Introduction

About This Guide

With the increased inclusion of First Peoples' content in the changing BC curriculum, there is a need to incorporate unappropriated First People's perspectives into Science courses. Previously, the First Nations Education Steering Committee and the First Nations Schools Association developed teacher resources to support English Language Arts, Social Studies and Mathematics courses. This guide expands these resource materials to include Science.

The Science First Peoples Teacher Resource Guide is designed to assist science teachers in all BC schools, including First Nations and public schools. The resources focus on Grades Five to Nine, but can also be applied to other grade levels.

The guide includes background information regarding how First Peoples' perspectives in science can be recognized and included in science inquiry. It also offers curriculum planning suggestions, and provides examples of fully developed units that correspond with the Big Ideas and Learning Standards in the BC Provincial Science Curriculum for grades 5- 9.

This guide is intended in part to address the Calls to Action of the Truth and Reconciliation Commission, particularly the call to "integrate Indigenous knowledge and teaching methods into classrooms" (clause 62) and "build student capacity for intercultural understanding, empathy and mutual respect" (clause 63).

Goals of the Science First Peoples Teacher Resource Guide

- to contribute to Reconciliation for all by building greater understanding of the skills, knowledge and perspectives of First Peoples for all students
- to provide resources to enable teachers to incorporate First Peoples' perspectives into the teaching and learning of the sciences
- to ensure the inclusion of First Peoples' perspectives is done respectfully and without appropriating First Peoples' knowledge.
- to implement strategies to enhance First Nations students' participation in the sciences
- to encourage and support the respectful development of local resources
- to reflect the connection with the land on which we are all situated

First Peoples Pedagogy

These learning resources are guided by the recognition of ways of learning inherent in First Nations' world views. While each First Nation has its own unique identity, values and practices, there are commonly held understandings of how we interact and learn about the world. In respect of these, the activities in this guide:

- are learner centred
- are inquiry based
- are based on experiential learning
- emphasize an awareness of self and others in equal measure
- recognize the value of group processes
- support a variety of learning styles

The activities are based on the following principles which reflect a respectful and holistic approach to teaching and learning and are an example of Indigenous Knowledge. They were first articulated by a diverse team of Indigenous educators, scholars and knowledge-keepers during the development of English 12 First Peoples.

First Peoples Principles of Learning

Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.

Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

Learning involves recognizing the consequences of one's actions.

Learning involves generational roles and responsibilities.

Learning recognizes the role of indigenous knowledge.

Learning is embedded in memory, history, and story.

Learning involves patience and time.

Learning requires exploration of one's identity.

Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.

Perspectives of Science

There are many ways to view science, many ways to look at and understand the world, as these statements illustrate:

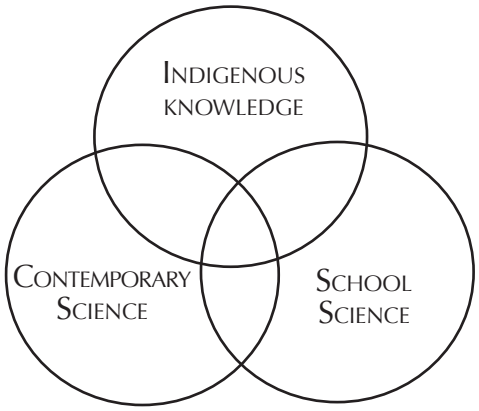
> "Science is about the pursuit and delving into the unknown." Dr. Leroy Little Bear. Indigenous Knowledge and Western Science: Dr. Leroy Little Bear Talk, Banff Centre. (https://www.youtube.com/watch?v=gJSJ28eEUjI)
>
> "Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence." UK Science Council website (http://sciencecouncil.org/)
>
> "Science is curiosity in thoughtful action about the world and how it behaves." NASA website (http://spaceplace.nasa.gov/science/en/)
>
> "Traditional Knowledge is science." George Hobson, Canadian scientist. (http://www.carc.org/pubs/v20no1/science.htm)
>
> "Science is experiment, science is trying things. It is trying all possible alternatives in turn, intelligently and systematically, and throwing away what won't work and accepting what will." R. Doyle. The Nature of Science. *Bridges*. October, pp 12-16, 1985.
>
> "Science is ... a rational, empirically based description–explanation of nature. This concept includes, among others, the Eurocentric cultural perspective (Western science) and Aboriginal cultural perspectives (Indigenous knowledge) held by First Nations, Inuit and Métis peoples in Canada." Glen S. Aikenhead. Towards Decolonizing the Pan-Canadian Science Framework. *Canadian Journal of Science, Mathematics and Technology Education*, v 6 n 4. 2006.

In bringing First People's perspectives to the classroom, we can consider three different approaches to science and find ways they can converge.

Indigenous Knowledge is the knowledge of Indigenous peoples, including scientific and evidence-based knowledge, that has been built up over thousands of years of interaction with the environment. It is holistic knowledge rooted in place and contained in language.

Contemporary Science is an evidence-based way of understanding the natural world. Asking questions and discovering answers results in a continuous revision of knowledge. Scientific knowledge is provisional and influenced by culture, beliefs and ethics.

School Science encompasses both what is considered important to teach and learn in K-12 schools, and how science is taught. Ideally, it incorporates scientific curiosity and inquiry.



Convergence

Indigenous Knowledge and contemporary Western Science are complementary ways of knowing about the world, and today they have in many ways converged in modern scientific practice. However, some school science has been left behind by not being part of the convergence.

There are many examples of contemporary science validating Indigenous Knowledge. Take the recent DNA studies that shows a direct genetic link between Ts'msyen people living at Metlakatla BC today with bones recovered from a nearby archaeological dig that are 5500 years old.[1] Underwater archaeology on Haida Gwaii has found evidence that people lived there more than 12,000 years ago.[2]

Contemporary science is moving towards a more holistic vision of nature, in accordance with Indigenous thought. For example, in July 2012 The Cambridge Declaration of Consciousness was made by leading neuroscientists who declared that animal and human consciousness are on the same level. This and other discoveries substantiate the interconnectedness of all things.

In another example, UBC forestry scientist Dr. Susanne Simard discovered that trees communicate with each other in the forest through sophisticated fungal networks. She also helped identify Mother Trees, large trees which act as hubs for a vast network of young trees and seedlings.

In environmental science, Traditional Ecological Knowledge is very important for scientists developing baseline data. Where scientific data about the behaviour of a certain species may only go back thirty years when scientific recording began, traditional knowledge can take it back generations. As well, it is a crucial indicator of how well resource management strategies are working, as Indigenous people observe changes in their local ecosystems.

Integrating traditional knowledge and contemporary science is seen as vitally important in working to achieve sustainability in our use of resources and bringing balance back to our ecosystems that have been impacted by modern society.

1 http://news.nationalpost.com/news/canada/groundbreaking-genetic-study-links-living-first-nation-woman-to-5500-year-old-ancestor

2 http://www.ancient-origins.net/news-history-archaeology/13800-year-old-haida-site-found-underwater-canada-002485

School science, on the other hand, is sometimes seen as prescriptive, based solely on facts to be learned. It often projects the view that what is important in the world has already been discovered. The knowledge that is transmitted is most often based in Western worldviews.

Today we have the opportunity to bring school science into convergence with Indigenous Knowledge and Contemporary Science through a broader understanding of what Indigenous Knowledge is and how it can be infused into the classroom.

What is Science?

Perceptions and Experiences of Aboriginal Students who are Successful in Senior Secondary Science

Student Science Definitions

Science is

"A method of understanding and postulating the world. It is a social construction and its theories are not proven."

"The study of living and non-living organisms of life."

"The study of humans and animals into great depth exploring all aspects of life and life's effectors."

"The study of all things that make up our world and making the unknown, known."

"The discovery of new forces, organs, etc."

"The thing that explains everything."

"A group process to find a conclusion to a hypothesis."

"The study of the world around us and how things interact."

"A way to understand the world we live in and easily share this knowledge with others, thus contributing to a greater global knowledge."

"A means by which to gather knowledge systematically."

Student Metaphors for 'Science'

If science was an animal, what would it be and why?

"Science is like a squid or a jellyfish because they have spawn off, they have lots of arms and science is at the centre, they are multi-limbed."

"Science is like a monkey - monkeys are always interested in everything that's around them and so they always have to examine things and I just find science does that too examines organisms or anything like that."

"Science is like a whale – it's one of the biggest animals and science, it's a pretty broad topic. It can go into lots of different things and it's versatile. Also it's big but there's lots of little intricate things about a whale as well same with science – different branches you can go into."

"Science is like a lion. It kind of came with everything. Science is really powerful to humanity and lions are the king of the jungle."

"Science is like a bear because science is very tough and a bear is very tough. It's kind of hard to get past [science] but once you get started, you can do it and finish it and get past the bear after awhile too, once you stop being afraid of it, you can just walk by it."

If science was an object, what would it be and why?

"Science is like a mountain because it is born of the earth, it gets bigger and bigger – part of a cycle trying to move towards a peak of knowledge; it would crumble back or it is continuously being reviewed – a circle kind of."

"Science is like a fridge because it has its boundaries. You can just look at it and it's a fridge or it's science and then when you open it up, you find lots of different things and everyone has their own things in it."

"Science is like a home. I feel comfortable in science. I just never felt puzzled by science."

"Science is like a bike. Once you start learning how to ride a bike, you don't know how at the beginning and you're scared then you start riding it and it gets easier. If you try your hardest at science, you could just roll through it and finish."

Source: Anne Tenning. *Metaphorical Images of Science: the Perceptions and Experiences of Aboriginal Students who are Successful in Senior Secondary Science*. Masters Thesis UVIC 2010. Used by permission.

Indigenous Knowledge

What is Indigenous knowledge, and how can it be brought into science classes? This section looks at important concepts in understanding Indigenous knowledge, the importance of Interconnectedness, Sense of Place, Language, Place Names, Story and Traditional Ecological Knowledge.

Interconnectedness

First Peoples are diverse, and the unique knowledge each group holds is part of their individual worldviews. 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 only sees it through a microscope or telescope.

Sense of Place

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 survival. 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[3]:

- 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.

3 Adapted from Michell et al., *Learning Indigenous Science From Place*, p. 27-28.

Language

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.

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 have been added to the language for contemporary objects. For example, in the Ts'msyen language Sm'algyax, the word flashlight is *laawksm ts'amti* (light lightning or lightning from a light). In Tsilhqot'in, the word for helicopter is *betŝit'ay naghedalt'ex* (Something that has something spinning on top of it.)

Incorporating traditional languages into experiential science activities wherever possible is an important part of bringing Indigenous Science into the classroom. There may be local community language resources in the school or community to support this. An online source that students can access is firstvoices.com which gives students searchable vocabularies in many of BC's diverse First Nations languages.

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.

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 used by First Peoples, and its power can also be brought to the science classroom.

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 where First Nations languages are taught.

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. As with the definition of science, there are differing meanings of TEK. Sometimes the term is expanded as Traditional Ecological Knowledge and Wisdom. Other terms used are Aboriginal Traditional Knowledge, Naturalized Knowledge Systems, local knowledge, and Indigenous Knowledge. Some view TEK as a construct of other contemporary sciences. Others fear the word "traditional" suggests the knowledge is stuck in the past, where in fact it is dynamic and continually being renewed.

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, an ATK 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.

TEK is, above all, local knowledge based in people's relationship to place. It is also holistic, not subject to the segmentation of contemporary 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.

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 there is other knowledge and wisdom that is considered private and is not shared.

Making Connections with the Community

Bringing First Peoples perspectives of science into the classroom means in part connecting with the local First Nations community. It is important to understand and practice the local protocols in areas such as:

- Inviting Elders and other knowledgeable community members into the classroom to speak
- Respecting the natural world when going out on field trips
- Visiting First Nations lands and territories
- Interviewing people
- Holding special events such as a celebratory feast
- Developing science units

Most communities have protocols in place to be followed when working with Elders and Knowledge Keepers. This may include showing respect by offering a gift to the person, or perhaps to the land when on a field trip.

Make contact with the local First Nations communities through workers in schools or through the local Band Council. There may be a School District staff member such as an Aboriginal District Principal, Aboriginal Helping Teacher, Resource worker or other liaison person to help with the initial contact. Guidance can be sought from local learning centres and community organizations such as Friendship Centres, First Nations offices, Tribal Councils or cultural centres.

It is important to work with the appropriate agencies to make sure that certain Elders and Knowledge Keepers do not get over-worked or called upon too often.

All knowledge shared by local First Nations is inherently their intellectual property. FNESC is developing intellectual property agreement and policy templates to support First Nations in protecting community ownership of traditional knowledge and language when entering into educational partnerships. Watch the FNESC publications page for updates.

First Peoples Guest Speaker Considerations[4]

It is important to follow protocols when inviting a member of a First Nations community or Aboriginal organization to a classroom or school. Below are some general considerations and processes. There are also often protocols specific to local communities. School district Aboriginal education departments or community education departments can also provide guidance regarding those specific protocols.

These considerations can also be adapted when taking students on field trips or into field learning experiences that will be led by, or facilitated by, a member of a First Nations community or Aboriginal organization.

Before the Visit

- Determine the purpose of the visit (how it is connected to the curriculum or learning standards for the class or course). If it is not directly connected to the curriculum, be clear about the intended learning standards so that the guest visit is meaningful experience for all involved.
- It is a culturally appropriate protocol for guest speakers to be provided with a gift and/or honourarium for sharing their time and knowledge.
  - Consult with the school district's Aboriginal education department or First Nations community to determine the appropriate amount or gift (if the speaker has not already indicated an amount for an honourarium).
  - Determine where funds will come from in advance. Check to see if the school or PAC can contribute.
  - If the school and/or school district requires any paperwork to be completed before payment can be issued, ensure that this is done well in advance of the visit so that payment can be issued at the time of visit or as soon as possible afterward.
- Talk with the speaker about the details of the visit:
  - Date and time of the visit
  - The course and grade levels of the students
  - Approximate number of students
  - Let the speaker know what content/learning has led up to the visit.
  - Ask the speaker about any specific needs:
    - Are there any hand-outs that need to be photocopied in advance, or any equipment or supplies needed?
    - Is there any specific information that students should know before the visit?
    - Are there any specific protocols that the students and adults need to follow during the visit?
    - Is there is anything else that will help make the visit more comfortable for

4 Adapted by permission from an original document by Anne Tenning, School District 68 Nanaimo-Ladysmith

the speaker (especially if it is an Elder)?
    - Would it help to have the classroom/space organized in a specific way?
  - Ask for permission to take photos or videotape (if desired).
  - Ask the speaker for some background information that can be used to introduce the speaker to the students (for example, where the speaker is from, his or her role or occupation, noteworthy experiences or accomplishments).
- Arrange arrival details:
  Ensure everyone knows where the speaker will be met.
  - For example, arrange to have the speaker met in the parking lot, at the front door of the school, or in the main office.
  - In some situations, the speaker may need transportation from home.
  - If possible, include students in the greeting.
- Ensure the students are prepared prior to the visit:
  - Connect speaker's visit to students' previous learning
  - Review respectful behaviour with students, including non-verbal communication
  - Model for students how to introduce themselves
  - Brainstorm with students questions that they can ask
  - Prepare students to provide a thank-you to speaker
- Ensure office staff and administrators know that a guest is expected.

Day of Visit

- Prepare physical space of classroom. Set up any necessary equipment.
- Welcome guest, offering water/tea/coffee. Let them know where washrooms are located.
- Introduce speaker to students and if appropriate do acknowledgment of territory.
- If students will be introducing themselves to the speaker, consider a talking circle format, saying name and where they are from.
  - Ensure there is time for questions/discussion at the end of the session.
  - Have student(s) formally thank the speaker and present gift or honourarium.
  - If possible, debrief the session with speaker.
  - Walk the guest out.

**It is important that the teacher stay present for the session as this models for the students a valuing of the knowledge and time of the speaker. If any behavioural challenges occur, it is the teacher's responsibility to address them, not the speaker's.*

After the Visit

- Debrief the session with the students.
- Do follow-up activity with students.
- Have students follow up with thank-you letter.
- Touch base with speaker to ensure that honourarium was received (if not presented on day of session).

Suggestions for Developing Locally Based Resources

This guide gives sample units which incorporate Indigenous Science perspectives into science activities. Teachers are encouraged to develop local units that speak to the local sense of place and non-appropriated knowledge of local First Nations, in collaboration with knowledgeable community members.

Below are a number of suggestions for developing local inquiry based, experiential lessons which can integrate with the BC Curriculum.

Working in Partnership with Community Members

Great success comes from working in collaboration with the local community. Here are some fundamental considerations when consulting with community members.

- Develop classroom resources in collaboration with Elders, knowledge keepers and other community members.
- Approach the community members with respect.
- Prepare to consult with community members by reading published or online resources relating to your topic to get an idea of local knowledge.
- Explore ways to allow students to get out onto the land and to experience the "place" of the local First Peoples.
- Remember that not all knowledge can be, or will be, shared. This needs to be respected.
- All cultural knowledge remains the copyright of the community. Educators, schools and/or school districts should not attempt to copyright lessons developed in collaboration with First Nations communities.
- How you connect with the local First Nations community will depend on your school and location.
  - Most school districts have a District Aboriginal Principal or similar position who may be able to connect you with community members.
  - Band operated schools have an education coordinator or other band council member whose responsibility is liaison with the schools.

Framework for Designing Indigenous Science Resources

On pages 18 and 19 is a rubric illustrating a framework for designing Indigenous science resources. It was developed by, and reprinted with the permission of Dr. Judy Thompson. Some fundamental aspects for involving Indigenous science include:

- Indigenous Voice. What cultural experts can contribute to the unit implementation?
- Indigenous Languages. How can the local First Nations languages be included in the lessons?
- Diversity of Indigenous Groups. Do the lessons recognize the diversity of First Nations? Can the unit be shared and adapted to other groups?
- Protocol. What protocols need to be followed during the implementation of the unit?
- Relationship with the Land. How can the unit reinforce the importance of the land, plants and animals to Indigenous people?
- Ways of Learning, Ways of Teaching. Are traditional ways of learning included? Are activities student centered? Is evaluation formative?

7E Model

The 5E model[5] has been widely used as a structure for developing experiential learning activities for science. This model can be expanded to include two significant components that incorporate Indigenous science: Environment and Elders. It can be used to structure a single lesson, or a over a number of days. It works well as an organizer for inquiry learning. See Shared Knowledge Science Celebration, page 193.

Environment

Situate the lessons in the local land and environment. This builds an appreciation for the concept that everything is connected to everything else and taps into a sense of Place.

Engage

Capture student attention and curiosity. Raise scientifically relevant questions. Connect what students know with a new question or idea. Ask a question, show something interesting, pose a problem.

Explore

Experiential. Students observe, record, connect ideas, ask questions, usually in groups. Teachers are coaches and facilitators.

(7E Model continued on page 20)

5 5E model developed by Biological Sciences Curriculum Study in 1987.
See http://bscs.org/bscs-5e-instructional-model.

Framework for Designing Indigenous Science Resources

	Gradations of Quality			
Criteria	***4***	***3***	***2***	***1***
Indigenous Voice	Cultural experts are a significant and critical part of unit implementation. Elders and community members are involved at all stages of the curriculum development process and an Indigenous person is directly involved in the writing of the curriculum.	Cultural experts are involved. Elders and community members have been involved in many stages of the curriculum development process.	Cultural experts have been involved, but their role is not clear.	Involvement of cultural experts not mentioned.
Indigenous Languages	Indigenous languages are recognized as being an integral part of Indigenous ways of knowing and worldview. The language plays a large part in the lessons and activities.	Indigenous languages are recognized as being an integral part of Indigenous ways of knowing and worldview. While the language does not play a large part in the lessons, the importance of learning the language from Elders and other fluent speakers is stressed.	No mention of the importance of Indigenous languages toIndigenous ways of knowing and worldview but there are Indigenous words used here and there throughout the curriculum.	Indigenous languages are not part of the curriculum and there is no mention of their importance to Indigenous ways of knowing and worldview.
Diversity amongst Indigenous Peoples	Focus of curriculum is on one particular Indigenous group. The curriculum is flexible enough so that it can be adapted to other Indigenous groups.	Focus of curriculum is on one particular Indigenous group. There is not much flexibility in the lessons so that they cannot be adapted to other Indigenous groups.	Curriculum is very general and is not focused on any particular Indigenous group. However, it does make reference to the diversity amongst Indigenous groups.	Curriculum is very general and is not focused on any particular Indigenous group. Does not make reference to the diversity amongst Indigenous groups.

Adapted from: Appendix F, pp. 136-140. Thompson, J.C. (Edōsdi), (2004). Gitga'at Plant Project: The Intergenerational Transmission of Traditional Plant Knowledge Using School Science Curricula. (Unpublished Master's Thesis). University of Victoria, Victoria, BC.

Protocol	It is recognized that when working with specific Indigenous communities and cultural experts that there are protocols to be followed. These are explicitly stated.	It is recognized that when working with specific Indigenous communities and cultural experts that there are protocols to be followed. These are not stated, but are directed to individuals and/or organizations (e.g. hereditary chiefs, band council members, educators, etc.) in order to find out the proper protocol to be followed.	The importance of following protocol is not highlighted, but individuals and/or organizations within the community are listed as contacts for general information.	There is no mention of the importance of following protocol.
Relationship with the Land	States the importance of the land, plants and animals to Indigenous peoples. Lessons either take place out of the classroom on the land (e.g. at fish camps, seaweed camps, etc.) or in the classroom. Cultural experts are integral to the lessons.	States the importance of the land, plants and animals to Indigenous peoples. While some lessons take place out of the classroom on the land, many of the lessons take place in the classroom. Cultural experts are often involved.	Does not state the importance of the land, plants and animals to Indigenous peoples. Most of the lessons take place in the classroom but cultural experts are brought in once in a while.	Does not state the importance of the land, plants and animals to Indigenous peoples. Lessons take place inside a classroom without the involvement of cultural experts.
Ways of learning, ways of teaching	Traditional ways of learning and teaching are outlined. Activities are numerous and varied and are student-centred. They often take place on the land with Elders (observation, practice, participation, active involvement, etc.). Learning and evaluation ideally take place at the same time; is formative.	Traditional ways of learning and teaching are mentioned. Several activities take place, such as videos, guest speakers, field trips, guided labs, non-directed labs. Lectures are limited and teacher acts as a facilitator. Evaluation is a balance of formative and summative.	Traditional ways of learning and teaching are not mentioned. Some activities, such as videos or guided labs. Evaluation is a balance of formative and summative.	Traditional ways of learning and teaching are not mentioned. Activities are teacher-centred (lecture oriented). Evaluation is summative.

Elder

Elders and other knowledgeable community members represent the Traditional Ecological Knowledge held by the community. They can connect the science activities through sharing their traditional knowledge. Where Elders or other knowledge keepers are not available, students may consult other authentic and appropriate cultural resources such as video, print and online sources.

Explain

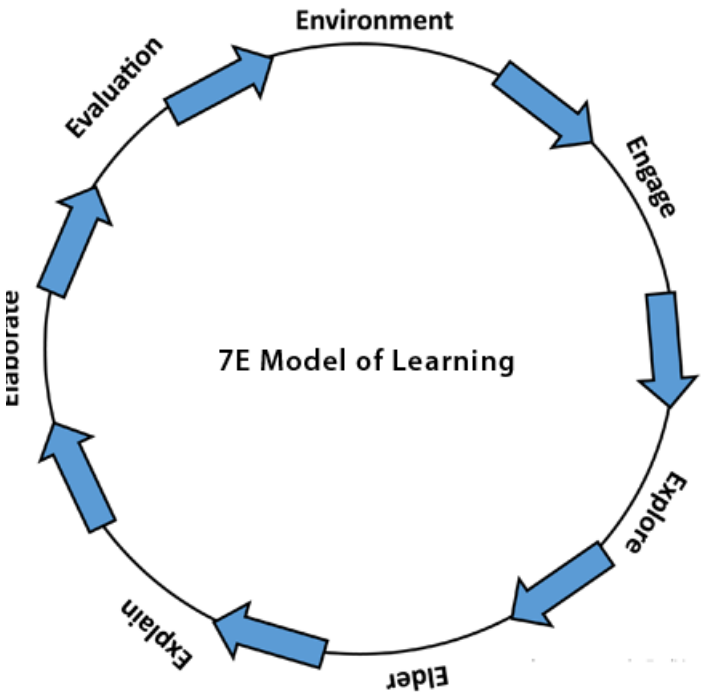
Describe observations and come up with explanations. Develop vocabulary, apply and interpret evidence. Students reflect on their processes, thinking and conclusions. Teachers guide students with questions and suggest additional resources.

Elaborate

Use information to extend learning to new situations. Make connections to their personal lives and to society. Teachers help students broaden understanding.

Evaluation

Students demonstrate their understanding of concepts and skills learned. Teachers ask open-ended questions and encourage students to self-assess their learning.



Encouraging Inquiry

Inquiry-based learning fits well with the First Peoples pedagogy discussed above, and the First Peoples Principles of Learning. It also supports the goals of the 2016 BC Science Curriculum.

Through an inquiry approach to the study of First Peoples scientific and traditional knowledge, students and teachers can learn together to connect new ideas with the following.

Characteristics of Inquiry-based Learning

Here are some of the characteristics that teachers can incorporate into their classrooms when using inquiry:

- **student driven**, allowing them to make decisions and take responsibility for their learning
- **rooted in the big ideas** set out in the curriculum; teacher's role is to connect the ideas with the interests and ongoing questions of students
- **authentic** learning opportunities to explore real life experiences based on curricular expectations
- **encourages reflection** on learning; students discuss daily why, how and what they are learning
- **patience and time**; students are given the time needed to explore their ideas and thinking
- **teachers model** how to question, plan, observe and reflect
- **teachers intervene** at appropriate moments to make sure all students understand the concepts and processes, and are engaged in the activity
- **direct instruction** occurs when needed, when students need certain information to move forward

The Inquiry Process

Inquiry is a circular and fluid process. It may be helpful to consider these four stages of inquiry:

- **Focus**: Activities provide a provocation, spark or experience to engage students; develop big ideas, questions or topics
- **Explore**: Students investigate, gather information, connect thinking to prior knowledge, record information and add samples of work to portfolios
- **Sharing Learning**: students answer and refine questions, communicate findings, reflect on their learning, extend learning
- **Analyze**: Students draw conclusions, test hypotheses, summarize and create new questions and hypotheses, which can then lead back to the other phase

Using the Thematic Science Units

The materials in the Teacher Resource Guide are meant to be a beginning or starting place for educators. They are not comprehensive, and hold only a sample of BC First Peoples' scientific knowledge. There are diverse First Nations communities in BC speaking over thirty languages, living in myriad different ecosystems from the desert of the Okanagan to rainforests of the coast. Each has its own unique body of knowledge special to its local territories.

The units can and should be used in conjunction with locally developed resources. A richer curriculum results when you connect with your local community, as there is significant diversity of cultures and languages between communities, and there is much knowledge that is locally held.

The eight units in this Teacher Resource Guide provide a variety of learning activities and resources for teachers to adapt to their own lesson planning. The activities are intended to be flexible in their use. Although the first activity is usually an introduction to the topic, the activities are not necessarily meant to be taken sequentially. It is not expected that a teacher would use all the suggested activities.

The units are designed to be embedded in the BC Science curriculum, but they also offer many opportunities for cross-curricular planning.

The units are organized as follows:

Introduction
A general introduction to the focus of the unit and important background information.

First Peoples' Connections
A discussion of some of the key concepts and issues in the theme that pertain to First Peoples cultures.

Planning to Teach the Unit
An overview of the goals of the unit and options for teachers to plan their lessons, including:

<u>Outline of Activities</u>

<u>Enduring Understandings and Essential Questions</u>
These guiding understandings and questions embody the core concepts, issues, problems or theories that are at the root of the activities. They ensure that Indigenous perspectives are at the centre of the activities.

Curriculum Connections
Each unit includes a table of Suggested Topics and Inquiry Questions, with suggested Learnings Standards from the BC Science Curriculum for Grades 5 to 9, including Curricular Competencies and Content.

Cross Curricular Links
These list some suggestions for extending the topic into other subject areas.

Suggested Resources
This list summarizes the essentials materials and resources that will be needed to carry out the activities.

Suggested Activities
The activities have been developed with a flow or sequence, but are intended to be flexible and adaptable. Generally they begin with introductory activities which in many cases ground the topic in the personal and local. Later activities build on knowledge and skills learned in earlier activities

Assessment
Most assessment will depend on the activities teachers incorporate into their lessons. This section provides suggestions for assessing the Essential Questions for each unit, providing a broad type of assessment.

For a further discussion of types of assessment that can be used for inquiry-based lessons, see the next page.

Additional Resources
At the end of each unit there is a list of suggestions for relevant additional books, videos and web sites for students and teachers to use. All resources mentioned are also listed in the Resources section following the Thematic Units.

Blackline Masters
Teaching resources that are ready to be photocopied for student use.

Assessment

Teachers are encouraged to use a variety of formative assessment strategies, in keeping with the First Peoples Principles of Learning and inquiry models.

Formative Assessment Strategies

Formative assessment is assessment for learning by providing ongoing feedback to students, and at the same time allowing teachers to tailor instruction to the needs of students or groups. It is embedded in regular instruction and inquiry.

A variety of formative assessment strategies can also help document students learning, and be part of their ongoing portfolio of student work.

1. Informal Questioning

By asking timely and thought-provoking questions, teachers can informally assess students' understandings of concepts and processes and also guide their learning.

- Questions can focus students' reflection on the concepts, skills, goals and processes involved in an activity, providing teachers with information about their learning before, during, and after an activity or step in an inquiry.
- Most questioning, being timely, will be undocumented, but checklists could be used to assess certain concepts, skills or processes.

2. Performance Task

Performance tasks are used both to teach and assess. They may consist of a single task or a set of tasks.

- Students communicate their understanding of skills and concepts through a variety of modes: active demonstration, text, images, or models.

3. Graphic organizers

Students can represent their learning in a visual way using a variety of graphic organizers. Examples of graphic organizers include:

- Concept Map
- Compare/Contrast
- KWL
- Venn Diagram
- Classifying Chart
- Cause and Effect
- T-Chart
- Story Board
- Sequencing Chart
- Topic/Subtopic Web

3. Rubrics or other scoring tools.

- Depending on the activity, teachers, students or both together can develop criteria to be assessed. They can be used for assessing understandings of concepts, project or reports, self assessment or peer assessment.

4. Journals and Portfolios
   - Provide students with relevant topics or cues for their reflective journalling.
   - Assess informally during the course of classwork.
   - Have students assess their journals and portfolios at the end of the unit. Ask them to identify 5 or 10 sections that seem to be the most important for their learning.
5. Projects and Presentations
   - Self and peer assessment can be used. Students can help set out the criteria for assessment.

Suggestions for Questioning During the 7E Phases

Environment

- What is special about the place we live? (in the context of the topic under study)
- How might place help you to think about the topic we're going to explore?
- What do you wonder about the place where we live?

Engage

- What do you already know, and what would you like to know about the topic, issue or idea? (KWL strategy could be used)
- Ask students questions that will help you to assess the level of students' understanding.
- Ask students questions that can lead to clearing up misconceptions in students' background knowledge.

Explore

- What is the big idea you want to explore?
- What questions do you have about this big idea?
- What one or two inquiry questions will you focus on?
- How will you go about investigating your question?

Elders

- How did working with Elders, cultural experts or other cultural sources add to your understanding of your question?
- Did you find out any relevant words or phrases from the local First Nations language?

Explain

- Ask questions that allow students to explain the processes they followed in their inquiry.
- Ask questions that enable students to connect their explanations with scientific knowledge and Traditional Ecological Knowledge.

Elaborate

- Help students develop new questions.
- Ask questions that guide students to apply their learning in new ways.

Evaluation

- Ask students questions that provide opportunities to show that they understand the key concepts studied.
- Ask questions that enable students demonstrate their learning progress.