Opening Doors to the Future: Applying Local Knowledge in Curriculum Development

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This article discusses and illustrates the underlying pedagogic and inquiry based theoretical frameworks that were used to guide the development of the Forests for the Future science curriculum materials. The rationale for linking local traditional ecological knowledge, local understanding of knowledge construction and science education is highlighted. This science curriculum is one beneficial outcome of meaningfully linking anthropological research with Tsimshian community educational needs.

Indigenous youth have disproportionately lower rates of academic success in British Columbia's public education system than their non-Indigenous classmates (BC Ministry of Education, 2003). Despite recent modest improvements 42% of Indigenous students graduate from provincial high schools compared to 79% of the non-Indigenous student population (BC Ministry of Education). The legacy of a colonialist educational system and its under representation of Indigenous knowledge is a key factor in limiting Indigenous peoples' futures. As reported in this paper contemporary educational research is clear: improvements in educational outcomes are connected to valuing Indigenous and minority students' cultural context and their communities' local level knowledge.

In this paper I describe the rationale for linking local knowledge, local understanding of knowledge construction, and science education. This paper outlines the central principles that guided the development of the *Forests for the Future* science curriculum. Orlowski and Menzies (this issue) describe the process involved in the development of the *Forests for the Future* (*Forests for the Future*) social studies curriculum materials. This paper focuses on the specific aspects of the aforementioned project that linked local ecological knowledge with science education curriculum development Orlowski, Menzies, and I agree that meaningful curriculum must necessarily be rooted in local knowledge and history and that this is especially so in the case of Indigenous students whose typical experience of mainstream education is one that has distanced and denied First Nations knowledge (Snively, in press; Snively & Corsiglia, 2000).

By establishing a connection between theory and the practice of pedagogy educators and researchers have begun to develop a better appreciation for how students construct durable and robust understandings of

their world and their place within the world. This is a strategic position that assists Indigenous students in using the education system as a stepping-stone to further education as opposed to a barrier to further education. Appended to this position are the numerous benefits that students, educators and the community derive from such an association. These advantages accrue not only to Indigenous students, for whom the curriculum is designed, but also to multicultural students and all students with culturally diverse backgrounds, science educators, and members of the larger community.

Anthropologists often discuss how to return and give back to the community the information that they research and collect (see, e.g., Gough, 1968; Asad, 1973; also Menzies, this issue). Many of these anthropological debates have focused on the relation between the studied and the studier and on the ways in which anthropologists have written up their results (Rabinow, 1977; Marcus & Fisher, 1986; Clifford, 1988; Geertz, 1988). While I have no argument with the validity of such concerns, from a community action point of view respectful relationships between researcher and researched have less to do with how anthropologists write than with how knowledge is made useful locally (Menzies, 2001; Smith, 1999).

The curriculum materials produced by the *Forests for the Future* project provide an example of how anthropological research, combined with community needs, can benefit all parties: researchers and community members. Our task as curriculum developers was instrumental in the process of ensuring that knowledge taken through research actually remained in and benefitted the community. We accomplished this through designing lesson plans for use in and beyond the local schools based upon the research component of the *Forests for the Future* project.

The lesson plans, designed to address the prescribed learning outcomes for British Columbia's provincial high school curriculum, were prepared on the basis of interview data gathered by university and community based researchers working in the Tsimshian territory of British Columbia (see Butler, this issue). Community Elders and other knowledge holders were interviewed and asked to discuss their local ecological knowledge. Particular attention was paid to local knowledge that might help achieve practical ends such as economic development, environmental responsibility, and cultural resilience (see Menzies & Butler, in press, for a description of local ecological knowledge). Curricula were then written and are in the process of being piloted and adapted for use in local schools (www.ecoknow.ca). In what follows I outline the theoretical basis upon which our curriculum model was developed and then turn to an explication of the science curriculum materials that were developed through this project.

The Curriculum Model: Community Based Research and Curricular Design

Student motivation and engagement in the learning process increases when students recognize that what they are being taught matters. For Indigenous students the curriculum must be relevant- "the content should address issues, controversies or provocative questions inspired by experiences in the student's life" (Kanevsky, 1999, p. 58). The above concerns were met in the curricula developed for this project through locally researched content, Indigenous knowledge content, and careful attention to context and process. This approach helped Indigenous students engage more fully than has traditionally been the case in the process of knowledge construction. To this end an inquiry and inductive reasoning approach was the recommended method of instruction.

Underlying our curriculum design was the recognition that teachers must be fully aware of and build upon the unique background knowledge of Indigenous students in order to best help them to meet the learning outcomes for their particular grade and subject area. A prime example was understanding how the natural world was perceived and understood by Indigenous students, especially those from families who actively harvested from the land and sea. Recognizing this perspective was consistent with the practice of successful educators who recognized the importance of helping students access prior knowledge as they constructed new knowledge (Ruddell, 2000).

Research continues to document the persistent nature of under representation of Indigenous students in science classes and professional programs leading to certification. Difficulties in motivating Indigenous students are most often cited as the reason for the under representation of Indigenous students. Consequently, the unique educational needs and potential of Indigenous students remain largely unrecognized and unmet.

Relevant content harnessed to expert research techniques increases the likelihood that Indigenous students will more fully identify and articulate their own culturally unique set of behaviors vis a vis knowledge construction. The inquiry based approach is useful for Indigenous students because it acknowledges and respects the fact that culturally different students have a different knowledge base compared to mainstream students (Garrison, 1989). Finally, an inquiry based learning approach can begin to address some of the needs for increased pluralism in programs for Indigenous students.

Inquiry research is linked to information literacy skills. Literacy skills are best understood as the ability to retrieve, assess and make use of a wide variety of informational sources (Moore, Moore, Cunningham, & Cunningham, 1998). The strength of the inquiry approach for Indigenous students is that it demands that the teacher adopt an indirect and facilitative role in the learning process of students. When using the inquiry approach teachers support the students in their learning endeavors as opposed to or-

chestrating the learning process. Hence, it is the students who "assume the primary responsibility for planning, conducting and evaluating their investigations" (Moore et al., 1998, p. 280). This particular approach is well suited to the learning needs of Indigenous students as it mirrors similar processes of learning involved in hunting, fishing, and gathering.

Ultimately, all inquiry begins with helping students know how to apply what they already know to novel learning opportunities. Thus, to effectively support Indigenous students in their learning process, educators need to be aware of Indigenous knowledge. This is important for two main reasons. First, in order to support and nurture the authentic achievement of students teachers need to be able to help students develop both their intellectual skills as well as their learning skills. Second, teachers need to provide their students learning experiences that are genuine and lead to real and measurable improvements not only for their immediate community but hopefully for the larger community as well (Goodlad, 1984). Thus science curriculum based on Indigenous knowledge has great promise to solve crucial environmental issues as well as assisting Indigenous students in connecting their own unique way of learning and knowing about the natural world with the wider scientific endeavor (Menzies, in press).

Understanding our Students for Curriculum Design

A critical part of programming for Indigenous students is developing and refining problem-solving and thinking skills. An inquiry based approach, as described above, is one way to accomplish this (Kanevsky, 1999). An added benefit is that an inquiry model is well suited to exploring real-life situations. For example, by researching and developing historical and present day manifestations of viral epidemics students become better able to address global issues (see below, "The Curriculum: Keeping Knowledge in the Community"). Indigenous students, like all students, should be taught skills that increase their knowledge of skills used by experts. For it is in this way that they are able "to polish and practice skills that could be used to benefit self and society" (George, 1989, p. 110).

The content of curricula for Indigenous students should be such that it functions to create an understanding of majority culture motives and the "social, psychological, and historic setting that causes people to think as they do" (Pfeiffer, 1989, p. 103). This is best accomplished with content that both meets the individual student's needs in a culturally relevant and sensitive manner and nurtures individual strengths in such a way as to enable the student to successfully participate in mainstream culture without undermining their participation in their own culture (Pfeiffer, 1989).

The quality of all students' lives is enhanced when their talents and skills are nurtured and developed. In turn the quality of life of the students' community is very likely also enhanced. Indigenous students

who recognize how the majority culture impacts their nation's culture are in a much better position to deal with social and treaty issues for example. This is because, according to Pfeiffer (1989), "the ultimate goal of all tribal groups is to acquire an economic stability and spiritual tranquility for tribal members' lives" (p. 103). The Indigenous students' heightened concern with justice and equity makes them well placed to "look beyond ethnicity, to plan for resolving critical issues that are of concern to the world population" (p. 103).

All students are increasingly challenged to understand the nature of knowledge construction. In particular, Indigenous students need to understand that both mainstream scientific and traditional ecological knowledge, like all knowledge, is created within a cultural setting. The setting influences the nature of the knowledge that is created. Effective science instruction recognizes that there are many interpretations of natural phenomena, just as there are many interpretations of religion, politics, economics and art. Thus, a central theme of our science curriculum is the recognition of the many different ways that people create meaning.

Understanding our Communities for Curriculum Design

Educators need to recognize the unique situation of Indigenous communities within the context of their colonial experience. This is not simply recognition of adverse impacts, but also of the positive features of Indigenous society that are the basis of, for example, traditional ecological knowledge. In the face of decades of attempts on the part of Canada and British Columbia to undermine and deform Indigenous society,[1] Indigenous communities have maintained the essence of their cultures and societies. Educators who fail to recognize simultaneously the legacy of colonialism and the persistence of Indigenous culture and society will ultimately fail in their attempts to educate Indigenous youth.

Community members, parents, and Elders have an important role to play as local knowledge holders, partners in education, and co-teachers in the everyday practice of teaching. However, despite the numerous calls to include parents within the consultative and decision making process of schools there are few practical attempts to resolve the issues that work against obtaining this goal. Schools still struggle with finding ways to include parents who are "committed to their children achieving educational success" (Crozier, 1999, p. 315). The role of teacher and parent are such that they are seen to represent a division of labor, in which the parent is subservient to the role of teacher. Too often traditional teaching strategies serve to "reinforce the parent's perception of teachers as the professional (who knows best)" (p. 316).

The curriculum development component of this project addressed this division of labor in two ways. First the curriculum team acknowledged community members, parents, and Elders as holders of knowledge. Second, we attempted to break down the notion that the teacher is the

professional 'who knows best.' Rather, the culture and the traditions held and developed by the community were recognized to be a powerful repository of knowledge and, through linking the community based research project to curriculum design.

Kimmerer (2002) provides support for this view in describing a form of knowledge—traditional ecological knowledge—as being relevant to resolving many problems in areas such as resource management, ecological restoration and sustainable development. Traditional ecological knowledge is important because it presents critical information and perspectives that are absent from scientific approaches. There is a growing recognition and commensurate body of literature of the importance of this information in providing insights into the problems facing conservation biologists, ecosystem management and ecological restoration projects (Kimmerer, 2002).

The Curriculum: Keeping Knowledge in the Community

Over many generations Indigenous people have developed a holistic knowledge of their lands, natural resources and environment. This knowledge has been recorded within oral traditions (Berkes, 1999; Battiste & Henderson, 2000; Menzies & Butler, in press). The oral tradition must be respected and viewed by the teacher as a distinctive intellectual tradition-not simply as myths and legends. Too often attempts to contrast Indigenous Knowledge with scientific knowledge create a sense within Indigenous students that their way of knowing is inadequate and inferior. In contrast, scientific knowledge is presented as paradigmatic of knowledge itself (Heyd, 1995). The implication being that only science is fully epistemologically adequate. To address this problem the curriculum explores and focuses on the common themes that emerge in the way that Indigenous Knowledge and scientific knowledge are acquired and communicated.

A series of seven detailed curriculum unit plans -some of which were supported with broadcast quality videos- were developed out of the primary research conducted with Gitxaala community members and their non-Indigenous neighbors.[2] Throughout this process our goal was to create learning activities that a teacher could easily and seamlessly implement in their everyday classroom activities. This curriculum provided students with the opportunity to explore the following themes:

1. the construction of scientific and Indigenous knowledge (Ignas, 2003; Thompson, 2003);
2. the differential impact of viral epidemics on North Coast Indigenous peoples (Ignas, 2003);
3. the traditional use of plants by North Coast Indigenous peoples (Thompson 2003; Thompson, this issue);
4. the transmission of traditional ecological knowledge (Ignas, 2003; McKeen, 2003; Thompson, 2003);

5. First Nations resource use and traditional ecological knowledge (McKeen, 2003).

The Construction of Scientific and Indigenous Knowledge

Though the construction of scientific and Indigenous knowledge can be understood to be an element of most of the unit plans developed for the *Forests for the Future* project, this issue is most clearly and explicitly developed in *Unit Plan 1: Two Ways of Knowing* (Ignas, 2003). The practical implications of how traditional ecological knowledge is used are also discussed in the lessons on traditional plant usages (Thompson, 2003).

Over many generations Indigenous people have developed a holistic traditional ecological knowledge of their lands, natural resources and environment. This knowledge has been recorded within oral traditions. The oral tradition must be respected and viewed by the teacher as a distinctive intellectual tradition-not simply as myths and legends. Too often attempts to contrast traditional ecological knowledge (TEK) with scientific knowledge creates a sense with Aboriginal students that their way of knowing is inadequate or inferior. In contrast scientific knowledge is presented as paradigmatic of knowledge itself (Heyd, 1995). The implication being that only science is fully epistemologically adequate. To address this problem our curriculum materials explores and focuses on the common themes that emerge in the way that TEK and scientific knowledge are acquired and communicated. The following sections will describe the curriculum units.

Differential Impact of Viral Epidemics on North Coast Indigenous Peoples

Using an historical case study as background knowledge students can explore and discover the commonalities and differences between the smallpox and the aids virus on Indigenous populations (Ignas, 2003). Students are challenged to situate these two viral pandemics into a wider historical setting and are assisted in their discovery of larger patterns associated with viral disease migrations. Disease has had a differential impact on the population size of North Coast Indigenous populations. The smallpox virus resulted in dramatic population decreases. The timing of the viral outbreak and the large number of deaths contributed to a dramatic reconfiguring of Indigenous culture. The related issues stemming from disease persist and negatively impact the quality of life for Indigenous students. For example, dramatic reductions in population size resulted in a change in land use patterns. As a result of this change, traditional Indigenous lands were perceived as being unoccupied by white colonists. As Indigenous peoples engage in treaty negations they rely upon traditional land use and occupancy to substantiate their claims.

Traditional Use of Plants by North Coast Indigenous Peoples

Science curriculum has been developed based on traditional plant knowledge of North Coast Indigenous peoples with many of the lessons focusing on the intergenerational transmission of knowledge and wisdom. Students research customary uses of plants from primary sources—Elders and community members—and secondary sources—books, the internet, and other media. They then collect plant samples, identify them, press and mount them. They also take photographs of the plants in their natural habitat. Once this is done, students bring all of the knowledge that they have learned, all of the images and plant samples that they have accumulated, and create a plant booklet to present to their community at a gathering to thank and honor those who have shared their knowledge. Students also learn about the different methods of preservation and storage of berries in a hands-on manner: they will dry the berries in the sun either whole or as cakes, and they will preserve berries in grease and/or water. They will also examine the reasons why certain berries were preserved or stored in different ways by looking at the time of year they were harvested and testing their pH level to look for relationships. The fifth lesson focuses on nutrition and how North Coast Indigenous peoples fulfilled and continue to fulfill their nutritional requirements with their traditional foods. The final lesson deals with the relationship North Coast Indigenous peoples had and continue to have with neighboring Indigenous groups, focusing on the types plants that may have been traded.

The Transmission of Traditional Ecological Knowledge

Three of the unit plans provide learning opportunities for understanding how traditional knowledge is transmitted: two ways of knowing (Ignas, 2003), traditional use of plants (Thompson, 2003 and this volume), and First Nations resource use (McKeen, 2003). Each of these units highlights the unique ways in which traditional ecological knowledge is transmitted within Indigenous communities.

Drawing upon the *Forests for the Future* community-based research the curriculum designers attempted to model the instructional approaches upon the customary methods of knowledge transmission. It is important to point out that there is a clear difference between learning in a classroom setting and learning by actually practicing harvesting, hunting, and gathering techniques. The lessons draw upon a number of strategies to overcome some of these barriers. First, the lesson plans are designed to encourage community knowledge holders to participate in the teaching process. Second, lessons are designed to facilitate active student research and inquiry in which they interview and participate in family based activities that support the transmission of Indigenous ecological knowledge and then report back to the classroom. Third, students are provided with documents generated during the *Forests for the Future* project as sources to use in their classroom learning environment.

First Nations Resource Use and Traditional Ecological Knowledge

One of the central goals of the *Forests for the Future* project involved linking local level ecological understandings with effective resource management policies. The unit designed by Scott McKeen presents a series of lessons in which students learn to identify local ecological knowledge and the role TEK might play in establishing more effective programs of resource management. This includes having the students compare and contrast different types of knowledge about the land, the environment and resource development. The unit concludes with a mock resource management conference, in which students play various stakeholders that they have researched in an attempt to develop a resource management plan. Many of the lessons are suitable for co-operative and group learning activities, which build skills required in the running of the conference.

Conclusion: Linking Research, Education, and Anti-Colonialism

As educators our primary goal is to facilitate the learning of our students. To be successful as teachers and curriculum designers working with and amongst Indigenous students we must confront the legacy of colonialism actively in our teaching and curricular design. In this project we have done so by linking our teaching practice with community based research in ecological knowledge. In the lesson plans that we developed Indigenous students are provided with the opportunity to explore the social forces that influence their lives. Thus, students are able to build upon their histories and knowledge of the dramatic changes that have emerged as a result of contact with White settler nations. Students are provided with devices that affirm the ways in which their communities have maintained enduring values and also explore the ways in which their communities have changed. An important benefit of this approach is that it encourages students to draw on community resources, such as the knowledge held by their nation's Elders. This last point is particularly relevant for Indigenous students since education should be responsive to the community it serves as well as involving families of the students (Pfeiffer, 1989).

Indigenous students need the opportunity to explore and study how their culture constructs its own knowledge. By making reference to traditional Indigenous knowledge and contrasting it to knowledge created using scientific methodologies students have the opportunity to analyze, synthesis and evaluate various ways of knowing. Kanevsky (1999) notes that "learning processes should stress the use, rather than the acquisition of information" (p. 60).

Research projects such as Forest for the Future lead to the production of curricular material that engages and motivates students to participate more fully in the process of understanding how knowledge is created, systematized, modified and shared. Community based research, which produces measurable outcomes in terms of increased learning and thus increased success in school, is a powerful way to empower and motivate

Indigenous and multicultural students. Important lessons can be learned from a community based research approach that highlights the significance of producing curriculum that has as its central premise respect for all cultures and culturally unique ways of building knowledge. When educators engage in this form of research and practice they are better able to appreciate how Indigenous students learn and thus how best to motivate and increase the participation and learning outcomes for Indigenous students.

All of the project curriculum materials are based on Indigenous students learning from their Elders and valuing their people's knowledge and wisdom about nature. These lessons have been developed in a way that should allow students to view their own knowledge and the knowledge and wisdom of their Elders and community as valid and valuable in the context of science, and more generally, all academic work. "The idea of students as researchers who explore their own lives and connect academic information with their own lived experience is alien to many schools" (Steinberg & Kincheloe, 1998, p. 13). It is vital that Indigenous students realize that their people's understanding of the world, their world view, and their understanding of natural phenomena is as valid as Western modern science. Our approach emphasizes that science is not only found in textbooks—materials that do not usually include the world view, experiences, and knowledge and wisdom of Indigenous people—but it is also found in the world within which Indigenous students live. If school science curricula can find ways of bringing in traditional ecological knowledge—a body of knowledge and wisdom that has largely been ignored in regards to its contributions to science—without appropriating it, then science education will finally become accessible and relevant to a Indigenous students. The task of opening doors to the future for Indigenous students involves recognizing the importance of the ecological knowledge held by community members. We trust that—in some small way—the *Forests for the Future* science and social studies curriculum has been able to accomplish this goal.

Notes

[1]It is instructive to point out that the architects of these policies (government administrators, church leaders, etc.) have often seen them as in the best interests of Indigenous peoples even in the face of opposition from the communities themselves.

[2]Particular care needs to be taken when researchers work in Indigenous communities documenting traditional ecological knowledge. Researchers need to be mindful of local protocol, ownership, and ultimately the intellectual property rights that accompany this form of knowledge. As Snively and Corsiglia (2000) point out, "TEK information is sometimes cherished as private or belonging to one family only. Also, in many traditions, oral information may only be shared under particular circumstances, for example, when it is clear that no one intends to use the knowledge for gain" (p. 11; see also Menzies, 2001; Menzies, this issue; Lewis, this volume; Smith, 1999).

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