Part One: Foundations

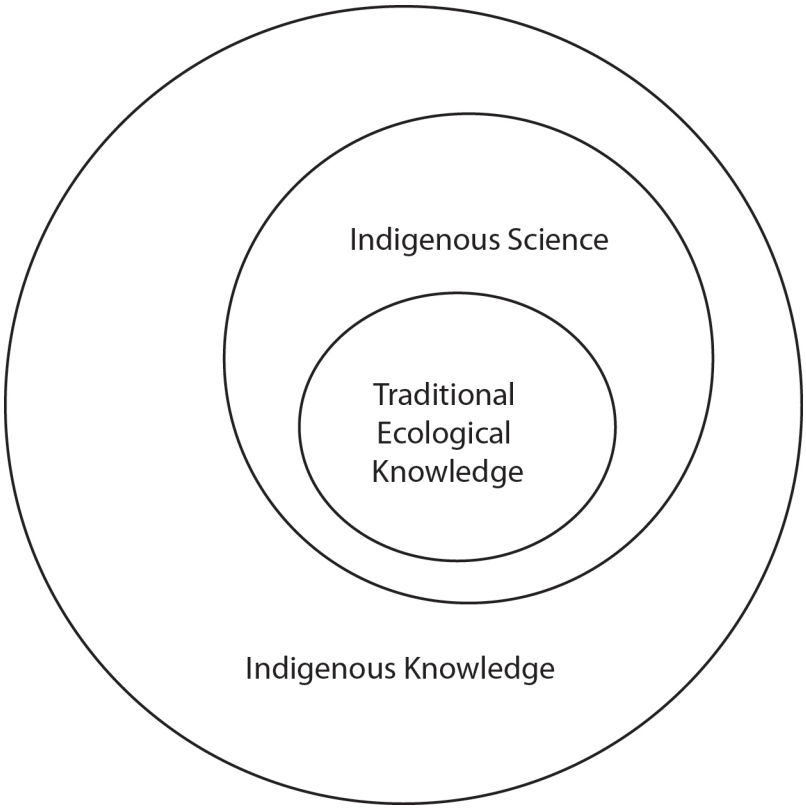
What is Indigenous Science, and how can it become a significant component of senior secondary classes?

This section provides some background information and insights into ways of bringing First Peoples' knowledge and perspectives on science into the classroom, and ensuring a reciprocal relationship with local First Nations communities when planning student activities.

This section includes:

1. Indigenous Knowledge, Indigenous Science
2. Involving Local First Nations Communities
3. Connecting With the Land: Including Land-Based Activities in Your Units
4. Finding and Using Narratives in the Science Classroom
5. Encouraging First Nations Learners' Engagement in Science
6. Suggestions for Developing Locally Based Resources
7. Assessment Suggestions

> Resonance is the key term in this whole perspective [of Indigenous Knowledge]. The idea and the understanding that the focus of Native Science was really not to try to explain away the mystery of the natural world but was about finding ways to resonate with the natural world and the natural order towards the effect of sustainability and also of the meaning of life as a whole.
>
> Dr. Gregory Cajete



1. Indigenous Knowledge, Indigenous Science

Indigenous Science makes up a significant part of the greater body of knowledge often called Indigenous Knowledge, which is the sum of cultural knowledge and wisdom held by Indigenous peoples of the world. It contains all that can be encompassed by a unique worldview, such as values and beliefs, creative expression, history, political and economic systems, and human relationships as well as science. While it is rooted in historical knowledge, it is also dynamic and growing.

For more about bringing Indigenous Science to the classroom, see *Knowing Home: Braiding Indigenous Science with Western Science, Books 1 and 2*, Gloria Snively and Wanosts'a7 Lorna Williams, eds.
https://tinyurl.com/fnesc83
https://tinyurl.com/fnesc76

Some characteristics of Indigenous Knowledge include:

- Knowledge that is locally-based. First Peoples have occupied their traditional territories for millennia and their knowledge reflects an intimate connection with their lands.
- Diversity. Because it is based locally, Indigenous Knowledge has developed in a multitude of ways.
- Shared principles. Despite the diversity between individual groups of First Peoples, most share common underlying principles, such as a worldview based on interconnectedness and reciprocal relationships with the natural world.

A portion of this knowledge can be classified as Indigenous Science. This is a body of evidence-based local knowledge and skills acquired over thousands of years.

Traditional Ecological Knowledge

Traditional Ecological Knowledge, or TEK, is the most popular term to denote the vast local knowledge First Peoples have about the natural world found in their traditional environment.

Some people consider the term misleading because "Traditional" suggests that the knowledge is stuck in the past, where in fact it is dynamic and continually being renewed. As well, the use of "Ecological" can be seen as limiting, for the knowledge referred to is holistic and goes beyond the discipline of ecology, and embraces many topics such as spirituality, astronomy, medicine and technology. However, "ecological" in its broader usage can refer to the idea that TEK is rooted in the local landscape.

One way of understanding TEK is to consider it not as just a database of collected information, but as a *process* of participating in relationships, as explained in this quote:

> Native understandings of TEK tend to focus on relationships between knowledge, people and all of creation (the "natural" world as well as the spiritual). TEK is viewed as the process of participating (a verb) fully and responsibly in such relationships, rather than specifically as the knowledge gained from such experiences. For First Peoples, TEK is not just about understanding relationships, it is the relationship with Creation.[1]

TEK is, above all, local knowledge based in people's relationship to place. It is also holistic, not subject to the segmentation of Western science. Knowledge about a specific plant may include understanding its life cycle, its spiritual connections, its relationship to the seasons and with other plants and animals in its ecosystem, as well as its uses and its stories.

TEK is widely used in biological and environmental sciences, and is largely considered to be complimentary to, and equivalent with, Western scientific knowledge. The environmental knowledge of generations is important to fields such as resource management, climate change and sustainability. For example, at the federal level, a TEK subcommittee reports to the Committee on the Status of Endangered Wildlife in Canada which make recommendations to the Minister based on TEK in their own local regions on species that may need to be listed.

It is important to recognize that TEK is the intellectual property of the First Nations who hold it. Many people share much of their knowledge with others, but some knowledge and wisdom, due to cultural protocols, is considered private and is not shared.

1 Deborah McGregor, Linking Traditional Ecological Knowledge and Wester Science: Aboriginal Perspectives from the 2000 State of the Lakes Conference. *Canadian Journal of Native Studies* XXVIII, 1(2008):139-158. Page 145.

Language and Story

Language is the vessel that contains Indigenous knowledge. Understanding is embedded in language, and knowledge is structured and transmitted through language. Learning through oral language is part of its experiential nature.

Indigenous languages are rich and precise, expressing the specific knowledge required to understand the local ecosystem.

Through the processes of colonization, First Nations languages have undergone attack. Most communities suffered significant language loss, and one of the results of the loss of language is the loss of knowledge. As well, learning has moved from the oral to the written.

Some languages face extinction, but others are experiencing renewal. People are working to revitalize languages which in turn will serve to keep traditional knowledge alive.

Like most languages, strong Indigenous languages continue to grow and sometimes new words are added for contemporary objects. For example, in Sm'algyax, the Ts'msyen language, the word flashlight is *laawksm ts'amti* (light lightning or lightning from a light). In Tsilhqot'in, the word for helicopter is *betsit'ay naghedalt'ex* (Something that has something spinning on top of it.)

First Voices is a useful online source for BC First Nations languages. It gives students searchable vocabularies in many of BC's diverse First Nations languages www.firstvoices.com

Incorporating traditional languages into experiential science activities wherever possible is an important part of bringing Indigenous Science into the classroom. Using appropriate language in non-trivial ways helps to validate Indigenous students and the knowledge of First Peoples communities. It also helps other students experience and understand a diversity of world views.

Where possible, develop a word bank of words and phrases from the local First Nations languages that are relevant to the units and subjects you teach, and incorporate them into lessons and assessments. There may be local community language resources in the school or community to support this.

Story

Story is one of the main methods of traditional Indigenous learning and teaching. Combining story and experience is a powerful strategy that has always been used by First Peoples, and its power can also be brought to the science classroom.

Foundations For suggestions on how to find and incorporate story into your science units, see the section Finding and Using Narratives in the Science Classroom, page 24.

Stories enable holistic learning. They meld values, concepts, protocol, practices and facts into a narrative. They also develop important skills of listening and thinking.

Story can be an important part of the science curriculum. Oral storytelling can be incorporated by inviting First Nations storytellers into the class, or the teacher can read a written version of a traditional story where appropriate. Reading published stories that are relevant to the science class can integrate with English Language Arts, or with First Nations language classes.

Place Names

Traditional place names provide information about First Peoples and their relationship with the land. Traditional knowledge is often embedded in place names. Paying attention to the name of places in traditional territories can lead to a wealth of information about local ecosystems, land use or plant and animal behaviour.

Many First Nations communities have documented the traditional place names of their traditional territories and they may be available as a classroom resource. However, some place names may considered private and to be used only by community members.

Shared Concepts of Indigenous Knowledge

As mentioned, despite the incredible diversity of the locally-based knowledge held by First Peoples, there are some important concepts that are key to understanding Indigenous Knowledge.

❖Reciprocal Relationships

An essential value of Indigenous worldview is the understanding of reciprocal relationships in all interactions in life, including those with the natural world. In such relationships, there are mutual benefits to both parties. From a First Peoples perspective, it means giving back to the land when we receive from it. It is like an exchange of gifts.

This relationship is often expressed symbolically. It is the mind-set with which a person approaches the relationship; the feeling or intent of gratitude that is key from the human perspective. Usually First Peoples thank the plants or animals that give themselves to nourish the humans as they harvest them. Sometimes, people leave a gift such as tobacco or another item as a token of respect and thanks.

By emphasizing the importance of reciprocity, First Peoples ensure that the natural world is kept in balance and maintained in a sustainable way.

❖Interconnectedness

First Peoples are diverse, and the unique knowledge each group holds is part of their individual worldview. However, they share a common belief that we are all connected to nature and to each other. This notion that we are all connected with everything in the world is expressed by many First Peoples in the phrase “All my relations.”

Inherent in this view of the world is the understanding that everything in the universe has a place there and deserves respect. From this vantage point, people view their relations with others as well as the natural world differently than someone who sees it through a microscope or telescope.

❖Transformation and Renewal

The natural world works in patterns and cycles. These processes mean that change is essential; everything from quarks to weather systems to solar systems are in constant motion. Change brings about transformation.

In transformational processes, things move through different states and dimensions, whether it is energy, carbon atoms, thought or spirit.

Transformation is at the centre of many First Peoples' traditional narratives and origin stories. They include characters called Transformers and Tricksters who assist human in ways that included transformation. Those stories are often placed in times when animals and people were able to transform shape. For example, many narratives tell of humans or other beings that have been transformed into physical features of local landscapes.

The cyclical nature of transformation results in renewal, like the seasons, the returning salmon, or the camas blooming. Renewal is necessary for life to be sustained. This implies that people need to behave in sustainable ways to ensure renewal.

First Peoples recognize the significance of renewal through communal events and ceremonies. Many communities mark the beginning of the return of important resources such as the First Salmon, First Fruits and First Bitterroot ceremonies.

❖Sense of Place

Foundations
For ideas to build a sense of place and include land-based activities, see Including Land-Based Activities in Your Units, page 21.

Connection with place, with the land, is the foundation of Indigenous Knowledge. This means that each Indigenous group holds unique world views, technologies and pedagogies according to their environment and territories. Indigenous knowledge, passed on through the generations, was essential for sustaining life. Survival for First Peoples depended on and depends on their particular knowledge of the land, their unique relationship with the environment, and their shared values and practices through which they made sense of the world.

The concept of Place goes far beyond the physical space. It includes a crucial Sense of Place, the memories, emotions, histories, spiritualities that bind the people to the land.

Five concepts of place have been identified, common to most First Peoples:

- Place is multidimensional. More than the geographical space, it also holds cultural, emotional and spiritual spaces which cannot be divided into parts.
- Place is a relationship. All life is interrelated.
- Place is experiential. Experiences a person has on the land give it meaning.
- Place is local. While there are commonalities, each First Nation has a unique, local understanding of Place.
- Place is land-based. Land is interconnected and essential to all aspects of culture.

Making connections with place in science curricula is an integral part of bringing Indigenous science into the classroom. That means including experiential learning in local natural and cultural situations.