and The Robert Wood Johnson Foundation.

The NSRC would like to acknowledge Douglas M. Lapp, former NSRC Executive Director, for his vision and leadership on the STC/MS project. The STC/MS development staff, under the direction of Kitty Lou Smith, and the publications staff, under the direction of Heather Dittbrenner, working in cooperation with Dorothy Sawicki, Managing Editor for the first four modules, and Linda Griffin Kean, Managing Editor for the second four modules, are to be commended for their creativity, dedication, and commitment to develop these excellent curriculum materials that will be used to improve the learning and teaching of middle school science in the nation’s schools.

We welcome comments from students and teachers about their experiences with the STC/MS program materials and recommendations for ways the STC/MS courses can be improved.*

Sally Goetz Shuler
Executive Director
National Science Resources Center

*Please forward your feedback and suggestions to STC/MS Program, National Science Resources Center, Smithsonian Institution, Washington, DC 20560-0403.
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