

Providing Authentic Portrayal of Science in Sustainability Education

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Sustainability is neither a vision nor an unalterable state but a creative and local process of searching for balance that spreads into all areas of urban management and decision making. A sustainable environment involves the protection of natural wealth, the controlled consumption of nonrenewable resources, the controlled emission of contaminant agents, the maintenance of biological diversity, the health of the inhabitants, and the preservation of flora and fauna . In recent years, much attention has been devoted to authentic science representation in environmental and sustainability education in Canada. More specifically, the concern has arisen from the inability of students to relate science knowledge to their own history, culture, and social and physical environment. The concerns have until now been mostly directed toward the junior and senior high school levels of science education. With increased discussions relating to global change and sustainability, all levels of education from elementary to post secondary must also be included when attempting to promote an authentic science context in teaching about sustainability and related environmental issues. This paper outlines one approach that could be taken using a Science-Technology-Society-Environment (STSE) context applied to science education in Canada.

Beginning with the discussions that arose around the Science Council of Canada study of science education in Canadian schools (Mrazek 1983,1986), through the challenges of implementing the new science curricula of the 1990's (Mrazek 1989), to the challenges of introducing a Pan Canadian common framework of science learning outcomes into the provincial curriculum (Mrazek 2002, 2005), there has been a consistent attempt to create a mandate and classroom environment which will promote scientific literacy for all students. The scientific literacy envisioned would allow students to better understand the complex interrelationships of a world viewed through a Science-Technology-Society-Environment (STSE) perspective. The emergence of Sustainability Education and teaching for sustainability provides an excellent opportunity to promote authentic science by using an STSE approach. Science classrooms provide a natural venue for the integration and focus on sustainability..

An STSE context for science education is one stance that is being brought forth as a way of dealing with science in a social context – in our case a Canadian social context. This context, when applied to curriculum materials, will yield one kind of assessment for curriculum development, implementation, and evaluation in Canadian science education. This assessment would reflect goals of education held in common by Canadians, goals such as acquisition of

basic knowledge and development of skills and attitudes in the sciences with appropriate local, national, and international emphasis; development of an understanding of the meaning, responsibilities, and benefits of active citizenship at the local, national, and international levels; development of a commitment to the careful use of natural resources in Canada and to the preservation and improvement of the physical environment; and the fostering of an ability to understand and respond to change as it occurs in personal life and in society.

Many science educators already do convey, almost intuitively and quite often unconsciously, many elements which are included in an STSE context. This usually occurs not in attempting to fulfill the objectives of science education but rather in an effort to comply with the more general goals of education.

An STSE context establishes a relevance for the student and has as its basis the influences of the Canadian social and physical environment. The influences of the Canadian social environment include the body of customary beliefs and social forms which constitute a distinct complex of traditions referred to as Canadian culture. These influences are reflected in the unique characteristics of science in Canada, the philosophy underlying science activity in Canada, and the relationship of Canada's history, politics, and sociology to science. Therefore, interaction of science and Canadian society, where science includes all science disciplines and technologies, and Canadian society includes all aspects dealing with Canadian people, is integral in an STSE context for science education. Science in an STSE context should align the goals of science education with the current needs of Canadian society.

Science is a discipline of many dimensions which include philosophical, empirical, historical, and technological components. In order for an STSE context to reflect these many dimensions, it must include a number of content and methodological components.

If an STSE context for science education is to be applicable, it must be developed around the interdisciplinary nature of science which would allow science to become a function of its history, philosophy, and relationship to Canadian society. To allow science education to close the gap between science and society, science teaching must consider the issues and problems facing Canadian society. Science education could promote an understanding of science which would allow its incorporation into our cultural and social patterns as well as demonstrate the relation of processes in the sciences to investigations of current issues. For this to occur the context must include accurate representation of the effects which scientific and technological developments are having on Canadian society.

The unique characteristics of science in Canada can be conveyed to encourage students to develop an awareness of the significant role of Canadian scientists and technologists in Canada's growth and development, as well as their significant contributions at the international level of science. If a student is presented science in an STSE context which includes a historical element, not only is the impact of science and technology upon Canadian life conveyed but also also provides insights as to how they can be used to promote sustainable development.

Though Canada, like most countries, seems to lack a comprehensive philosophy of the type of life and environment desired for the future, it is possible to identify the philosophy underlying Canadian science. If, for example, students are made aware of our British legacy of an ideology that science was more than a tool for the understanding of nature, they will be in a better position to understand the unique way in which the advance of science in Canada followed technology and defined the social needs rather than preceded it.

If students are to become scientifically literate they must be able to understand both the language of pure science, which is essentially international and independent of cultural, social, and political background and which allows us to understand nature, and applied science or technology which serves as a link between science and society. The integral relationship of the two could be used to emphasize the interrelationship of pure and applied sciences in Canada and throughout the world.

To enable science education in Canada to include the fundamental relationship of Canadians to their environment and the need to look at sustainability of that environment, science instruction could focus on an inquiry approach centered within the most pressing problems of Canadian needs. By teaching science as inquiry students will develop an understanding of knowledge of science and the process by which that knowledge comes into existence and is accepted. If students are to comprehend the direction of science in Canada, they will have to be familiar with Canadian science policy and the impact the political structure in Canada has on defining what areas will be supported in research and development. Knowledge of science policy is a prerequisite for students to understand and critically comment on the direction of research in science. With necessary background information on science policy and research emphasis, students will be able to question the present research and development support, and by attempting to find answers to their questions become aware of the present state of science as it pertains to the concept of sustainability.

STSE concepts should be presented in a context which allows students to examine topics of current scientific interest, including analysis of current problems and possibilities, and to participate in studies of local phenomena or documented cases from the Canadian scene. By providing concrete reinforcement of science concepts which allows students to develop an awareness of the physical and natural world in which they live, a commitment to the preservation and improvement of their physical environment may be developed – a central thesis of sustainability. If students are able to recognize the impact of science on the ecological balance of Canada's natural resources in their own community, it will be that much easier to consider that impact on a national or international scale.

Promotion of more Canadian produced materials related to these issues will ensure that value-based attitudes, which are implicit in each piece of instructional material, are consistent with those attitudes which reflect the goals of science education in Canada. Hopefully the impression that nothing is happening in Canada in science or that there are no scientists and inventors in Canada may be replaced by a balanced view of Canadian science within the larger context of science on an international or universal scale. Recent examples could include documentaries such as Water Under Fire (Gallant, Byrne and Mrazek 2005) and Understanding Global Change (Mrazek 2004).

Through science in an STSE context, students learn that regions of Canada are interrelated through energy requirements, resource use, environmental concern, and numerous other factors. Regionalism is replaced by the primary concern of science policy in Canada, and when we consider sustainability, throughout the world. An example is the development in students of concerned awareness of the unique problems of the North and science is integrally involved in the causes and solutions of those problems. Through such an approach, not only can science in an STSE context provide assistance in overcoming problems of regionalism, it can provide students with a sense of identity beyond the scope of their local environment.

It will not always be possible to include all elements of an STSE context when teaching certain science concepts or teaching science at differing grade levels. However, if science is taught using a variety of contexts within which science knowledge can be deployed, including an STSE context, then we are sure to incorporate more of the aims and goals of sustainability education.

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