

COMMENTS ON THE BOSE SCIENTIFIC STANDARDS

The major question is whether the social sciences are part of science and therefore are part of STEM. I believe the National SCIENCE Foundation and the National Institutes of Health believe so, since the social and behavioral sciences are integral parts of both agencies' portfolio of research they support.

In addition, the House reauthorization of the America COMPETES legislation includes the following language: "For the purposes of Title II of this Act, the term `STEM' should be understood to be an umbrella term that covers every academic discipline and research area supported across the entire Foundation, including discipline based education research. Where the term `STEM' is used elsewhere in this Act, it is likewise meant to cover all disciplines supported by the relevant agency, or in the case of the PCAST and NSTC committees established in Title III, STEM should be understood to encompass the entire breadth of Federally supported research areas."

It is clear that this report thinks not. Apparently no "major scientific ideas (1-1 line 7) have come from our sciences and therefore students do not need to know them.

References to earlier work (1-3 line 12) that have included our sciences are supposed to help build on "prior work" (1-3 line 12), but are ignored by this report.

As always there is citing of "a large growing body of research on teaching and learning science" (1-4 line 4-5. The references to research permeate the report). Presumably, the Committee believes this is 'scientific' research. Who conducts most of this research? Social and behavioral scientists, ergo we must be part of "science."

The report notes: "...children begin school with a set of ideas about the physical, biological, and social worlds" (1-5, line 9-10) and therefore "educators can build on what children already know and do" (1-5 line 11-12). If children have ideas about the social world, why not include that world in teaching them about science, how it is done and what the responsibilities of a scientist are.

"...all sciences share certain common features at the core of their problem-solving and inquiry approaches" (1-8 lines 4-5). This includes the SBE sciences!

"Research suggests personal interest and enthusiasm are important" for children to learn science (1-8 lines 21-22). In addition, "classroom learning experiences in science need to connect with students' own interests and experiences (1-9 line 1). This point is reiterated throughout the report. Young children have an interest in their social world (see above). Teachers need to use this to introduce social and behavioral science concepts to teach them how to do science.

"Research demonstrates the importance of enlisting and embracing diversity" (1-9 line 20-21). The social and behavioral sciences have taken the lead in this research and also in the implementation of programs to enhance diversity. Using the social and behavioral sciences to teach the importance of diversity would seem imperative.

The major domains (1-11, lines 6-8) are clearly not inclusive of all the "major domains" in science!

“Students can see better how science and engineering apply to real world problems.” Since I suspect most of those “real world problems” are social, economic, and political phenomena, omitting the SBE sciences as worthy of study ‘as science’ will leave out an important part of the story.

Reference is made to the importance of “Science, Engineering, Technology, and Society and the need to explore the historical, social, cultural, and ethical aspects of science, engineering and technology” (1-12, lines 20-22). How do you do this without including the study of the social and behavioral sciences as part of the ‘science’ curriculum?

All of the identified ‘key elements of science’ (2-1) and discussed throughout this section can be applied to the SBE sciences as well.

It is quite interesting that how engineering gets integrated into this framework, but not the SBE sciences. Apparently, learning how to build stuff is important, but understanding human and social behavior in a scientific way is not.

Students “need to be able to answer questions about the world,” and need to “understand the country’s current and emerging social, technological, and environmental issues (3-1 lines 11-14). How do students’ do that without a ‘scientific’ understanding of human and societal behavior?

“Genes and genes by environment interactions determine how organisms look and perform” (3-3 lines 12-13). Learning about the behavioral environment will clarify this for students.

Interacting organisms (3-4 lines 3-4) also have social environments.

Biodiversity – “the human impact is exceeding sustainable limits” (3-6 lines 7-8). Are we going to teach students about the ‘human impact’ and why this is occurring? Are we going to rely on social/behavioral research to explain this phenomenon?

“Human Interactions with Earth” (3-9 line 19). How humans affect the earth and how Earth’s changes affect humans. How do we teach this without teaching about the social and behavioral sciences?

“The designed world and the natural world co-exist and in some ways are interdependent” (3-14 lines 22-23). There is also interdependence with the social world. The designed world is created by humans – should we not teach about their motivations, perceptions, etc.?

“Technology both affects and is affected by decisions people make...” (3-15 lines 2-4). Should we not teach about how these decisions are made by people?

Solving technological problems involves “time, resource, economic, environmental, social, and ethical considerations” (3-15 lines 21-22). Student should learn about social, behavioral and economic research that indicates how these constraints are created and impact the implementation and use of technology.

“Finding the best solution often requires making decisions regarding tradeoffs among competing criteria” (3-16 line 7). Again, teaching about how decisions and tradeoffs are achieved requires understanding social and behavioral science research.

“What are the societal risks and benefits of technology” (3-18 line 11). Is this taught in a vacuum from understanding social and political objections to new technology, see the GMO case? I don't think this is possible.

“How have developments and uses of technologies brought about changes in the natural environment and human culture” (3-18 line 13-14) Is human culture taught without regard to teaching about social/behavioral research?

Cross cutting elements include: history and cultural role of S&T, effects on society, effects of societal norms and values, personal decision-making, and career choice (4-1 lines 12-18). How do you teach this material without the scientific evidence provided by the SBE sciences?

“There are cause and effect relationships to be explored across all the disciplines of science, for example in population changes, in disease spread, ...” (4-6 lines 16-17). How do you explain population changes without reference to the disciplines in the social and behavioral sciences?

“Maps” (4-10 lines 13). Can you talk about maps without understanding geography and spatial science?

“Instruction should also include discussions of the interactions within a system” (4-12 lines 22-23). Having students study social networks would provide a ‘relevant’ example to explain this phenomenon.

Students need to understand “how change occurs in nature and in social and technological systems” (4-16 line 15-16). How are you going to explain social change without teaching about the social and behavioral sciences?

“Science, engineering, and technology do not exist in isolation from society: they are a part of, contribute to, and are influenced by the society and culture in which they take place. Consideration of the historical, social, cultural, and ethical aspects of science and technology needs to be linked to other social science studies and raised in the science classroom” (4-19 lines 6-9). Hurrah!

“Recent educational research highlights...” (4-24 line 12). Social/behavioral research is ok for justifications, but not for teaching and studying?

Science education should “develop scientific habits of minds such as the critical spirit which is the hallmark of the scientist, an understanding of the approach to scientific inquiry, and how to reason in a scientific context” (5-1 line 6-8). I am arguing that this can be done as easily and perhaps better by including the social and behavioral sciences as part of how students learn and understand science.

Another generic question: Is it possible to DO science, given the importance of teams, etc., without understanding humans? If not, then incorporating the social and behavioral sciences into this framework is imperative.

“Judging the validity of knowledge claims also requires knowledge to be contextualized in its socio-historical context” (5-7 lines 7-8). This is further evidence of the need for social/behavioral knowledge.

“Scientists and engineers are always part of a wider social environment” (5-8 lines 2-3). Should they not understand that larger environment based on scientific evidence?

Analyzing large data sets is important (5-17 line 8). The social/behavioral sciences are full of large data sets that would probably effectively speak to the students' interests and motivate their learning.

"Other opportunities for applying and using scientific knowledge occur at the interface between science and social science, where the practices of constructing and critiquing arguments are applied to discourse around societal problems and the role of science and engineering in understanding and addressing them" (5-23, 24). So, we are important, but somehow distinct from 'science.'