Coming to Know: A Guide to a Deeper Understanding of Implementing Science and Indian Education for All

This guide was created to answer questions and address concerns commonly put forward by teachers about implementing Indian Education for All and science content, build background knowledge of what Indigenous knowledge and traditional ecological knowledge is, and provide suggestions and ideas for various levels of implementation in Montana's K-12 classrooms. Each section can be read and utilized separately.

This standalone Frequently Asked Questions document can also be found in the complete Coming to Know document which can be found on the OPI Indian Education for All webpage.

Frequently Asked Questions:
Indian Education for All and Science Content Integration

What is Native American/Traditional/Indigenous science? What is Traditional Ecological Knowledge (TEK)?

TEK, or traditional ecological knowledge, is the use of knowledge gathered over millennia through observation, experimentation, and comparison of landscape and ecosystem conditions. This knowledge has been transferred through generations of oral traditions and lived experiences, and included hunting, gathering, and ceremonial and spiritual practices. Indigenous peoples have been surviving and thriving on landscapes since time immemorial using this deep, holistic knowledge of the natural world and the resources it provided for food, shelter, clothing, medicine, tools, and cultural practices.

Native American or Traditional or Indigenous science is simply knowledge gathered about the natural world over millennia that informed survival. The terms Native American, traditional, and Indigenous are used somewhat interchangeably.

> *"…Native people were the first ecologists, as the mythologies, understandings, and technical knowledge were always directly tied to specific ecologies, or specific regions, plants, and animals. The knowledge base itself becomes one of maintaining a thoughtful, proper relationship to those natural forces."*
> *–Gregory Cajete, Native Science: Natural Laws of Interdependence*

INDIAN EDUCATION FOR ALL
Montana Office of Public Instruction

Does integrating Indigenous science meet Montana Science Content Standards?

Yes, it absolutely does! By incorporating topics such as ethnobotany (cultural uses of plants), cultural fire management, traditional technologies, and so many more, into your existing curriculum, there are multiple opportunities to meet Life Science (LS), Physical Science (PS), and Earth and Space Science (ESS) standards. Not sure how this works? Contact Jennifer Stadum at jstadum@mt.gov and she will be happy to assist you in seeing the possibilities to maximize your science planning time to include IEFA and Indigenous science.

There are seven Montana Science Content Standards including Indigenous knowledge:

5-ESS 3-1: obtain and combine information from various sources about ways individual communities use science ideas to protect the Earth's resources, environment, and systems and ***describe examples of how American Indians use scientific knowledge and practices to maintain relationships with the natural world***

5-ESS 1-2: graph the daily changes in the length, shape, and direction of shadows; lengths of day and night; ***and the seasonal appearance of select stars to communicate the patterns of the Earth's movement and describe how astronomical knowledge is used by American Indians***

MS-ESS 3-4: construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems ***including indigenous populations***

HS-ESS 3-3: create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, biodiversity, ***and investigate and explain how some American Indian tribes use scientific knowledge and practices in managing natural resources***

MS-LS 2-1: analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem ***and analyze scientific concepts used by American Indians to maintain healthy relationships with environmental sources***

HS-LS 2-7: design, evaluate, and refine a solution for reducing the direct and indirect impacts of human activities on the environment and biodiversity ***and analyze scientific concepts used by American Indians to maintain healthy relationships with environmental resources***

HS-LS 4-5: evaluate the evidence supporting claims that changes in environmental conditions may result in: changes in the number of individuals of some species; the emergence of new species over time; the extinction of other species; ***investigate and explain American Indian perspectives on changes in environmental conditions and their impacts***

In addition, when teaching certain topics using Indigenous knowledge or tribally-researched resources, students are working with ELA, math, social studies, and even art and music standards. There are many ways in integrate Indigenous science into standards you are already teaching such as (but not limited to):

- using drums and flutes to learn about the properties of sound;
- the chemistry of using certain minerals, vegetation, and even animal products to make pigments for painting;
- exploring physical properties of various methods of making cordage (using dog bane or other plants to make twine);
- using tribal natural resources department data to explore if wildlife crossings benefit both humans and animals;

- learning to observe specific species of indicator animals or insects such as beaver and ants to indicate the type of season it will be (e.g., when beavers start to gather food in early autumn it can indicate a long, cold winter or the structures ants build for their colonies can indicate a hot and dry or cooler and wetter summer, observing the behavior of birds when fruits/nuts/seeds are ripening);
- learning about how enzymes found in an ungulates' (bison, pronghorn, deer) brain can be used when tanning to make the hides water repellent;
- the difference in nutrition between pre-settlement diets and US government distributed commodity diets;
- how landscapes changed after the massive herds of bison were gone;
- how technologies such as baskets and digging sticks made from plants and animals saved energy, made work easier and were ergonomically designed;
- the impact of traditional fire management strategies on a landscape over millennia and how the landscapes changed after the reservation and allotment periods

And, so many more!

Are there elements of Indigenous science assessed on the 5th or 8th Grades Montana Science Assessment?

No, Indigenous science is not assessed on the Montana Science Assessment in either 5th or 8th grades. What is used on the science assessment is culturally specific knowledge and tribally-researched data as a culturally responsive strategy to provide context for the assessment item.

How does American Indian science/Indigenous knowledge fit within what I am expected to teach in my school/district?

Indigenous knowledge about a place and all that it takes to survive in that place has existed for millennia. There are more connections than you may think. Even if you are using a highly prescriptive curriculum such as Mystery Science, Amplify, or another curriculum provided by your school or district, it might take a little planning time, but there are ways to integrate IEFA into the pre-written units. A great place to begin is considering who lived on the landscape where your school is located and the resources that people could have used for food and shelter.

Is Indigenous science only about the past?

It sure isn't all about the past! One way to integrate IEFA into science is to showcase Native STEM professionals such as scientists, mathematicians, and engineers. Indigenous science and Western science can be found contributing in complementary ways in computer science, space science and engineering, biomedical research, ecosystem studies, ecology, horticulture, architecture, pharmacology, hydrology, etc. There are many ways that Indigenous scientific contributions are being made across the many science and engineering disciplines.

How relevant is teaching Indigenous science to current day applications of science?

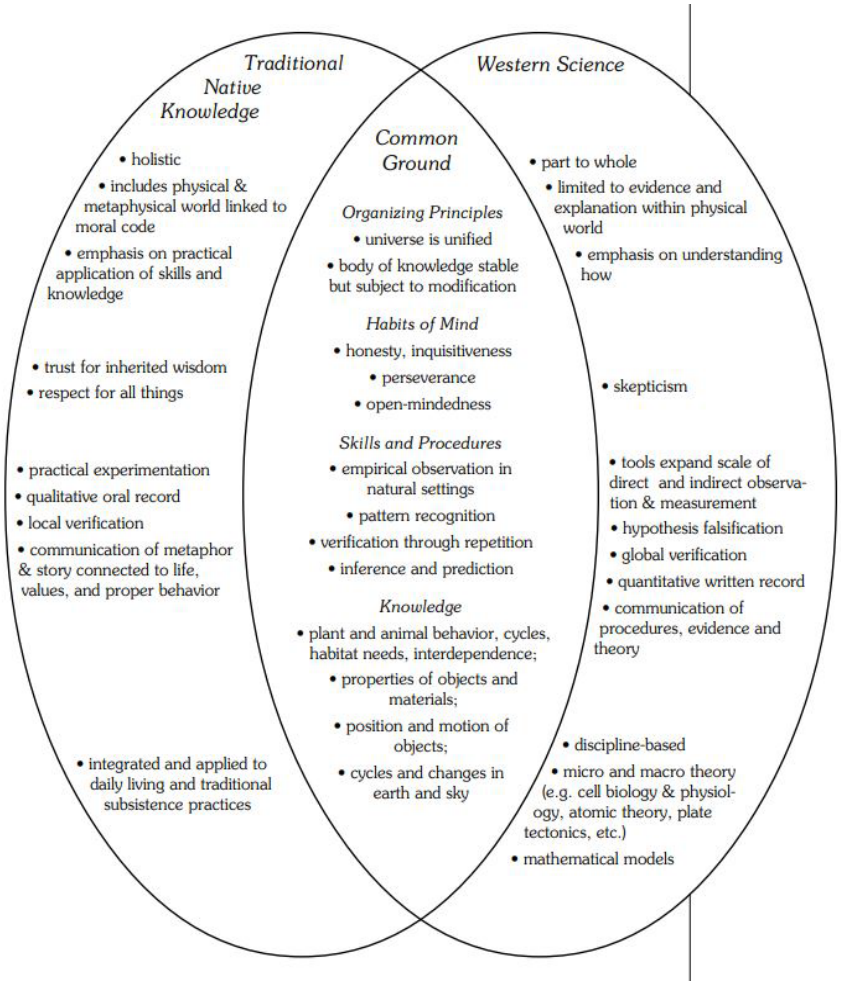
As referenced in the previous section, Indigenous STEM professionals are actively engaged in solving some of the world's most complex issues. In addition, traditional knowledge, such as traditional ecological knowledge, is an extremely important and complementary contribution to western science.

Does teaching American Indian sciences/Indigenous Knowledge meet teaching Indian Education for All requirements?

Absolutely! Tribes in Montana continue to use knowledge today that has lasted and been shared over millennia. This is a valuable concept for students to understand. Not only does it place tribes, their traditions, and the knowledge in the present, it also honors the cultures that have thrived across the Montana landscape for thousands of years.

How is teaching about Indigenous/Traditional Science/Knowledge or Traditional Ecological Knowledge the same or different from western science?

There are many ways that Traditional or Indigenous science and knowledge is complementary to western science practices. A great example of this would be The Peoples Way on the Confederated Salish and Kootenai. The Peoples Way wildlife crossings project used both cultural knowledge and western science to develop a solution for safer roadways through the Flathead Reservation on Highway 93. (check out this high school science unit – scroll down to second unit once on the webpage).



From the Handbook for Culturally-Responsive Science Curriculum by Sidney Stephens, 2000. Available from the Alaska Native Knowledge Network: http://www.ankn.uaf.edu/

Can I teach about Indigenous science if I'm not Native and what if I get it wrong?

If you are reading this document, you are making an effort to understand how to better integrate Indian Education for All and science. Having good intentions and respectfully sharing about other cultures and their knowledge and contributions is the best place to start integrating. Not doing anything or not including multiple perspectives or acknowledging significant achievements and contributions of other cultures, is more harmful than getting something wrong. Building your background knowledge by reading books by Native authors, such as *Braiding Sweetgrass* by Robin Wall Kimmerer, or *Native Science* by Gregory Cajete, or attending/watching professional development events such as the Office of Public Instruction Indian Education for All Ethnobotany Webinar Series is the best way to not "get it wrong".

Is integrating or teaching about Indigenous sciences teaching Critical Race Theory?

No, it is not Critical Race Theory. Critical Race Theory is a theory covered in some college and graduate level American Indian law classes. It is not taught, nor is it appropriate to teach, in K-12 grades.

How do I vet Indigenous science lessons for tribal/informational accuracy?

Check out the guide for Evaluating American Indian Materials and Resources for the Classroom

A great place to begin is to ask these general questions:

1. Which tribe or tribes are identified in this resource?
2. If the creator of this resource is not a tribal member, were tribal members, cultural committees, or knowledgeable experts consulted about the American Indian content in this resource?
3. Has this resource been reviewed by a tribal cultural committee, tribal historian, or other well qualified reviewer?
4. Is there anything about this resource that leads you to question the validity, accuracy, or authenticity of the information it presents about American Indians?