

Introduction

1. About This Guide

With the increased inclusion of First Peoples' content and perspectives in the 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 courses in Science for Grades 5 to 9, English Language Arts, Social Studies, and Mathematics. This guide expands these resource materials to include Senior Secondary Science courses.

The Secondary Science First Peoples Teacher Resource Guide is designed to assist science teachers in all BC schools, including First Nations, public and independent school.

The guide includes background information regarding how First Peoples' knowledge and 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 10 to 12.

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 Secondary 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 Indigenous 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

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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.

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

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What Is Important to Understand About Using This Guide

The guide is intended to help facilitate the respectful and meaningful inclusion of Indigenous knowledge and perspectives into the BC classrooms. As such, it often reflects an approach to Indigenous knowledge that values a holistic, integrated approach to teaching and learning.

As a part of a holistic approach, this guide does not attempt to create units for sole applicability to one course or a single grade, and does not attempt to match individual lessons with specific learning outcomes.

Teachers will need to explore and examine all parts of the guide to determine what to use that makes the most sense given the contexts of who the students are, where the learning is taking place, the course and grade level, and the background knowledge or comfort levels of the teacher.

It is acknowledged that exploration of the thematic units to determine the best units and activities to use for specific courses, grades, and student contexts may require thoughtful consideration and time of a teacher, but it is also more consistent with an Indigenous approach to learning.

It is expected that the additional time required to explore the guide will result in an increase of background knowledge and understanding for educators, and is an opportunity for teachers to collaborate with educators of other courses and grades.

While this guide is focussed on a specific curricular area of learning, teachers are encouraged to make explicit links to other curricular areas.

This guide also does not replace what educators are expected to already know about effective assessment practices. As such, the guide does not endeavour to include these in detail. While some formative assessment opportunities are suggested, educators may need to use their own expertise to more fully develop these. As well, they will need to develop their own summative assessments to match the activities that they use.

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3. Perspectives of Science

All science begins with an innate curiosity about the world. Humans strive to understand the natural world by observing, testing and hypothesizing. But being human, we interpret what we discover in diverse ways, for multiple purposes. Based in the worldviews and traditions of different cultures, unique perspectives on what is important to know about science have developed.

In thinking about the context of bringing First Peoples perspectives into the science class, we can consider three different approaches to science:

- Indigenous Science is the knowledge of Indigenous peoples, including scientific and evidence-based knowledge, which has been built up over thousands of years of interaction with the environment. It is holistic and relational knowledge rooted in place and contained in language.
- Western Science is an evidence-based way of understanding the natural world. Asking questions and discovering answers results in a continuous revision of knowledge. The application of science has often been in discrete or compartmentalized specialities.
- 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.

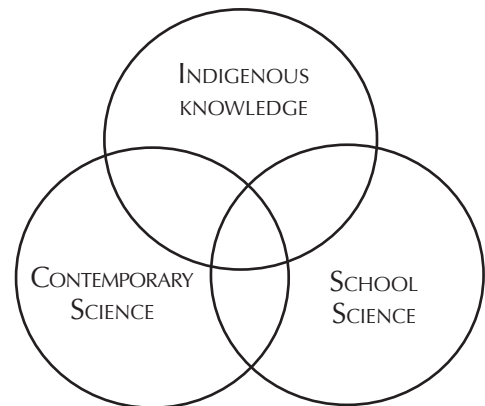
Convergence

Indigenous Science and 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 Western science discovering what has already been known by Indigenous peoples. For example, recent DNA studies show 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. Underwater archaeology on Haida Gwaii has found evidence that people lived there more than 12,000 years ago.

Western 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



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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.

Some scientists are understanding story and narrative as an important way of communicating the findings from their labs to a public which is increasingly bombarded with information that may be true or false. See, for example, the article “And, But, Therefore: Randy Olson and the Art of Science Storytelling” (Huffington Post 2016, <https://bit.ly/2OJaQWj>).

Integrating Traditional Knowledge and Western 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.

School science, on the other hand, has sometimes been seen as prescriptive, based solely on facts to be learned. In some cases, it 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 more educators are bringing school science into convergence with Indigenous Knowledge and Western Science through a broader understanding of what Indigenous Knowledge is and how it can be infused into the classroom.

When we braid Indigenous Science with Western Science we acknowledge that both ways of knowing are legitimate forms of knowledge. For Indigenous peoples, Indigenous Knowledge (Indigenous Science) is a gift. It cannot be simply bought and sold. Certain obligations are attached. The more something is shared, the greater becomes its value.¹

1. Gloria Snively and Wanosts’a7 Lorna Williams, Braiding Indigenous Science with Western Science, Book 1, page 4.

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4. Using the Secondary Science Teacher Resource Guide

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 minute 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 guide is made of up three parts:

- **Foundations** which offer key information to support and guide teachers in incorporating First Peoples science into the curriculum
- **Thematic Science Units** which provide a variety of student activities that integrate with the BC Science Learning Standards
- **Bibliography**: an annotated list of resources for students and teachers.

The Thematic Science 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 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:

- **Overview**: An overview of the goals of the unit and options for teachers to plan their lessons
- **Guiding Questions**: These guiding 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.
- **Learning Standards**: A table indicates relevant Content Learning Standards and Curricular Competencies for the senior secondary science courses that the unit is most applicable to.
- **Resources**: Essential and useful resources are listed. They include:
 - Suggested Resources (required for the main activities)
 - Additional Suggested Resources
 - Blackline Masters

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- **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

- **Formative Assessment Strategies:** The activities include some suggestions for formative assessment, noted in the margins beside the relevant activity.
- **Summative Assessments:** It is expected that teachers will adapt the suggested activities to create their own units, and will thus develop their own summative activities depending on the activities their students undertake.