Addressing the questions of what Native Science is and why it should be taught in schools is not a simple task. There are many ways of understanding ‘science’ and therefore many ways of approaching Native Science. In this primer we offer one perspective on Native Science as an invitation to science educators interested in engaging with this area in their teaching.

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Teaching Native Science

What is Science?

The word ‘science’ is derived from the Latin *scientia*, meaning ‘knowledge’, and refers to both bodies of knowledge and specific processes of learning about the natural world.

What is Native Science?

Native Science, which is also referred to as Aboriginal Science and Indigenous Science, includes the “wide range of tribal processes of perceiving, thinking, acting, and ‘coming to know’ that have evolved through human experience with the natural world” (5). It is one aspect of a broader body of Indigenous Knowledge and is characterized by the following traits:

- **Holistic** - Native Scientific Knowledge includes knowledge of the metaphysical (spiritual) world and reflects a Native view of nature as interconnected and interdependent.

- **Locally valid** - Native Science is rooted in local places and is often practiced to meet community needs for the long term survival of a people.

- **Contextual** - Native Scientific Knowledge is derived through direct interaction with the natural world.

- **Value-laden** - Native Science assumes responsibility for maintaining harmonious relationships among people, nature, all life, and the spiritual realm.

What is Western Science?

Native Science can also be understood in comparison to ‘Western Science,’ which is the kind of science more commonly taught in schools. It is important to note that both Native Science and Western Science are umbrella terms that include diverse systems of knowledge. For example, Western Science includes knowledge from around the world, including some that was appropriated through processes of colonialism and imperialism. Traits characteristic to Western Science include:

- **Discipline-based** - Western Scientific Knowledge is organized into categories (e.g., biology, chemistry, physics) and is limited to knowledge of the physical world.

- **Universally valid** - Western Science takes the search for knowledge that is universally valid as a fundamental goal. It proceeds by falsifying hypotheses and requires ongoing questioning and skepticism.

- **Abstraction** - Western Scientific Knowledge is frequently obtained through experiments that limit the complexity of natural environments by controlling variables and placing phenomena of interest into controlled environments.

- **Value-free** - Western Science holds the ideal of value-free research for the objective and unbiased search for knowledge in high regard.
How are Native Science and Western Science the Complementary and Divergent?

Note: Records of the “findings” of Native Sciences were not kept in the same way as Western models of Science. Traditionally Native peoples recorded and disseminated data using stories and descriptive names of places (13). Stories can be decoded in relation to specific landscapes and can wield a wealth of information regarding a multitude of data, for example the effects of over-fishing on plant populations or the changes in migration patterns due to new land use activities (13).
How Does Native Science Work?

Native nations developed their own sciences through centuries of living on and with particular landscapes. Each Native nation is rooted in a particular landscape, and therefore there are many different Native sciences, each with their own principles, values, and methods. Even though this plurality of sciences is recognized, there are some common methods that can be identified (4); three are described below.

**Contextualized Experience**

One of the primary methods that Native Sciences use for gathering information is direct experience with specific landscapes (3). From these experiences, knowledge is generated by “testing” the accuracy of the gathered information in the context of everyday survival within that landscape (3). Universal “truths” and “facts” which are sought after in Western models of science are not the goals of Native Sciences, instead sustainable living within a specific landscape is the desired goal.

**One Example:** Quinine, a tonic and antimalarial drug, was discovered by an Amazon people who experimented with multiple variations of mashed or chewed roots, stems, bark, and leaves until the needed effect was found (10).

**Another Example:** Through practical experimentation with temperature, storage, and wrapping methods the Yupiaq people of Alaska found that the traditional method of wrapping salmon heads in local grasses was safer than using plastic bags. (10)

**Long-Term Observation**

Observations by Native nations living closely with the land are made regarding animal and plant life-cycles, seasonal changes, mineral resources, climate, as well as many other natural phenomena. Many variables are noted during observations, such as what, when, and where plants are in bloom, birds are active, or animals migrate. After centuries of living on the land, observations of natural phenomena accumulate and knowledge is refined to near precision (13).

**One Example:** In 1993, the Navajo people were suffering from an outbreak of an unidentified virus. After the Centre for Disease Control (CDC) was unable to identify the source of this virus, Navajo Medicine people utilized observations from over a half century. They determined that due to increased rainfall, the rodent population increased, which in turn is always correlated with sickness. The CDC later labelled this virus the hantavirus which is caused by rodent feces. Without the Navajo’s cumulation of long term observations, however, the cause of the virus would have remained unknown and fatalities would have continued (2).
**Another Example:** In 1989 scientists were attempting to determine the reason for the decline in the pike fish population in the Tanana and the Tolovana Rivers. The scientists were trying pinpoint the reasons using technical tracking systems which were implanted in the pikes’ gut sacks (ruining a food staple of the Minto people). Using long term observations, Peter John, a Minto Elder, was able to convey to the scientists that beavers were beginning to migrate due to a new burn policy which resulted in beaver dam being destroyed. Beavers began to migrate and construct their dams upstream, destroying fish spawning beds, resulting in a pike population decline. Due to the cumulation of the Minto peoples long-term observations, Peter John was able to connect the new burn policy and effects of the new beaver dam locations (8).

**Visions**
Additional and equally valid methods for Native Science to gather information are visions, dreams, or intuitions (1). Information using this method can be acquired in spiritual ceremonies such as vision quests, fasting, smudging, prayer, or sweat lodges (1). Typically the received visions are interpreted by knowledge keepers such as Elders or Medicine people, and the resulting data/information is tested in the world of everyday experiences.

**Example:** Native healers use dreams to locate the plants and herbs that are needed to make medicines, which are then used to cure the ailments of their communities (6).
What are some issues that may arise when teaching Native Science?

Many Native peoples may be resistant to science because of its role in justifying and perpetuating injustice and oppression. Teachers should be aware of the events that have contributed to this situation.

*Suggestion:* Put Native Science and Western Science on equal terms and highlight complementarities among them to help to ease students’ resistance.

There may be concerns about the appropriateness of some topics, particularly spiritual knowledge, in school curricula.

*Suggestion:* Most teachers will not be a position to have access to this type of sensitive information. If possible, consult local community authorities and encourage positive ongoing relationships between communities and schools to limit the potential for this to occur.

Non-native teachers have reported feeling uncomfortable teaching Native Science because of their lack of experience and expertise.

*Suggestion:* Encourage the participation of parents, community members, and other knowledge keepers in the life of the school.
Why Incorporating Native Science is Important

Students excel when their culture and background is reflected in what they are learning. Science classrooms filled with ideas and activities based on a western conception can be an alienating place for students. Instead of being excited to explore the world they distance themselves from learning and disengage.

By incorporating Native knowledge into classroom discussions and activities, Native and non-Native students gain a greater understanding of the many ways to think about the world. They become excited to share their own knowledge and background with others, develop excitement for learning new and different ideas, and recognize that their own people have a great deal to contribute to the global society and the resolution of modern ecological crises.

The world is increasingly becoming a more technological and scientific place, and Native students need to have appropriate access to scientific and technological schooling. Making science classrooms more culturally appropriate for Native students will facilitate their greater participation.

Bringing Native Science into Your Classroom

1) **Discuss holistic ideas** and think of how activities and experiments can be discussed across multiple subject areas.

2) **Incorporate outdoor/land/place-based approaches** by taking your class on a walk around the school and taking field trips to observe science at work. Hold lectures outside and ask students to observe their natural world for homework.

3) **Remember your students are a resource** and have a discussion with your class about science and their perspectives on different ways of understanding the world.

4) **Invite community members into the classroom** to talk about their knowledge and share stories with students.

5) **Ask for community collaboration** and ask what local community members would like to see in the curriculum.

6) **Use experiential and problem-based learning** to encourage students to draw on their own knowledge and find new solutions to problems.

7) **Teach the science of complex systems** such as evolution and ecology in a way that highlights the importance of relationships and how multiple ways of looking at these systems provide new perspectives.

8) **Invest in Indigenous languages** by encouraging their use in the classroom.

9) **Explore the resources listed** to find lesson plans and learning outcomes that can be adapted to your students’ interests.

10) **Keep the discussion going** and continue to encourage students to think about how their background influences how they seek to understand the world and how multiple perspectives add strength to our understanding.
Resource List For Classroom Activities and Discussion

FORESTS AND OCEANS FOR THE FUTURE CURRICULUM

http://www.ecoknow.ca/activities.html

The key focus of these materials has been inspired by the experiences of students and community members living within the Tsimshian territory of the province of British Columbia. The resources material in this package include curriculum material designed for use in the Province of British Columbia’s K-12 education system. In addition, the material can be easily adapted to function as reference resources for community members and other interested resource stakeholders.

SASKATCHEWAN ECO NETWORK – ECO EDUCATION


On this website we do not try to outline the teachings themselves, instead, we have listed a number of curriculum resources that have been developed by indigenous educators for the classroom.

INDIGENOUS SCIENCE RESOURCES

http://www.dlese.org/dds/histogram.do?group=subject&key=dlisr

Indigenous Science Resources is a collection of online text, video, audio, and image files of Indigenous science and ways of teaching and learning about it.

LIVING KNOWLEDGE: INDIGENOUS KNOWLEDGE IS SCIENCE EDUCATION


Welcome to the Living Knowledge website. This site is part of a three year Australian Research Council (ARC) research project Indigenous knowledge and Western science pedagogy: a comparative approach. The project aims to determine the most effective ways of incorporating Indigenous knowledge within the NSW secondary school science curricula.

INDIGENOUS KNOWLEDGE ACTIVITIES


In class activities for exploring perspectives of time, indigenous knowledge and sustainability.

DIGITAL LIBRARY OF INDIGENOUS SCIENCE RESOURCES

http://www.dlisr.org/nativescience.html

An online library collection of text, video, audio, and image files of Indigenous Science for use in curriculum and classroom activities.
Bibliography


Other recommended Resources:

Research Literature on the Influences of Culturally Based Education on the Academic Performance of Native American Students (PDF) By: William Demmert

http://www.nbowmanconsulting.com/Indigenous%20Education.htm

This 143 page review of the research literature on the influences of culturally based education on the academic performance of Native American students focuses on quantitative and select qualitative research.