Some teachers have asked how “The Nature of Science” differs from “The Scientific Method.” There is a common myth that there is only one way to do science: The Scientific Method. However, in spite of its persistence in science textbooks and science standards, there actually is no one “scientific method.” In addition, we find there is much more to science than its special ways of solving problems by testing proposed solutions. The “Nature of Science” (NoS), on the other hand, consists of those seldom-taught but very important features of working science, e.g., its realm and limits, its levels of uncertainty, its biases, its social aspects, and the reasons for its reliability. Popular ignorance of these features of science has lead to many misuses, misrepresentations and abuses of science.

**Science has its limits:** it cannot be used to solve any kind of problem. Science can only address *natural* phenomena (not supernatural phenomena, as such), and only *natural* explanations can be used in science. Supernatural or magical explanations cannot be definitively or reliably tested - they cannot be disproved, since any result of any test could be attributed to some supernatural or mysterious influence. Natural explanations are testable (open to being disproved) by being shown *not* to consistently follow the rules of nature. The fact that the most highly credible concepts in science today have survived such critical testing attests to the practical reliability of scientific knowledge and the processes of science that created that knowledge. Scientific solutions tend to work! In addition, scientific knowledge accumulates over time to give us an increasingly better understanding of the natural world.

Questions that require subjective, political, religious, ethical or esthetic judgment are generally beyond the power of science. Science can be used to shed light on such issues, but it seldom provides any final answers.

**Scientific knowledge is inherently uncertain.** What we know in science is only with a relative level of confidence - a particular degree of probability. Many ideas (understandings) in science have been extensively tested and found to be highly reliable, as close to a fact as an idea can be. Others are merely speculative hunches, awaiting suitable testing to measure their respective probabilities. And there is every level in between.

**Science can be done poorly, and it can be misused.** There are many variations of medical quackery, false advertising and other forms of “pseudoscience,” where unconfirmed claims are presented as “scientific fact” to “prove” a flood of discredited assertions about a whole range of seemingly mysterious phenomena. Students must learn (and practice) the critical strategies for recognizing such claims.

**Science is a very social process.** It is done by people working together collaboratively. Its procedures, results and analyses must be shared with the scientific community, and the public, through conferences and peer-reviewed publications. These communications are critically assessed by the science community, where errors, oversights and fraud can be exposed, while confirmation and consilience (agreement from different lines of evidence) can be achieved to strengthen its findings. Being done by people, science is also subject to any of the biases that its workers have, but its openness to critical science community oversight tends to expose those biases when they have been allowed to creep in.
Additional points to consider in your treatment of the NoS can be found in the Papers and Articles section of the ENSI site at http://www.indiana.edu/~ensiweb/paper.fs.html

Students must learn, understand and retain these very important elements of science. Research has clearly shown that this requires experiences where those elements are repeatedly explicit and vivid. The elements of the nature of science are arguably more important than any particular set of steps supposedly used to solve a problem. Science teachers should commit to making sure that every student is deeply aware of the several elements of the NoS as summarized above.

Many of the lessons on the ENSI site, especially in the NoS section, are designed to provide interactive experiences for students with those elements of the NoS. You can find the index to these lessons at http://www.indiana.edu/~ensiweb/natsc.fs.html Among the perennial favorites in these lessons are: Sunsets, Souls and Senses; Mystery Boxes; Crime Scene; and the Checks Lab. They’re a good place to start, but take a look at the others to provide greater variety, each focusing more on different aspects. The NOS-ENSI Lesson Selection Matrix provided at the top of this page can help in your selection.