Towards Indigenous Literacy: Science teachers learn to use indigenous knowledge resources

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Environmental education

Under the influence of Agenda 21, adopted at the Earth Summit in Rio de Janeiro in 1992, environmental education has increasingly been recognized as a critical element in the process of improving and conserving the world's environment (Tokar 1992). This growing awareness of environmental education stems from a challenge posed by grassroots community groups all over the world, who are exploring alternatives to the dominant monocultural paradigms in ecology and school curricula (Third World Resurgence 1992). These alternatives include lessons from indigenous peoples, who urge the wider community to be kinder and gentler to the environment. Such lessons are based on the tenets of environmental education, which is aimed at changing the attitudes and behaviour of individuals and societies in order to bring about positive social transformation and to promote environmental ethics (Lucas 1979).

The Workshop

The interface between school and indigenous knowledge of local plants is rarely a focus of attention in American classrooms. The transfer of indigenous knowledge from everyday life to school work is not always valued or encouraged, and indigenous ways of knowing may not be recognized by teachers. To meet this need, an interdisciplinary group of teachers met at Pennsylvania State University in the summer of 1996 to learn about the role of native plants in the teaching of science. This article presents the highlights of the workshop and provides a context and a rationale for the use of indigenous knowledge in the classroom.

Building on the region's rich variety of local species, the summer workshop enabled the participants to develop teaching methods based on a constructivist perspective: teachers and students construct their own understanding and meaning, on the basis of their own experiences.

Drawing on their work in a local elementary school, the teachers attending the workshop learned to utilize local knowledge systems to construct a thematic unit on plants and animals; this is part of a larger unit that will include plants and habitats from other ecosystems. In preparation for the workshop, a sample of five species of herbaceous wild flowers were successfully germinated and grown: 1. *Aquilegia canadensis* (Wild Columbine), 2. *Asclepias tuberosa* (Butterfly Weed),

3. *Aster novae-anglae* (New England Aster), 4. *Baptisia australis* (Blue False Indigo), and 5. Woody vine, *Campsis radicans* (Trumpet Vine). These plants, all native to Pennsylvania, were grown from seed and later planted in a sunny spot on the school grounds. The idea was that being actively involved in learning about the plants, organisms, habitats, variation, and biological diversity of African and North American ecosystems would help students to construct their own meaning and understanding of ecology, by relating this information to the native plant habitat area. The goal was to foster new conceptions of knowledge, both international and indigenous, as well as to establish a basis for lifelong science learning, informed by educational practice (Spork 1992; Unesco-Unep 1988). During their discussions, the teachers contributed their own disciplinary expertise, examining ways to connect what they knew with the environment.

Indigenous knowledge — a valuable resource

By involving in-service teachers in the discovery of local botanical resources, classroom practice acquires new meaning. The workshop emphasized that teachers need to be trained to recognize indigenous knowledge systems. They should also encourage rural students to bring to their science classrooms the local knowledge of flora and fauna native to the area in which they reside. If teachers are not trained to recognize indigenous knowledge of local plants, they will continue to neglect it, deny it, or even denigrate it when it appears as part of student responses in classrooms. Science teachers must be trained to value indigenous knowledge of plants, because it is part of the knowledge which students bring into the classroom (Hills 1989).

In an article published in the Monitor (December 1995) vol. 3 (3), Kroma laments that, in many countries, enrollment and retention in science and mathematics are unacceptably low. This is due in part to a disjunction between course content and the local knowledge of students. Kroma argues that science and mathematics would be more popular if the course content reflected the indigenous knowledge of local communities, and if it featured familiar subject matter, which has traditionally been excluded from science curricula.

Kroma's comments appear to owe something to Piaget's theory that learners abstract understanding from experience. Many opportunities are lost when teachers ignore their students' prior knowledge of indigenous ways of knowing. Opportunities to teach language skills by describing native plants in the students' garden, or recounting local history by discussing local heroes and heroines can reinforce the links between what is learned in the classroom and what students already know.

Construction of knowledge

Various theories have been put forward

to explain the interaction between indigenous knowledge and formal school knowledge. Hawkins and Pea suggest that knowledge develops as a result of the interaction between an individual and his environment, in much the same way that organisms are biologically adapted to their ecological space. The child is surrounded by a rich cultural setting which Hawkins and Pea define as 'objects and events' (1987:294). These play a crucial role in the construction of the knowledge that the student brings into the classroom. Such 'objects and events', which are unique to each individual culture and locality, may include the interaction of the media, people, plants, animals, buildings, informal learning situations, and the practices of institutions such as churches or schools.

Gaining an understanding of the interplay of 'objects and events' in the constructed nature of knowledge provides the rationale for integrating indigenous knowledge into classroom teaching practice. Constructivist scholars classify constructivism under the philosophical paradigm of pragmatism, which the American educator John Dewey helped to create (Dewey 1983). As outlined by Fensham and others (1994), the construction of understanding and meaning is a complex task for both teacher and student. It involves:

- bringing each student's prior knowledge and experiences to the subject area;
- actively participating in learning experiences which challenge, elaborate on, and revise the students' ideas and thinking, and thus expanding or redesigning their knowledge;
- teaching by guiding the students to question, ponder, discuss, and reach conclusions; and
- teaching by providing a fair, open, honest, and supportive learning environment.

One of the findings to emerge from the new perspectives on knowledge construction is that often the scientific knowledge available to the public is not used in its pure form, but is instead integrated into other types of knowledge (Layton 1991). Through this constructivist methodology, students can generate an interest in, and ownership of, the subject matter, precisely because it is relevant to the learner. By the same token, it is misleading to assume that students come to class ready to learn, like so many blank slates. Teachers must take account of the interaction between knowledge which emanates from science (what is actually learned as new knowledge) in relation to a particular situation or problem, and the understanding and dispositions which students themselves bring to bear (that is, the meaning-making processes that occur as part of a rationalization of what they already know and what they learn as new). Freire was emphatic in his critique of the banking method of education, where students are seen as passive depositories of knowledge previously digested by the teacher, and the teacher as the active depositor (1970:52-67). To overcome this apparent teacher-student

contradiction in the construction of knowledge, as addressed by Freire, teachers can encourage students to be not only consumers, but also active producers of scientific knowledge. When students bring to the classroom what they already know, and are acknowledged as knowers, the classroom becomes an interactive environment for knowledge production which engages both the student and the teacher.

Literacy skills

In the example illustrated by the summer workshop, the study of local species provides the relevance and connection with students' environment (Pameroy 1992). When students bring into science laboratories their discoveries and knowledge construction based on local botanical resources, they are demonstrating the production of alternative ways of knowing and of keeping alive alternative forms of knowledge production. This alternative form of indigenous knowledge production is what has come to be known as indigenous literacy, i.e., a competency with respect to its own environment that a community has acquired and developed over time. The ability to use local history, information about flora and fauna, and local medicines for humans and animals as a means of solving problems endemic to the community creates important literacy skills that are critical to the survival of indigenous peoples.

If students' knowledge of local plant species is allowed to interact with the formal knowledge being learnt in the classroom, indigenous literacy is not only valued, it is also made relevant, while at the same time helping students to generate interest in, and ownership of what they ultimately learn. As Shiva (1993) maintains, such ownership inevitably renders impotent the dominant culture which, if unchallenged, could eliminate the use and appreciation of local botanical alternatives, traditions, and other forms of knowledge associated with the unique culture of the locality.

One can understand Kroma's frustration. If the study of science and mathematics is to capture the interest of students and challenge their intellect, indigenous literacy must be assessed at its true worth. One way of doing this is through the integration of indigenous knowledge of botanical resources into science curricula, as a means of discovering and exploring scientific concepts and inquiry procedures.

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