

Teaching Science in the Context of Societal and Personal Issues

Introduction

From personal health to climate change and from bioethics to energy, a myriad of personal and societal issues requires citizens to make informed decisions based on their understanding of science and its applications. These issues provide a rich and motivating context in which students can learn scientific and engineering practices, crosscutting concepts that unify the study of science and engineering, and the disciplinary core ideas of the sciences and engineering (Klosterman and Sadler 2010). These disciplines influence every aspect of our lives, and in turn, we influence the direction and use of scientific and technological endeavors (Roberts and Bybee 2014). In addition, science and engineering are central to our well-being and success as individuals, as members of society, and as members of the global community. Therefore, NSTA advocates that K–16 science and engineering instruction be provided within the context of personal and societal issues. Contextualizing science learning through compelling issues not only showcases applications of science and engineering, but doing so can also transform the learning experience itself such that more impactful learning outcomes can be achieved (Zeidler 2014).

NSTA strongly promotes the education of a citizenry that understands the interdependence of science and engineering and the influence they have on society and the natural world as promoted in *A Framework for K–12 Science Education* (NRC 2012). This requires that we not only know, understand, and value scientific and engineering core ideas, practices, and crosscutting concepts, but that we are able to use and apply science and engineering in our personal and social lives (Sadler 2011). Both science and engineering are human endeavors that involve similar basic procedures; however, science involves exploration of the *natural world* seeking explanations—based on evidence—for objects, organisms, and phenomena encountered, while engineering focuses on solutions to problems in the *human-made world*.

There is a national consensus about the central role that science and engineering play in our society and its connection to our nation's competitiveness and future economic prosperity (Business Roundtable 2005). However, we have yet to ensure all students have the ability to use what they have learned when making decisions about what is appropriate in personal, societal, and global situations involving science and engineering, and to value these endeavors (Lee et al. 2013).

The purpose of understanding science and engineering is not solely for the sake of learning, but rather to enable and motivate citizens to contribute to and engage in society (DeBoer 2000). Therefore, NSTA sets forth the following declarations to promote the teaching of science and engineering within the context of personal and societal issues.

Declarations

Regarding what students should be able to know and do in science within the context of societal and personal issues, NSTA recommends that students

- know the major concepts, hypotheses, and theories of science and be able to use them;
- include knowledge of science concepts and practices of science in making responsible everyday decisions;
- engage in science and engineering practices in the context of societal and personal issues and problems;
- understand that the generation of scientific knowledge depends upon inquiry processes and upon conceptual theories;
- understand that the invention and improvement of technologies depends on the engineering design process;
- understand that science and its applications are products of human creativity and imagination, subject to verification and rigorous tests;

- recognize that scientific understanding is subject to change as evidence accumulates, or old evidence is re-evaluated;
 - distinguish between scientific evidence and personal opinion;
 - understand how society influences science and engineering and how science and engineering influence society;
 - understand and weigh both the benefits and burdens of scientific and technological developments;
 - be able to consider the trade-offs among alternative solutions when considering decisions that involve competing priorities;
 - recognize that scientific and technological advances may have unanticipated consequences, which only become apparent over time as the technology becomes more pervasive or more powerful;
 - recognize that many decisions are global in nature and that people in other parts of the world are affected by our decisions and faced with similar decisions and issues themselves;
 - understand how sustainable solutions to societal issues are those that meet the needs of the present without compromising the ability of future generations to meet their own needs;
 - recognize how scientific and technological advances may affect the environment positively or negatively;
 - appreciate the value and role of research and processes of engineering design;
 - know reliable sources of scientific and engineering information, how to access them, and how to use these sources in the process of decision making; and
 - analyze the ways in which science and engineering ideas and practices can contribute to solving societal and personal issues.
- incorporate scientific issues that are personally and socially relevant, and developmentally appropriate, as a way to generate interest in and motivation to engage in relating science to personal and societal issues;
 - focus as much as possible on scientific and engineering issues that are identified by students;
 - incorporate the practices and understanding of scientific inquiry and engineering design;
 - provide multiple learning opportunities that encourage the study of science in personal and societal contexts;
 - provide an authentic learning context by examining the societal dimensions of scientific issue, such as political, economic, and ethical considerations;
 - approach decisions based on scientific evidence in an open unbiased way, while acknowledging that different perspectives, views, beliefs, and other ways of knowing exist;
 - prepare students to become future citizens who understand science and engineering and are willing to engage in making responsible and informed decisions.

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Regarding how science instruction should occur within the context of societal and personal issues, NSTA recommends that science instruction

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