

## Key Ideas from the Literature: Nature & Practices of Science

### *Science is ...*

- Science is evidence-based, consistent, durable, peer-reviewed, self-correcting and based on observations and hypotheses within a testable framework of ideas.
- Science is a social enterprise (NRC, 2012). Evidence is collected, interpreted and influenced by current scientific perspectives and by the society, culture and even the scientists' personal subjectivity.
- Science is a way of looking at the world that may be distinct from other worldviews based on ethnicity, culture, and socioeconomics, including everyday ways of thinking and talking about the world.
- Science is done through a set of practices, not a distinctive approach common to all science, as in a single "scientific method", nor is uncertainty a universal attribute of science (NRC, 2012).
- Science is done by using multiple methods that guard against error including: (a) observations and experiments that build and test fundamental theories and concepts; (b) systematic observation and measurement of phenomena; (c) mathematical models that incorporate theories and observational data and are tested against new data; (d) systems of checking measurements and peer-reviewing research studies to catch errors; and (e) scientific debate and deliberation about the meaning of the evidence, with special attention given to new evidence that calls previous ideas into question (Weber, 2011).

### *Learning & teaching science*

- Science in school has been observed by researchers as attempting, but often failing, to communicate an accurate view of science (Cobern, 1991; Duschl, 1988). Rather the curriculum often provides students with a stereotype image of science as authoritarian and absolute truth.
- Implicit instruction about the nature of science, such as performing scientific inquiry with no reflection on the nature of the activity, is insufficient for students to develop an understanding of what is science. The nature and practices of science needs to be explicitly part of instruction (Abell, Martini, & George, 2001; Lederman, 1999; Moss, 2001).
- A narrow focus on content alone has the unfortunate consequence of leaving students with naive conceptions of the nature of scientific inquiry and the impression that science is simply a body of isolated facts (NRC, 2012).
- The modeling undertaken, the arguments developed, the explanations constructed in the classroom can only ever be approximations of practice. The distinction is that scientists are creating/generating/discovering new knowledge. Students rarely do that, but rather use practices that approximate what scientists do to learn knowledge that has already been created/discovered (Osborne, 2011).
- Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world (NRC, 2012).

### ***References for Key Ideas from Literature***

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