

Nature of Science Objectives: Enduring Understandings

The Tentative Yet Durable Nature of Science

A change in scientific knowledge is a strength and allows for the overall durability of scientific knowledge.

1. Scientific knowledge changes over time to be consistent with evidence (from data) and/or new reasoning. Knowledge can change through growth or revision.
2. Scientific knowledge is reliable because it is continually tested and evaluated.
3. The debate of scientific explanations occurs at the level of peer review in a scientific journal and leads to the tentative yet durable nature of science.

Science as a Way of Knowing: A Human Construction Based on Evidence

Scientists construct explanations based on well-reasoned, logical arguments built upon multiple lines of valid scientific evidence using what they already know as a basis.

1. Evidence and explanation are different things: Scientists construct explanations based upon what is known in order to understand or account for new evidence.
2. Objectivity in scientific observation and reasoning is a learned skill/disposition that is an important part of the process.
3. Not all data are valid. In order to be used, scientific data must meet particular criteria: they must be the result of carefully designed tests and observations and the data must be repeatable/duplicated.
4. Scientific investigations, and so scientific knowledge, are based upon an understanding of existing ideas. Because of this, what we know determines what we find out in an investigation.
5. Because scientists are influenced by what they already know, multiple explanations can be produced from the same set of data.

Our objectives correspond to NSES (p.176)- **Standards for Understandings about Scientific Inquiry**

Results of scientific inquiry—new knowledge and methods—emerge from different types of investigations and public communication among scientists. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. In addition, the methods and procedures that scientists used to obtain evidence must be clearly reported to enhance opportunities for further investigations.

Scientific explanations must adhere to criteria such as : a proposed explanation must be logically consistent; it must be open to questions and possible modifications; and it must be based on historical and current scientific knowledge.

Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.

Our objectives correspond to Science For All Americans (p. 2-5)
–**Recommendations for the Nature of Science**

•**Scientific ideas are subject to change**

Science is a process for producing knowledge. The process depends on both making careful observations of phenomena and on inventing theories for making sense out of those observations. Change in knowledge is inevitable because new observations may challenge prevailing theories. No matter how well one theory explains a set of observations, it is possible that another theory may fit just as well or better, or may fit a still wider range of observations. IN science, the testing and improving and occasional discarding of theories, either new or old, go on all the time.

•**Scientific knowledge is durable**

Although scientists reject the notion of attaining absolute truth and accept some uncertainty as a part of nature, most scientific knowledge is durable. Continuity and stability are as characteristic of science as change is, and confidence is as prevalent as tentativeness.

•Science demands evidence

The production of scientific claims demands evidence, so scientists concentrate on getting accurate data.

•Science is a blend of logic and imagination

Although all sorts of imagination and thought may be used in coming up with hypotheses and theories, scientific arguments must conform to the principles of logical reasoning—that is testing the validity of arguments against criteria of inference, demonstration and common sense. But scientific concepts do not emerge automatically from data or from analysis alone, inventing hypotheses to imagine how the world works and then figuring out how these explanations can be tested is a creative activity.