Excerpts from

Towards an Understanding of Socioscientific Issues as Means to Achieve Critical Scientific Literacy

A. Raveendran and S. Chunawala
HBCSE (TIFR), Mumbai.

Why learn science? Learning science should provide us with the ability to negotiate and make decisions regarding complex social issues that have theoretical or conceptual links to science. (Fowler, S., Zeidler, D., & Sadler, T. (2009).

There exists a gap between what students are taught in the classrooms and what they experience in the real world. This gap can be bridged by embedding socio-scientific issues in school science curriculum.

According to Hodson (2003) in A. Raveendran and S. Chunawala, a politicised science curriculum which enables students to understand that science and technology-related decisions are taken in accordance with particular interests of certain groups and are justified by certain values often “prejudicial to the needs of the poor and powerless”. In effect, we advocate a conflict view of science education that seeks to question power relations and foster social justice concerns in the students. (A. Raveendran and S. Chunawala, 2013).

The following is an excerpt from Going Beyond STS: Towards a Curriculum for Sociopolitical Action, by Derek Hodson in The Science Education Review, 3 (1), 2004

Regrettably, science is often regarded as a body of knowledge that can be transmitted by teachers, memorized by students, and reproduced on demand in examinations. Regrettably, too, science is often portrayed as the de-personalized and disinterested pursuit of objective truth, independent of the society in which it is practised and untouched by ordinary human emotions, values, and conventions.

Although the science-technology-society movement (STS education) has done much to shift the emphasis of science education in some educational jurisdictions towards a more authentic representation of scientific knowledge and scientific practice (Kumar & Chubin, 2000; Solomon & Aikenhead, 1994; Yager, 1996), the reforms do not go nearly far enough. Although some curricula draw on elements of the history, philosophy, and sociology of science to show students how scientific inquiry is influenced by the sociocultural context in which it is located, this insight is not used to politicize students.

Too often, teachers avoid confronting the political interests and social values underlying the scientific and technological practices they teach about, and seek to avoid making judgements about them or influencing students’ views.

Two points are worth making. First, curriculum cannot be value-free. Values are promoted as much by what is omitted as by what is included. Second, the so-called “value-free” approach diverts attention away from what I consider to be the major purpose of science education: preparation for responsible citizenship.

It almost goes without saying that science education should lay the foundation for further study and for a potential career as a scientist, engineer, or technician, but it should also be concerned with enabling young citizens to look critically at the society we have, and the
values that sustain it, and to ask what can and should be changed in order to achieve a more socially just democracy and to ensure more environmentally sustainable lifestyles.

So what is SSI? Socio-scientific issues (SSI), are science-related issues at the interface of science, technology and society that have ethical/moral/social dimensions to them. These issues while representing social dilemmas, involve open-ended, debatable and real-world problems, subject to multiple perspectives and solutions.

According to Kolsterman and Sadler, 2010, the use of socio-scientific issues while addressing content knowledge increases students' interest and motivation in science and also develops higher order thinking skills among them.

If we have to develop curriculum models dealing with contemporary issues in general, and SSI in particular, it must include students’ active participation in developing their argumentation skills, the ability to differentiate science from non science issues, and the recognition of reliable evidence and data. (Zeidler, D. & Nicholas, B 2009).

What is lacking in most of the science classrooms is the focus on the recent or contemporary social scientific issues which give the children a scope in critical thinking and informed decision making.

Significance of including SSI in science curriculum. The deliberation of SSI requires a basic understanding about nature and content of science as well as the ability to engage in informal reasoning and argument. Since these factors are present in the principles of modern science, there is a possibility of these factors fitting well in the context of science classrooms. Also, in today's school scenario the factors such as argumentation, informal reasoning, content knowledge, etc are normally expected from students. (Fowler, S., Zeidler, D., & Sadler, T. (2009).

- Helps students to develop connections from theoretical concepts to real life situations
- Allows the students to learn the nature and process of science illustratively
- Promotes rational and informed decision making
- Helps consider and appreciate the ethical aspects of an issue
- SSI requires students to develop multiple perspectives of any event which is how real issues are outside the formal school setting.

The term Scientific Literacy (SL) is a concept used to 'express what should constitute science education for all students' (Roberts, 2007). The term is contested politically and intellectually and multiple meanings have been attributed to it. Douglas Roberts (2007), in an extensive review devoted to discussing the meanings of SL identifies two positions that have 'come to represent the extremes on a continuum'. He terms them vision-I and vision-II. Vision I represents a view of SL that emphasizes the “cannon of orthodox science”- “products and processes of science itself” in the curriculum. Vision II advocates SL “through situations with a scientific component”- situations students are likely to encounter as citizens (Roberts, 2007). Roberts points out that “considerations other than science” are also emphasised in this vision of scientific literacy. In the vision I-vision II continuum, we position ourselves at the vision II end and advocate a critical scientific literacy. The concept of a critical scientific literacy is not new. Several science educators (Roth & Désaultels, 2002; Hodson, 2003) have advocated it. Weinstein ( 2008) defines critical scientific literacy as, “a certain scholarly and activist tradition rooted in dialogues between Marxism, Anti-racism, Feminism, Queer Politics, Liberation Theology, and anti-colonialism—for starters—but also to a prior tradition
both within science communities as well as “lay” spheres challenging science’s embeddedness within the militarism and capitalism”.

To understand the issue of whether the Indian Science curriculum has any scope to deal with SSI in the manner we advocate to use it, we examine the National Focus Group's position paper on the Teaching of Science (National Focus Group, 2006) for its vision of scientific literacy and its advocacy for STS education. This position paper informed the National Curriculum Framework 2005 on which recommendations for textbook writing, both at the national and state level have been based. The position paper appears to advocate a vision of scientific literacy with emphasis on the learning products and process of science as evidenced in this statement:

_Facts, principles, theories and their applications to understand various phenomena are at the core of science and the science curriculum must obviously engage the learner with them appropriately_ (p.11, Position Paper on the Teaching of Science)

According to the position paper, the “general aims of science education” should be understood in terms of 6 validities- cognitive, content, process, historical, environmental and ethical validities.

Cognitive validity requires that the material be age-appropriate and within the developmental level of the child while content and process validities emphasize the need for factually correct content and appropriate training in the methods of the science. Historical validity requires that some history of science be included so that students appreciate how 'concepts evolve with time' and get acquainted with biographies of prominent scientists while environmental validity requires that the student “appreciate” issues at the interface of science technology and society. Ethical validity requires that student develop certain habits of the mind like honesty, freedom from prejudice and objectivity. Although a hierarchy in the importance of the validities are not stated, there is an implicit sense that the core emphasis is on content and processes of science.

References