

Case Studies for Indigenous Science

Application of differentiating between indigenous Science and Indigenous concepts in Science for Teachers and Students.

This series of case studies is fictional but will provide teachers and students with real world applications of the concepts prepared along with guiding questions for how to work through the situation. This document will also provide 10 quick guidelines to remember when dealing with these type of situations.

Case study #1 - Smudging

Curriculum Expectations

Grade 9 Academic and Applied Science:

Overall Expectations:

- C1. assess social, environmental, and economic impacts of the use of common elements and compounds, with reference to their physical and chemical properties;
- C2. investigate, through inquiry, physical and chemical properties of common elements and simple compounds;

Specific Expectations:

- C1.1 assess the usefulness of and/or the hazards associated with common elements or compounds in terms of their physical and chemical properties [AI, C]
- C2.4 investigate and distinguish between the physical and chemical properties of household substances (e.g., starch, table salt, wax, toothpaste) [PR, AI]

Grade 10 Academic and Applied Science;

Strand: Biology: Tissues, Organs, and Systems of Living Things

- B1. evaluate the importance of medical and other technological developments related to systems biology, and analyse their societal and ethical implications;

Chemistry: Chemical Reaction

- C2. investigate, through inquiry, the characteristics of chemical reactions;

Grade 12 Chemistry

Chemical Reactions

- B1. assess the social and environmental impact of organic compounds used in everyday life, and propose a course of action to reduce the use of compounds that are harmful to human health and the environment;

Grade 12 Biology

Biochemistry

B1. analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology;

B2. investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions;

In many locations in Ontario, students acknowledge the traditional territory in which they operate but as a teacher you want to take the next steps in your learning to support your rich diverse students. Your board has offered optional PD and you have tried to attend however it often conflicts with science PD. Articles online have talked about the scientific benefits to smudging - a practice you know little about. You want to discuss the article but unsure how or where to fit it in to your course and how to do it appropriately. You want to make sure it is done in a meaningful way without offending anyone.

Articles:

Study Reveals How Smudging Does A Lot More Than ‘Clear Evil Spirits’

<https://awarenessact.com/study-reveals-how-smudging-does-a-lot-more-than-clear-evil-spirits/>

The Science Behind Smudging

<https://upliftconnect.com/science-behind-smudging/>

Curriculum Connections

After doing your homework on the material, the burning of sage is a chemical change as it cannot be change back to its original state. With assistance of a cultural teacher you could talk about the process and the importance of the smoke and what it produces from the second article it says it states “burning sage and other herbs neutralises positive charge and releases negative ions, and has antiseptic, bacteria-killing properties”.

For grade 10 students teachers could have a discussion about the positive benefits of cleansing the air for the environment and personal use. As for senior students having them read the articles shared and then discussing their understandings. Senior students should also look at the chemical reaction and the metabolic process of antiseptics on the human body.

Cross-curricular connections

Science and World Cultures Classes

After reading the articles, students could research other practices around the world that are similar to smudging.

Guiding Questions

1. What steps could be taken to learn more for your personal develop on this subject area?
2. Who should be contacted to share with your class?
3. How do you ensure all students feel comfortable learning about this practise and discussing it through a scientific lens?
4. Is this an example of Indigenous Science or Indigenous Knowledge in the Science Classroom? Explain.

Case Study #2 - Can trauma be passed on in your genes?

Grade 10 Academic and Applied Science;

Stand: Biology: Tissues, Organs, and Systems of Living Things

B1. evaluate the importance of medical and other technological developments related to systems biology, and analyse their societal and ethical implications;

Grade 11 Biology University Preparation

Stand: Genetic Processes

D1.1 analyse, on the basis of research, some of the social and ethical implications of research in genetics and genomics (e.g., genetic screening, gene therapy, in vitro fertilization) [IP, PR, AI, C]

Grade 12 Biology University Preparation

Stand: Molecular Genetics

D1. analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology;

Curricular Connections

Students could have a debate on the processes used by Genetic Testing companies such as 23andMe or Ancestry DNA. Allow students to read this article about an Indigenous man that sends his dogs DNA in and it comes back that he is Native American

Indigenous researcher says ancestry testing is 'stupid science'

<https://www.cbc.ca/news/canada/edmonton/dna-testing-indigenous-ancestry-1.4705797>

Students could also read this article on intergenerational trauma in indigenous families

<https://www.theglobeandmail.com/life/health-and-fitness/health-advisor/the-intergenerational-trauma-of-first-nations-still-runs-deep/article23013789/>

Cross-Curricular Connections

Science and Sociology, Anthropology and Psychology/ World Cultures

Students could discuss the theory that all people originate from Africa (Out of Africa theory (OOA)) and see how this aligns with various genetic theories to allow them to open their eyes and think about the conflicts that arise when discussing social issues alongside genetics.

In Caledonia, Ontario you are a science teacher who is teaching grade 11 biology and you are discussing genetics and a student asks “can trauma be passed on in your genes?”. You have the opportunity to talk about intergenerational trauma but you want to make sure it’s culturally relevant to the student so they can better understand the concept. A second situation comes up while on this topic another student brings up the idea of using websites to track ancestry such as Ancestry.com or 23andme which take DNA and do an analysis. The student then goes on to tell the class about how their mom got the DNA test done and it came back saying their family was French, English, Dutch

and 5% native American. The class is intrigued by the students' excitement however; you could sense some frustration from your self-identified Indigenous students.

Guiding Questions

Part 1

1. How would you go about finding more information in intergenerational trauma through a cultural context?
2. What resources could you access to share an Indigenous perspective on this topic?
3. Is this an example of Indigenous Science or Indigenous Knowledge in the Science Classroom? Explain.

Part 2

1. How would you respond to the class's interest in DNA testing and how would you make sure that all students feel comfortable while addressing this topic?
2. How do you think the students involved felt include the student sharing and students listening (non-Indigenous and Indigenous)?
3. Is this an example of Indigenous Science or Indigenous Knowledge in the Science Classroom? Explain.

Curriculum Expectations

Grade 10 Academic

Stand: Biology: Tissues, Organs, and Systems of Living Things

B1. evaluate the importance of medical and other technological developments related to systems biology, and analyse their societal and ethical implications;

Curriculum Connections

Students could debate the concept of dissections to see the varying perspectives from different communities and backgrounds. This could be extended by having students take on a variety of roles such as a vegetarian or animal rights activist and scientists which would need to do the tests. Additionally students could include their families in the conversation to see if there will be other viewpoints that maybe not be considered.

Case Study #3 – Frog Dissection

In London, Ontario there are three surrounding First Nations communities along with a rich diverse urban Indigenous community. The school in question has a large complement of staff and a large First Nations population however; many staff have limited background on the unique circumstances that the Indigenous students face especially those First Nations students coming from the local reserves. A science teacher at this school has noticed that many of their students identifying as First Nations do not want to participate in the grade 10 frog dissection. Without knowing any better the teacher attempt to encourage the students to participate and complete the activities. Upon refusal, the teacher offers an electronic substitution. The teacher notices this trend of years and wants to find out more information and ask questions but is not sure where to start and is worried they are finding connections where there might not be any.

Guiding Questions

1. What steps could you take to find out more about why students might not participate in a dissection?
2. What is the benefit of the hands on experience rather than electronic substitution?
3. Would there be any other cultures within your school the might share a similar worldview?
4. How do you develop a better understanding of Indigenous worldview and ensure you are respecting it throughout classroom activities within a science concepts.
5. How would you share this knowledge with the class to ensure each child feels safe and understood in their decision?

If you find yourself in a similar situation and forget how you thought you would respond, remember these simple guidelines to help you come up with a solution.

- Be okay with admitting that you don't know but follow up with question in your teaching circle or beyond as needed.
- Ensure your content does not appropriate the culture or commodify it.
- Do your best to honour authentic Indigenous voices from Indigenous communities.
- Ask questions, you will only learn if you ask questions. Privileged information will be kept out of the classroom.
- Keep ceremonial practices away from the classroom and only spoken about by a traditional knowledge keeper and/or elder
- Contact your board's Indigenous Education lead for help
- Build a network of colleagues that support each other's learning of the true history of Canada.
- Keep in tune with your own biases and worldview.
- Keep an open mind and open heart
- Ensure the inclusion of Indigenous content is meaningful and not tokenized.