SCIENCE AND TECHNOLOGY CONCEPTS FOR MIDDLE SCHOOLS (STC/MS)

STC/MS is an 8-module middle school science curriculum for grades 7 and 8. The modules are designed to be offered as two one-year courses (each year including one unit from each of the four scientific strands), or as four one-semester courses for earth science, life science, physical science, and technology. The Middle School program complements the 24-module STC K–6 program that was also developed by the National Science Resources Center.

Publisher:	Carolina Biological Supply Company	Grade Level:	7–8
Year Published:	2000, 2003	Scientific Domain:	Life, earth, and physical science, technology
Developer:	National Science Resources Center	Web site:	www.si.edu/nsrc/stcms/overview.htm

CONTENTS STC/MS unit titles are listed below.

Unit Title	Unit Description
Properties of Matter	The unit begins with investigations on characteristic properties of matter (density, boiling and melting points, and solubility). Students explore the effect of heat on density, the dynamics of phase change, and the difference between pure substances and mixtures. Students use characteristic properties to identify pure substances, and to identify the components of a mixture. Elements, compounds, and simple chemical reactions are then introduced. Students investigate the overall similarities and individual differences among one group of elements—metals. Conservation of mass is investigated.
Human Body Systems	Students follow the nutrients in a well-balanced meal as they are processed by the digestive system. Next, they explore how the respiratory system transports oxygen to individual cells. Students then investigate the circulatory system and the musculoskeletal system. Diseases, proper nutrition, and physical fitness are explored throughout the unit.
Catastrophic Events	Students begin by investigating the causes and results of thunderstorms, tornadoes, and hurricanes. They then examine earthquake data from around the world, and investigate factors that cause earthquakes, including plate tectonics. Finally, students investigate how magma and lava from volcanic eruptions contributes to land formation.
Energy, Machines and Motion	Students investigate several forms of energy, starting with a simple, student-constructed storage battery. They then explore the transformation of chemical energy into electricity, light, heat, and mechanical energy. Students learn about force and work as they use simple motors and three different simple machines (inclined plane, pulley, and lever) to lift a load to a given height. In the final section, students compare the motion of a fan car, a mousetrap car, and a roller coaster car.
Earth in Space	Students use shadows, phases, eclipses, and seasons to investigate the relative sizes, motions and positions of the Sun, Earth, and Moon. Students then investigate geological processes, such as cratering, erosion, and volcanism. Students conduct investigations of gravity and tides. Finally, students explore Earth's history as a planet, and compare Earth to other planets in the solar system.
Electrical Energy and Circuit Design	Students begin by building electric circuits. They use ammeters and voltmeters to measure current and voltage, and calculate the power in various devices. Students learn to calculate the total amount of energy electrical devices use. They learn to identify various components in a circuit, including resistors, capacitors, and diodes. Students then have an opportunity to design an electrical device that uses feedback to monitor and control a variable, such as a thermostatic temperature control system.

©2003 Education Development Center, Inc.

Light	Students begin by investigating the movement of light, the formation of shadows, and the electromagnetic spectrum. Students start to compare two models—particle and wave—to explain the behaviors of light they investigate. Next, students examine the reflection and refraction of light by mirrors, prisms, and lenses. They then use combinations of lenses to construct simple optical devices (such as a telescope). Finally, students investigate the structure of the human eye and visual perception.
Organisms—From Macro to Micro	Students explore the growth and development of a diverse set of organisms. First, students investigate the brief life cycles of Wisconsin Fast Plants and cabbage white butterflies. Students can easily observe traits passed on from parents to offspring. This leads to an exploration of cells, and asexual and sexual reproduction. In the remaining lessons, students design their own inquiries with organisms such as mold, yeast, Daphnia, and Hydra. Finally, students create a dichotomous key for the organisms encountered during the module.

FORMAT

Teacher Guide: Each STC/MS teacher's guide features an alignment matrix that links each module's content to the NSES content standards for grades 5–8. In addition, the teacher's guides provide background material on scientific content and student misconceptions, advice on materials preparation and setup, and instructions for guiding classroom investigations and discussions. They also include master copies of student record sheets, and suggestions for relating science to other areas of the curriculum.

Student Guide: Reusable student guides contain detailed instructions that guide students through classroom investigations. Student guides also include reading selections, that are frequently framed by photographs and illustrations. All lessons in each module include one or more reading selections.

Materials Kit: Each STC/MS module kit contains all of the equipment needed to implement the module with five classes of 32 students. Consumable materials can be replenished by purchasing a refurbishing kit.

INSTRUCTIONAL DESIGN

Both the content and the pedagogy of the STC/MS program were developed with the needs and interests of the middle school learner in mind. The program focuses on students' emerging abilities to explore causal relationships, discover patterns, and draw conclusions based on their observations. The instructional strategies built into the program allow students to work cooperatively and independently as they progress through challenging, carefully structured investigations.

Each STC/MS lesson is based on a 4-stage learning cycle that is grounded in educational research and practice:

- First, students **focus** on what they already know about a topic, and identify questions they want to explore. They develop goals for learning through brainstorming and discussion.
- Next, students **explore** a scientific phenomenon, following a carefully structured sequence of classroom investigations. They often work in groups to record observations in science journals.
- Third, students **reflect** on their observations, review their original ideas and discuss results with team partners, and develop new explanations for what they have observed.
- Finally, students **apply** their learning to new contexts and real-life situations.

©2003 Education Development Center, Inc.

ASSESSMENT In the STC/MS program, assessment is woven throughout the instructional cycle. The strategies for assessment fall into four categories:

- **Preassessments**
  Each STC/MS module begins with an activity-based assessment of students' baseline knowledge of the topics to be addressed in the module. Teachers can use this pre-assessment to identify areas of confusion or naïve conceptions. Throughout the module, students return to these initial ideas to investigate the growth in their knowledge and understanding.

- **Assessments incorporated into lessons**
  STC/MS provides multiple opportunities for teachers to continuously assess student progress as lessons proceed. Modules include strategies for assessing student participation in lab activities, informal and formal oral communication and presentations, and student work products (such as a science journal).

- **Tests, including both written and performance-based components**
  Each module is divided into two or three sections, and each section concludes with a formal assessment. These assessments include both written and performance-based components, with grading rubrics for evaluating student performance. The final assessment in each module addresses the science content and skills developed during the *entire* module.

- **Anchor activity**
  Each module includes an extensive student research project, or anchor activity. Students work on the anchor activity throughout the unit, constantly adding to and refining it as they gain more knowledge. The anchor project is typically presented at the conclusion of the unit.

©2003 Education Development Center, Inc.