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REKINDLING TRADITIONS:
CROSS-CULTURAL SCIENCE & TECHNOLOGY UNITS

The project, *Rekindling Traditions: Cross-Cultural Science & Technology Units*, illustrates one way to address the under-representation of Aboriginal people in careers related to science. Unless teaching materials in schools provide students with a meaningful way to learn (i.e. in the context of the local community), many Aboriginal students find the science curriculum inaccessible to them, and they do not continue studying science in high school. In our *Rekindling Traditions* units, Western science content is taught in the context of the local community's Aboriginal knowledge of nature, a context that creates an Aboriginal point of view for each unit. Aboriginal content is treated as an *asset* in the science classroom. To achieve this, we consistently sought the wisdom of Elders throughout the two years of our project.

Our collaborative research and development team consisted of six science teachers from across northern Saskatchewan, along with a facilitator/coordinator from the University of Saskatchewan. We developed six units of study for grades 6 to 11:

- | | | |
|---------------------------------|--|-----------------|
| 1. Natures' Hidden Gifts | <i>Iyiniw Maskikiy</i> in Cree | Morris Briz |
| 2. Snowshoes | <i>Asâmak</i> in Michif or Cree | David Gold |
| 3. Survival in Our Land | <i>Kipimâcihiowininaw ôta</i>
<i>Kitaskînahk</i> in Cree | Earl Stobbe |
| 4. The Night Sky | <i>Tth'ên</i> in Dëne
<i>Acâhkosak</i> in Cree | Shaun Nagy |
| 5. Trapping | <i>Itts'usi Thêlai</i> in Dëne
<i>Wanihikewin</i> in Cree | Keith Lamaigre |
| 6. Wild Rice | <i>Mânomin</i> in Cree | Gloria Belcourt |

Each unit contains relevant background information and specific lesson plans for teachers to follow. We also wrote a *Teachers Guide* to provide general background knowledge and guidance for any cross-cultural unit. Personal advice to science teachers is found in *Stories from the Field*, which documents how to involve the community in the modification of any of our units, or in the production of a new unit, to suit the community's unique culture. The six units, the *Teacher Guide*, and the *Stories from the Field* are available at the project's web site (<http://capes.usask.ca/ccstu>) and on CD from Northern Lights School Division, La Ronge, Teacher Resource Department, Bag Service 6500, La Ronge, SK, S0J 1L0, for less than \$10.

It is anticipated that a teacher will print out a unit and take it to some people in the community who know the topic well, and ask, "How could *we* modify this unit so it fits our community?" Elders and other knowledgeable people in the community will help the teacher modify the unit by teaching local content to the students and teacher, who in turn record this knowledge appropriately; thereby producing a revised unit for their community. This process teaches students the proper protocol for gaining access to their

community's knowledge and wisdom, and it teaches them to value and respect their Aboriginal heritage.

The *Rekindling Traditions* project would not have been possible without the support and funding from the Cameco Access Program for Engineering and Science (CAPES), the Stirling McDowell Foundation (Saskatchewan Teacher's Federation), Northern Lights School Division, Ile-la-Crosse School Division, Saskatchewan Education (Northern Division), and the Colleges of Education and Engineering, University of Saskatchewan. The project was completed within two calendar years, 1999-2000.

Need for the Project

The goal of conventional science teaching has been to transmit to students the knowledge, skills, and values of the scientific community. This content conveys a Western worldview due to the fact that science is a subculture of Western culture (Pickering 156). Thus, students with a much different worldview (such as many Aboriginal students) can experience a cross-cultural event whenever they study Western science (Aikenhead 55). How can these students master and critique a Western scientific way of knowing without losing something valuable from their own cultural way of knowing?

To First Nations science educator Madeleine MacIvor, the answer is clear: "The need for the development of scientific and technical skills among our people is pressing. ... Reasserting authority in areas of economic development and health care requires community expertise in science and technology" (MacIvor 74). "Conventional science must be presented as a way, not *the* way, of contemplating the universe" (p. 88). In Australia and New Zealand this is called "two-way" learning (Ritchie & Butler 225), while in the U.S. it is often called "bi-cultural" instruction (Cajete, 165). This non-assimilative approach to teaching science is illustrated in Snively's (1990) case study of Luke, an Aboriginal boy in grade 6 whose science class had studied the Canadian seashore:

Clearly, after instruction, Luke continued to have many ideas and beliefs about seashore relationships consistent with a spiritual [Aboriginal] view of the seashore and many ideas and beliefs consistent with an ecological view of the seashore [gained from science instruction]. ... It is possible to increase a student's knowledge of science concepts without altering substantially his or her preferred orientation [worldview]. (53-54)

In other words, First Nations and Métis students can learn Western science without being assimilated into Western culture, that is, without losing their cultural identity as Aboriginals. But to make this happen, the curriculum and instruction must be cross-cultural in nature, as it was for Luke.

Central to this cross-cultural approach is the tenet that Aboriginal children are *advantaged* by their own cultural identity and language, not disadvantaged in some deficit sense. Aboriginal students have the potential of seeing the world from at least two very different points of view, rather than just one, as many of their Euro-Canadian counterparts do.

Based on the premise that future science teaching needs to be cross-cultural in nature, Glen Aikenhead and Bente Huntley (1997) conducted a research study into science teachers' views of: (1) the connection between the culture of science and the culture of Aboriginal students, (2) the possible assimilation of these students in their science classes, and (3) the degree to which teachers saw themselves as culture brokers who could smooth the transition into school science. The teachers (both Aboriginal and non-Aboriginal) taught Aboriginal students across northern Saskatchewan in grades 7 to 12. The research identified barriers to student participation in science and technology (and math). While the science teachers tended to blame various inadequacies (a lack of this and a lack of that), Aboriginal educators clearly pointed to the vast differences between Aboriginal culture and the culture of science there are two differences that make science a foreign forbidding world to most students. Several recommendations emerged from that study, two of which are relevant here:

1. Knowledge of nature learned in school science should combine both Aboriginal and Western science knowledge systems. A more relevant, culturally sensitive curriculum would refocus instruction into cross-cultural science teaching that supports potential scientists and engineers.
2. A group of teachers who are already fulfilling some of the principal roles of a culture broker should be identified, and they should form a working network with other educators who could facilitate their collaborative efforts. Together, they should develop: (a) an array of culturally responsive instruction and assessment/evaluation practices; (b) a culturally sensitive science curriculum; and (c) specific lessons, units, or modules for other teachers to use.

The study also found a great diversity in cultures from community to community across the north. Thus, instruction and teaching materials developed in one community are *not* necessarily transferable to another community. The materials must fit into a meaningful cultural context of the local community, otherwise many students will find the science curriculum inaccessible. If teachers are going to teach science in a meaningful way - in the context of the school's community as teachers need continuous professional support.

A culturally sensitive science and technology unit will present an Aboriginal framework within which Western science is introduced as *one* way of understanding nature as a way that conveys Western scientific values and worldview. Aboriginal ways are identified and contrasted with the Western way, as appropriate.

Project Initiation and Funding

When the above research was presented at the June 1998 CAPES meeting in La Ronge, Dr. Bruce Decoux (Deputy Director, Northern Lights School Division) and Dr. Bill Duffee (Director, Ile-la-Crosse School Division) encouraged Dr. Glen Aikenhead to write a proposal for a project that would implement these recommendations in a meaningful way. Over a series of summer meetings among the three educators, a final proposal was developed and submitted to possible funding agencies.

As a result, Cameco Access Program for Engineering and Science (CAPES) awarded \$50,730 while the McDowell Foundation awarded \$10,000. In addition, there

were \$66,000 in-kind costs born by the two school divisions, Saskatchewan Education (Northern Division), and the Colleges of Education and Engineering (University of Saskatchewan).

Objectives of the Project

Guided by Aboriginal educators (Battiste, 1986; Cajete, 1986; Casebolt, 1972; Ermine, 1995; Hampton, 1995; Kawagley, 1995; MacIvor, 1995; McKinley, 1996; Nelson-Barber, Trumbull & Shaw, 1996; Ogawa, 1995), research findings (Aikenhead, 1997; Allen & Crawley, 1998; Baker, 1996; Deyhle & Swisher, 1997; Fler, 1997; Harris, 1978; Jegede, 1995; Snively, 1995), and the practical knowledge of teachers, the following objectives were formulated for the *Rekindling Traditions* project:

- 1 . To establish a collaborative team of science teachers and a university science educator, along with the support of various stakeholders.
2. To develop a *prototype process* for producing culturally sensitive instructional strategies and curriculum materials that support student learning within any particular community.
3. To produce some teaching strategies and materials that exemplify culturally sensitive science teaching for Aboriginal students (grades 6 to 12), and are available to communities electronically through CD and website sources.
4. To inspire others to continue the practice of cross-cultural science teaching.

The results of our project are reported in the next four sections of this paper, organized around these four objectives.

Results: To Establish a Collaborative Team

A number of teachers were nominated by their school division as possible participants in the project. Each teacher was contacted by telephone by project facilitator/coordinator Glen Aikenhead. Seven teachers who volunteered were selected to participate in this R&D project. One withdrew midway through the first year. The collaborative R&D team of teachers became: Gloria Belcourt, Pinehouse Lake; Morris Brizinski, Beauval; David Gold, Ile-la-Crosse; Keith Lemaigre, La Loche; Shaun Nagy, La Loche; and Earl Stobbe, Timber Bay. All had a personal interest in developing their cross-cultural science teaching further. All were highly involved in school activities and projects related to their school. They were particularly busy people.

On the advice of the Northern Lights School Division, Glen Aikenhead approached Elder Henry Sanderson of the La Ronge Indian Band to ask him to be our project guide. At a meeting in La Ronge with Glen, Elder Sanderson accepted a gift, thereby agreeing to become our project's Elder. At our first project meeting in La Ronge in January 1999, he provided the team with the direction to care for Mother Earth. He continued giving us guidance throughout the project at key decision points. Other elders also kindly provided knowledge and wisdom from time to time. These were Ann Lafleur (Cree) and Alec Campbell (Dëne), both from the Beauval area.

There were a number of consultants and advisors who assisted the R&D team: (1) translators who helped us write key words and phrase in Cree and Dëne (Ken Carriere, NLSD, La Ronge; and Walter Park, La Loche Community School, La Loche); (2) technical support and advice from Saskatchewan Education, Northern Division (Tobby Greshner and Debbie Mielke); (3) computer and secretarial support from the College of Education, University of Saskatchewan (Rodger Graham, Lois McPherson, and Audrey Swan); (4) website support from the ITLC lab, College of Engineering, University of Saskatchewan (Keith Jeffrey and student assistants); (5) Aboriginal artist, Tammy Alexander of Saskatoon; and (6) a great many competent people in the teachers' communities who contributed to the project by helping students and teachers learn local Aboriginal knowledge, and by assisting teachers in the classroom and on field trips.

Results: To Develop a Prototype Process

It took concerted effort over several months to patiently develop culturally sensitive instructional strategies and curriculum materials that support student learning within any particular community. Our experiences in this development are summarized here. A detailed documentation of our experiences may be found in our *Teacher Guide* and our *Stories from the Field*, written for the purpose of guiding teachers who want to walk along our pathways. These two documents, along with the individual units themselves, convey a process for others to follow. The following summary indicates key aspects to our prototype process.

Teachers received a modicum of release time for research, writing, and working with the local experts in their units topic, throughout the first six months of the project. This release time was essential. Without it, the project could not have been successful. We also conducted six two-day meetings, attended by the R&D team and usually an Elder:

January 28-29, 1999, La Ronge (with Henry Sanderson, La Ronge)
March 18-19, 1999, Little Amyot Lake (with Ann Lafleur, Beauval)
May 20-21, 1999, Little Amyot Lake (with Alec Campbell, Beauval area)
August 20-21, 1999, Waskesui (with Dr. June George, Trinidad & Tobago)
November 18-19, 1999, Saskatoon (with Joy Star, Saskatoon Tribal Council)
May 3-5, 2000, Little Amyot Lake

Minutes of these meetings were distributed to all stakeholders, and posted on our web site. The focus of each meeting changed as time went on. We started by becoming familiar with past work in cross-cultural science education (see the *Teacher Guide* for details). Then we went on to identify themes for our units. Next we found appropriate resources, activities, and sensitive teaching methods to suit the unit. Time was taken during the later meetings to edit the units, to polish the lesson plans, and to plan professional development workshops. Some units developed faster than others. Those that related to specific seasons (e.g. trapping, wild rice, and snowshoes) could not be implemented on a trial basis until the season was right.

Significant progress in developing individual units was always achieved when the teachers interacted face to face, away from their school setting, or when an individual teacher interacted face to face with the project's facilitator in the teacher's community.

The R&D team needed uninterrupted time to share ideas, to reflect on the units, and to consider how to involve community people in the school science curriculum. Time was taken to support each other as new ideas emerged. The synergy from people interacting around a table with a common purpose proved to be very powerful. Uninterrupted time was a precious and valuable commodity. The face-to-face meetings led directly to independent initiatives being taken by each teacher. The project could not have progressed without these meetings.

Face-to-face meetings could not have been replaced by e-mail list-servers, telephones, or faxes. These modes of communication do not allow for the synergetic interaction needed, because in the culture of schools there are hourly demands on busy teachers to interact with students in terms of academic, social, personal, and parental results. These demands wrap teachers up in a whirl of responsibilities that leave them with neither the time nor the energy to interact on list-servers, telephones or faxes.

Schools are not yet structured to facilitate communication through the internet. In order to ensure internet communication, schools will need to change the time demands placed on teachers, schools will need to acquire reliable and compatible technology (a very rare commodity at the present time in the business world of computers), and schools will need to establish routines centered around the internet rather than around students' needs a development none of us would want to see, to be sure. Face-to-face meetings were a major reason for the progress of the project. Future projects should follow this pathway, rather than the "information highway."

Another major facet to the project's success can be attributed to the time spent on the project by Glen, the facilitator/coordinator. Although he worked on the project while carrying a full time teaching load for the first and last six months of the project, he was released from teaching responsibilities at the University (1) full time during the fall of 1999 (when the communities were involved with implementing the units), and (2) part time in the spring of 2000 (when the units were being edited and electronically designed for desk-top publishing on the CD). Funding for his time came from CAPES and the College of Education, respectively. Progress on the project would not have been smooth without a coordinator to organize meetings, to follow up on teachers' suggestions when needed, to visit teachers in their schools, to be a writer, to be a researcher, a "gopher", to negotiate computer software peculiarities as they arose, and to keep everyone focused on the project's goals as defined by our Elders.

Key community people (at first called "local advisory people") were essential to developing the units and lessons sensitive to students' unique community. At first it was a challenge for each teacher to involve people from the community. The challenge was very different in each community. These challenges, and our advice on how to succeed, are found in *Stories from the Field*.

One culturally sensitive instructional strategy discovered by the team was to involve students in gaining local Aboriginal knowledge about the topic of the unit. Students learned that their community was rich in knowledge, as rich as the internet and print materials. To gain access to local knowledge, students were taught the protocol for approaching people who possess the knowledge, and students learned how to conduct interviews. Most of the *Rekindling Traditions* units contain a lesson dedicated to gaining local knowledge appropriately. Interview questions are composed by a class and then used by groups of students as they interview people in the community. The local

knowledge gained by students is shared and synthesized in class. Elders and other knowledgeable people in the community taught local content to students, who in turn recorded the knowledge in a way appropriate to the wishes of the person who gave them the knowledge (some stories are not to be repeated while others may only be repeated orally). Having helped students synthesize the local Aboriginal knowledge, teachers verified the validity of the knowledge by talking with people in the community. This was one way of establishing a personal contact with community people. Alternatively, some teachers invited Elders or other local experts into the classroom. Students and teachers learned the Aboriginal content together. Either way, local knowledge was given respect. It was *foundational* to each unit. It was not a token “add-on.” In some cases, the Elders or experts helped the teacher conduct a field trip with the students, for instance, a trip to a wild rice stand or trap line.

All these instructional methods taught students the proper protocol for gaining access to their community’s knowledge and wisdom, and they teach students to value and respect their Aboriginal heritage. This has been shown to develop stronger cultural identity and self-esteem in Aboriginal students (Cajete, 1999; McKinley et al., 1992; Ritchie & Butler, 1990).

The Aboriginal knowledge found in each of our units creates a context for instruction that most Aboriginal students relate to. It is also a context into which Western science instruction logically fits. In other words, Western science content is taught in the context of the local community’s Aboriginal knowledge of nature, a context that creates an Aboriginal framework for the unit. Thus, a *Rekindling Traditions* unit brings Western science into the students world rather than insisting that students construct a worldview of a Western scientist.

When we introduced students to the science content in a unit (from the provincial curriculum), we did it with sensitivity to the authentic knowledge shared by the community. Consequently, students learned Western science without feeling the need to discredit the Aboriginal knowledge they had learned. At the same time, students become better prepared for, and sometimes more interested in, the next years science course. This interest followed from the fact that students found the Western science content more meaningful, rather than approaching it as content to be memorized.

We tried to avoid teaching science in a way that makes students feel they are being assimilated into Western science. At the same time, however, students were expected to see the world through the eyes of a Western scientist just as we would expect students to understand another person’s point of view on an issue. Understanding did not necessary mean believing, however.

Results: To Produce Some Teaching Strategies and Materials

Teaching Strategies

In Alaska, students’ standardized science test scores uniformly improved over four years to meet national averages, in classrooms where there was a strong cultural fit among the curriculum, the instruction, and the context in which students learned the science (Barnhardt, Kawagley, & Hill, 2000). Our *Rekindling Traditions* units aimed to accomplish this cultural fit.

The first strategy that made a world of difference was teaching “out of doors.” Students often behaved very differently when they were immersed in nature, away from

the school building, even for one lesson. It was as if they were sensing their natural place. This observation coincides with one of Eber Hampton's (1995) twelve standards of education for First Nations students, *a sense of place*: "Indian education recognizes the importance of an Indian sense of place, land, and territory" (p. 40). Kawagley and Barnhardt (1999) also stress the importance of place to the Alaskan Yupiaq First Nations and how science educators can be sensitive to that sense of place when planning instruction.

The integration of Aboriginal and Western sciences in the *Rekindling Traditions* units had a noticeable motivational effect on most students in our project. They tended to become more involved in science classes, even staying after school to complete projects sometimes. Voluntarily staying after school was previously all but unheard of.

A common pattern of integration found in the *Rekindling Traditions* units is the Aboriginal framework established at the beginning of each unit. This framework reflects local knowledge. In a later lesson in a unit, Western science and technology from the Saskatchewan science curriculum is introduced to students as useful knowledge from another culture (the culture of Western science). The introductory Aboriginal content takes the form of practical action relevant to a community, for example, going on a snowshoe hike, finding Indigenous plants that heal, listening to an Elder, interviewing people in the community, or assisting in a local wild rice harvest.

Central to cross-cultural strategies of teaching science is making students aware of different cultural ways of describing and explaining nature. Not only is content different in each culture, but the values attached to that content differ. Identifying values is another aspect of integration common to all our units, in keeping with an Aboriginal way of teaching (Cajete, 1999). Both scientific and Aboriginal values are made explicit in our units. Each lesson plan specifies either a scientific value (e.g. power and domination over nature) or an Aboriginal value (e.g. harmony with nature) to be conveyed by the lesson. In some cases where both cultures are compared within one lesson, both types of values are identified. Values are particularly salient in Aboriginal cultures. The introduction to a *Rekindling Traditions* unit clarifies key values that Elders expect students to learn. This practice of making values explicit is then extended to the clarification of values that underlie Western science when scientific content is studied in a unit. This happens to be a requirement of the Saskatchewan science curriculum, defined by one of its seven dimensions of scientific literacy "values that underlie science." Key scientific values can become the topic of discussion. During these discussions, values are expressed and can be critiqued. As the value structure of Western science becomes more apparent to students (e.g. the mathematical idealization of the physical world), students are freer to appropriate Western knowledge without embracing Western ways of valuing nature. This appropriation has been called "autonomous acculturation" (Aikenhead, 1997). It provides an alternative method to assimilating Aboriginal students into Western science.

Having established an Aboriginal framework and having identified key values as contexts for integration, the next mode of integration in a unit is a border crossing event into Western science, *consciously* switching:

- i) values (e.g. from harmony with nature, to power and domination over nature)
- ii) language (e.g. from mahihkan to *Canis lupis*),

- iii) conceptualizations (e.g. from “Who are these animals?” to “How are they classified?”),
- iv) assumptions about nature (e.g. from the observer being personally related to what is observed, to the observer being objectively removed), and ways of knowing (e.g. from holism to reductionism).

An effective culture brokering teacher clearly identifies the border to be crossed, guides students across that border, and helps students negotiate cultural conflicts that might arise. Each unit has a different place where border crossing first occurs. Another feature of integration often emerges when a teacher compares Aboriginal and Western science. Sometimes Western science can powerfully clarify one small aspect of Aboriginal science. For instance in the units *Snowshoes*, *Trapping*, and *Wild Rice*, the technologies associated with these topics are originally studied from the historical and cultural perspectives of the local community. Then the class takes a closer, in-depth, Western scientific look at, for example, the pressure exerted by snowshoes on snow and by traps on animals, or the habitat of wild rice. By understanding the Western scientific stories about force, pressure, energy, and habitat, students learn to predict more accurately the effects of variations in the technology associated with snowshoeing, trapping, or producing wild rice. While the Western science concepts may not improve students' know-how for snowshoeing, trapping, or growing wild rice, the concepts clarify one small aspect of the overall topic. Western science does not replace Aboriginal science, it enriches an aspect of it.

As various topics in Western science are studied within our units, additional, relevant, Aboriginal content is introduced from time to time. This is easy to do because the unit already has a framework for that content. Aboriginal content is not just tacked on for the sake of creating interest. It frames the unit in a way that nurtures the enculturation of Aboriginal students into *their community's* culture (Casebolt, 1972). This differs dramatically from the enculturation of students into Western science, the goal of past science curricula. Although it is not the goal of Saskatchewan's current science curriculum, it continues to be the goal for the so-called reform movements in, for example, the USA (NRC, 1996), the UK (Millar & Osborne, 1998), and Ontario (McNay, 2000).

The conversations among people engaged in Aboriginal science are very different from the conversations of Western scientists. Both types of conversations are integrated into a *Rekindling Traditions* unit. As students bring their community's Aboriginal knowledge, language, and values into the classroom, new relationships between a teacher and a student can replace the conventional hierarchy characterized by teachers transmitting what they know to students. In a *Rekindling Traditions* unit, teachers learn from students who themselves have just learned valid Aboriginal knowledge from people in the community. By learning from students and community people, teachers demonstrate how an educated adult learns new knowledge (i.e. life-long learning), and teachers share their own expert knowledge with students. In short, culture-brokering teachers are facilitators, cultural travel guides, and learners.

A more detailed discussion of the integrative teaching strategies used in all the units is found in our *Teacher Guide to Rekindling Traditions*.

Teaching Materials

We developed a 53 page (21,000 word) *Teacher Guide to Rekindling Traditions*. It can serve as a professional development document for cross-cultural science teaching and as a guide to the six units in *Rekindling Traditions*. In the *Teacher Guide*, we present background information and ideas that guided our work. The ideas came from several sources: Aboriginal educators from around the world, Aboriginal educators and Elders in Saskatchewan, and from our own experiences and perspectives. In addition, we discuss the integration of Aboriginal and Western knowledge of nature, drawing upon our six units to illustrate this integration. The *Teacher Guide's* table of contents (see Table 1) clearly indicates what each section in the document is about. The document gives information and general advice about teaching in a cross-cultural way.

Table 1. Table of Contents for the Teacher Guide

Chapter 1	INTRODUCTION
Chapter 2	TEACHING SCIENCE IN SASKATCHEWAN SCHOOLS
Chapter 3	THE NEED FOR CROSS-CULTURAL SCIENCE TEACHING
Chapter 4	THE <i>REKINDLING TRADITIONS</i> PROJECT
Chapter 5	BACKGROUND
	Western Science Versus Aboriginal Knowledge of Nature
	A Cross-Cultural Approach to Teaching and Learning
	Cultural Border Crossings
	Coming to Knowing
	Culture Brokering
	Different Relationships Between Western and Aboriginal Sciences
	Resolving Cultural Conflicts Between Aboriginal and Western Sciences
	Collateral Learning
	Translation is Not Enough
	Treating Aboriginal Knowledge with Respect
	Standards of Education for Aboriginal Students
Chapter 6	INTEGRATION OF WESTERN AND ABORIGINAL SCIENCES
Chapter 7	AN OVERVIEW OF THE UNITS
	Wild Rice
	Nature
	Hidden Gifts
	Survival in Our Land
	Trapping
	Snowshoes
	The Night Sky
	Summary
Chapter 8	CULTURALLY SENSITIVE STUDENT ASSESSMENT
	Principles of Assessment
	Written Tests
	Assessment Rubrics

	Checklists
	Portfolios
Chapter 9	CONCLUSION
References	

Some of the *Teacher Guide*'s sections (e.g. "Treating Aboriginal Knowledge with Respect") have already appeared in Aboriginal conference presentations by other people and on other web sites (e.g. <http://www.ozemail.com.au/~mmichie/network.html>).

As described earlier, in *Stories from the Field* we convey our experiences and advice related to contacting community people to learn their knowledge, involving them with the school, and gaining support from the community at large. This 19-page (8,000 word) document takes some of the mystery away from becoming involved with Elders and other people in ones community. We hope our stories will make other teachers feel more comfortable crossing the cultural border between their personal cultural identities and the culture of Elders and others in the community. This border crossing is the essence of *Rekindling Traditions*.

The main teaching materials for *Rekindling Traditions* are the six units:

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|---------------------------------|--|-----------------|
| 1. Natures' Hidden Gifts | <i>Iyiniw Maskikiy</i> in Cree | Morris Briz |
| 2. Snowshoes | <i>Asâmak</i> in Michif or Cree | David Gold |
| 3. Survival in Our Land | <i>Kipimâcihiowininaw ôta</i>
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| 4. The Night Sky | <i>Tth'ën</i> in Dëne
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| 5. Trapping | <i>Itts'usi Thëlai</i> in Dëne
<i>Wanihikewin</i> in Cree | Keith Lamaigre |
| 6. Wild Rice | <i>Mânomin</i> in Cree | Gloria Belcourt |

Because of the colored photographs throughout each unit and because several units have teacher resources placed in their appendices, the computer files for these units are very large, between 5,000 and 12,000 megabytes. They are available in two formats: (1) Microsoft Word 97 (software compatible with all schools across the north), and PDF, a format which reduces the size of the files considerably but does not allow a teacher to edit the files. Only the PDF files are on our web site. Both the PDF and Microsoft Word 97 files are on the CD.

One of the appendices to the unit *Wild Rice* is a multi-media tour of the La Ronge Wild Rice Corporation's processing plant. With the generous and continuous help of manager Bill Plunz, Glen learned about the process, took photographs, and wrote a script for a student tour of the processing plant. Debbie Mielke (Saskatchewan Education, Northern Division) took these materials and developed a NetScape file that takes students on a multimedia tour of the plant. Two announcers at the MBC radio station at La Ronge (Dallis Hicks and Jason Bekkatla) produced an oral version of the script, which was added to the NetScape file at the College of Education. As a result, teachers and their students can learn something about the processing of wild rice without travelling to La Ronge.

Our units are of most value to people when they can easily copy the units and then modify them to suit the needs of the local community. For this reason, we composed a copyright that would allow educators to do this, while at the same time, not allowing anyone (including ourselves) to make money on our units. Our copyright is shown in Table 2.

All the teaching materials are on our project's web site (maintained by the College of Engineering, University of Saskatchewan), and they are also available at cost (less than \$10) on one CD, available from Northern Lights School Division, Teacher Resource Department, Bag Service 6500, La Ronge, SK, S0J 1L0.

Table 2. The Copyright that Applies to *Rekindling Traditions* Units.

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Results: To Inspire Others Dissemination

Our fourth objective, to inspire others to continue the practice of cross-cultural science teaching, involves our work at disseminating the results of the project. The *Rekindling Traditions* team made presentations at several teacher-related conferences. To facilitate our presentation, we created a PowerPoint presentation of the project, which we modified as the project evolved. The following were group presentations designed for the professional development of science teachers:

Northern Lights School Division Teacher Convention, October 13, 1999, Prince Albert

Learning From Practice Conference, STF, November 20, 1999, Saskatoon

CAPES conference, June 8, 2000, La Ronge

Sciematics, Saskatchewan Science Teachers' Society, Sept. 29-30, 2000, Saskatoon

(7 workshops)

Learning From Practice Conference, STF, November 18, 2000, Saskatoon.

Pre-service science teachers at the College of Education, University of Saskatchewan, have begun to benefit from the *Rekindling Traditions* project in the science methods courses. The materials have been incorporated into the TEP sections of the elementary program, as well as into several methods classes for secondary teachers. New teachers are being made aware of the usefulness and availability of the units.

A limited number of black and white copies of *Rekindling Traditions* have been given to interested teachers at our workshops. Colored copies of the project, plus a CD, were distributed to key people, libraries, and institutions, including our funding agencies.

Letters describing the *Rekindling Traditions* project (including how to obtain a copy) were sent to the education directors of each Tribal Council in Saskatchewan. E-mail messages were posted to people worldwide who have expressed an interest in cross-cultural teaching. This has led to linking the *Rekindling Traditions* web site to some international web sites dedicated to Aboriginal education in science.

Outcomes

Although it is premature to describe definitive outcomes for the *Rekindling Traditions* project, initial reaction has been very positive such as, "This is what I've been looking for. There isn't any material like it."

Pre-service teachers at the College of Education are "hungry" for materials that show how theory can be put into practice. The *Rekindling Traditions* project concretely illustrates how a teacher can integrate Aboriginal science with Western science. The Sciematics workshops given by our team in Saskatoon (September 2000) were particularly well attended, with 25 to 30 teachers per session.

Glen has been contacted by Aboriginal science educators in the USA, New Zealand, and Australia, who learned about the project from our web site. As a result, Maori science teachers in New Zealand have arranged for Glen to spend time (in February 2002) at their Kura Kaupapa Maori school where they are beginning to develop a completely new science curriculum along the bi-cultural lines of *Rekindling Traditions*, and sanctioned by their Ministry of Education.

In the fall of 2000, two science educators from Australia involved in Aboriginal science teaching arranged to drop into Saskatoon (one in October and another in November) to see *Rekindling Traditions* for themselves; Dr. M. Flear, Camberra University, and Dr. Keith Skamp, University of the Southern Cross, Lismore.

Although it is too early to document the outcome of our project, it is interesting to note that at the "Coming Together" conference in Winnipeg, Dr. Greg Cajete took a copy of the *Rekindling Traditions* project back to New Mexico so he could give it to some colleagues in schools. "It is just what they were looking for," he mentioned. His positive reaction is of particular significance because it was Greg Cajete's (1986) original work that gave our project its initial direction. The unit "Trapping" has already been introduced into an northern Ontario community (Red Lake) by trapper/educator Kaaren Dannenmann who also learned about it at the "Coming Together" conference.

Our web site has already caused people to request copies of our CD from the Northern Lights School Division office, for example, people at the University of Alaska Fairbanks. These science educators run the "Alaska Native Knowledge Network" (www.ankn.uaf.edu) which produces excellent documents about culturally responsive

schools and teachers, plus science units of interest to Alaskan Aboriginal students. A personal note of encouragement came from Buffy Saint-Marie (2000) who heads the “Cradleboard Teaching Project” which is developing a series of interactive multimedia CDs for students, *Science: Through Native Eyes*. The group has just finished three science units (sound, friction, and lodges).

A different type of outcome has given us more confidence in one of our instructional strategies in cross-cultural instruction, that is, the strategy of “border crossing,” (described earlier in the section “Results: To Produce Some Teaching Strategies And Materials”). The strategy was based on students’ difficult school experiences when they tried to learn Western science: it seemed as if students were learning a foreign culture (Aikenhead, 1997). Thus for many students, there is a cultural border to cross between a student’s everyday world and the world of Western science (i.e. between these two cultures). Smooth border crossing is essential before students can access Western science. Making border crossings smoother is a central strategy for cross-cultural science instruction. This strategy was picked up by Dr. Greg Cajete and became the content of chapter 12 (“Border Crossings ‘94) in his 1999 book *Igniting the Sparkle: An Indigenous Science Education Model*. The border-crossing strategy was incorporated into our *Rekindling Traditions* units. Time and experience will tell how effective this strategy is for various teachers and students.

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