

EXECUTIVE SUMMARY—TEACHING ABOUT SCIENTIFIC INQUIRY AND THE NATURE OF SCIENCE

VIRGINIA MATHEMATICS AND SCIENCE COALITION
TASK FORCE
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Science education reform efforts emphasize teaching science for all Americans, and identify scientific literacy as a principal goal of science education. However, developing scientific literacy requires a broader view of science that includes three principal components: the knowledge of science, the methods of science, and the nature of science.

- **Scientific knowledge** includes all of the scientific facts, definitions, laws, theories, and concepts we commonly associate with science instruction.
- The **methods of science** refer to the varied procedures that scientists use to generate scientific knowledge.
- The **nature of science** depicts science as an important way to understand and explain what we experience in the natural world, and acknowledges the values and beliefs inherent to the development of scientific knowledge.

Since scientific knowledge is thoroughly covered in the *Virginia Science Standards of Learning* (Virginia Department of Education, 2010) and *Curriculum Framework for the Virginia Standards of Learning* (Virginia Department of Education), the purpose of this Task Force Report is to more clearly define **scientific inquiry** as a **method of science** and the **nature of science**.

The *National Science Education Standards* (NRC, 1996) provide guidelines for what students need to understand about and engage in **scientific inquiry**. Note that there are two facets to scientific inquiry. First, students should be able to understand about the nature of scientific inquiry as well as the attitudes and abilities they should develop by actively engaging in inquiry. Inquiry also refers to the instructional approaches that enable teachers to teach science concepts through inquiry. When evaluating whether an activity involves students in scientific inquiry, two questions are relevant:

- 1) Does the activity include a research question?

- 2) Do students engage in data analysis to answer the research question?

Effective science teaching also requires teaching about the **nature of science**. Research has provided a clear picture of the appropriate aspects of the nature of science which should be taught in the K-12 setting:

- 1) Scientific knowledge is empirically based.
- 2) Scientific knowledge is both reliable and tentative.
- 3) Scientific knowledge is the product of observation and inference.
- 4) Scientific knowledge is the product of creative thinking.
- 5) Scientific laws and theories are different kinds of knowledge.
- 6) Scientists use many methods to develop knowledge.
- 7) Scientific knowledge is, to a degree, subjective.

Providing an accurate understanding of the nature of science helps students identify the strengths and limitations of scientific knowledge, develop accurate views of how science differs from other ways of knowing, and helps students delineate the types of questions science can and cannot answer. Research indicates that effective nature of science instruction is explicit, set within a meaningful context, and linked to relevant process skills. Furthermore, teaching the **nature of science** and **inquiry** in tandem with **scientific knowledge** encourages students to develop scientific habits of mind that will enable them to be effective decision-makers beyond the classroom.