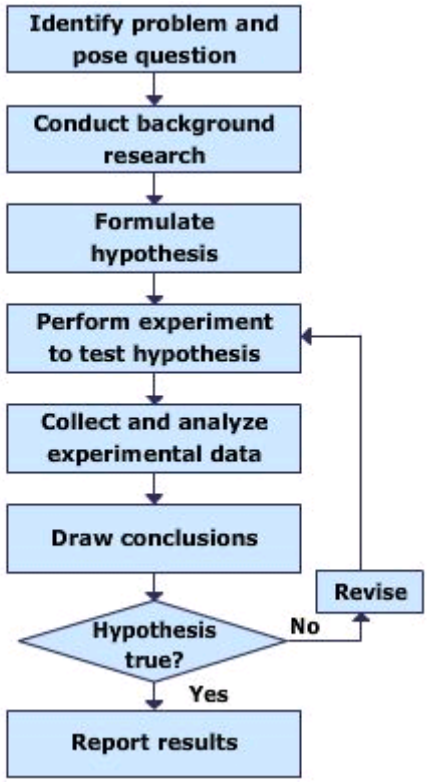
Teaching science through inquiry

CHILDREN ARE FULL OF QUESTIONS about the world around them. Why is the sky blue? How do fish breathe? What causes lightning? Inquiry-oriented instruction stimulates children's natural curiosity and helps them build a deep understanding of science by emphasizing hands-on experiments, research, and discourse.

The process of scientific inquiry

Science has traditionally been taught as a body of abstract and disconnected concepts and principles. These are passively assimilated by students, resulting in decontextualized and rote learning.

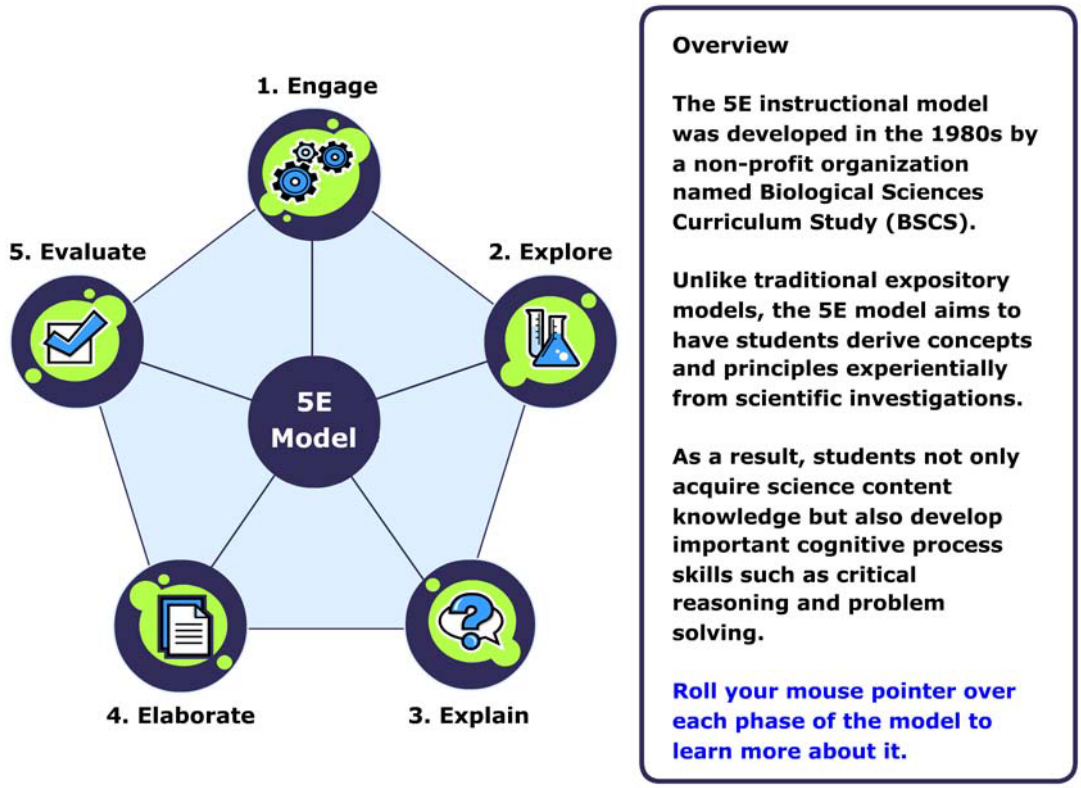
Inquiry-based pedagogy, on the other hand, takes a constructivist approach that engages students in the investigative nature of science (Haury, 1993) through explorations of the natural or material world. The explorations lead students to ask questions, make discoveries, seek explanations, and test findings as they look for answers and develop new understanding (National Science Foundation, 2000). This learning approach is modeled on the process that scientists follow for determining solutions to problems. The process involves the steps shown in the flowchart. By emulating the process, students learn scientific concepts and principles along with scientific ways of thought.



The Process of Scientific Inquiry

The 5E Instructional Model

To successfully implement the process of scientific inquiry in the classroom, teachers need to use a structured instructional framework. One such framework is the 5E model (Bybee et al., 2006) shown in the diagram. The model consists of a sequence of five learning phases—Engage, Explore, Explain, Elaborate, and Evaluate. Roll your mouse pointer over each phase in the diagram to learn more about it.



The Phases of the 5E Model: Engage, Explore, Explain, Elaborate, and Evaluate

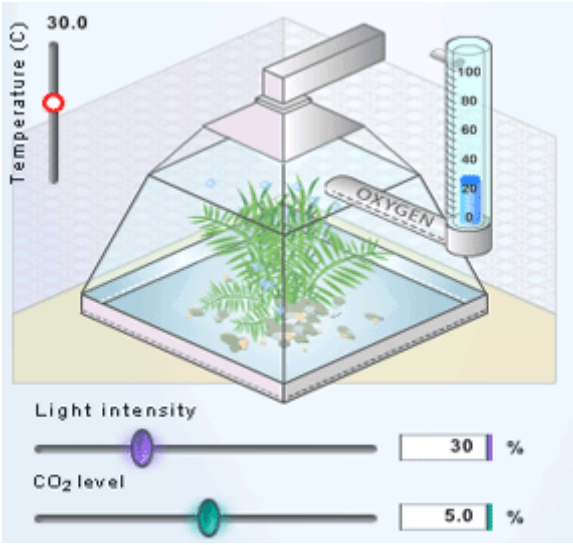
Sample 5E Lesson Plan

Take a look at this lesson plan for an example of how the 5E model enables the teaching of science through inquiry. Created by the National Aeronautics and Space Administration (NASA) as part of its Astro-Venture series, the lesson plan is designed to help children in grades five through eight understand the concept of density and the role it plays in determining the composition of the Earth's layers.

Using technology to support inquiry

Technology facilitates inquiry-oriented science instruction by providing the following:

- *Investigation environments.* Modeling and simulation environments help students visualize scientific concepts and principles that are abstract, complex, or difficult to study using concrete materials. By manipulating variables within these environments, students can investigate "what-if" scenarios (Spitulnik & Linn, 2002).



- *Data collection and analysis tools.* These tools include personal digital assistants (PDAs), graphing calculators, spreadsheet programs, and probes that enable students to record real-time data (such as temperature and voltage) on a computer (Spitulnik & Linn, 2002).

Photosynthesis Lab from ExploreLearning

- *Information access.* The Internet gives students easy access to science-related resources such as articles, animations, real-time data (for example, weather charts), and satellite images. Electronic databases and encyclopedias designed specifically for K-12 students are other useful information resources.

- *Cooperative learning aids.* Students can use software to create presentations, Web pages, and blogs for sharing their learning with each other. Further, communication technologies such as e-mail and virtual discussion forums enable students to collaborate on projects with geographically distant peers and interact with scientists working in the field (Spitulnik & Linn, 2002).

More Information

Astro-Venture
Biological Sciences Curriculum Study
Constructivist Theory
ExploreLearning
U.S. National Science Education Standards

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Kotwal, R. (2007). Teaching science through inquiry. In B. Hoffman (Ed.), *Encyclopedia of Educational Technology.* Retrieved October 18, 2007, from http://coe.sdsu.edu/eet/articles/scienceinquiry/start.htm