FROM TEST TUBES TO YOUTUBE: NATURE OF SCIENCE IN SOCIOSCIENTIFIC ISSUES AND HISTORY

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In preparing students to address socioscientific issues (SSIs), teachers must go beyond scientific content, and even beyond ordinary scientific reasoning. Citizens and consumers must understand the epistemic structure of science and its subsequent cultural communication (Kolstø, 2001; Raveendran & Chunawala, 2013; Ryder, 2001). Students must learn how scientific claims are grounded in observations in the lab or field, but also how they are transmitted and transformed in social contexts and the media—from the lab bench to the judicial bench, from test tubes to YouTube (Allchin, 2013, pp. 1–27). This knowledge guides non-experts in assessing the trustworthiness of scientific claims.

In this presentation, I describe the essential elements of this understanding—namely, how to conceive the nature of science (NOS), or how science works (Rai, 2011). Ironically, perhaps, this parallels a list of all the possible errors in science, or ways science can go wrong (Allchin, 2012a; Osborne, 2011).

The inventory of NOS concepts includes traditional internal (narrowly empirical, or evidential) concerns, as well as external (social and discoursive) contexts. It also includes both normative (philosophical) and descriptive (historical and sociological) dimensions (and their relationship to each other) (Allchin, 2013, pp. 107–120). This wide-ranging and inclusive "Whole Science" approach contrasts with the more limited focus and short lists proposed in recent years by some science educators (for example, by Lederman, Abd-el-Khalick, Bell & Schwartz, 2002; McComas & Olson, 1998).

Teaching this vast understanding of NOS seems challenging. What should teachers do? Science educators recognize three approaches as effective: student-led inquiry, contemporary cases, and historical cases. Each has benefits and deficits. Teachers must use and balance all three methods as complementary (Allchin, Andersen & Nielsen, 2014). However, the essential role of history is often overlooked. Educators need to appreciate the importance of studying scientific processes retrospectively, to understand fully how controversies and uncertainties are ultimately resolved. Teaching NOS should also be explicit and promote student reflection. Yet didactical lectures are not as effective as an inquiry style (Deng et al., 2011). Students should be actively involved in their own learning, for NOS as much as for science. Accordingly, for historical cases in particular, teachers must revive the historical perspective of science-in-the-making and pose open-ended NOS questions (Allchin, 2012b; 2013, pp. 28–45, 241–257; Hagen, Allchin & Singer, 1996). Educators thus benefit from collaborating with historians of science in producing valuable curriculum materials.

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