

# Two-Eyed Seeing and Biodiversity

## SBI3U Grade 11 Science

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### Curriculum Objectives

This series of hand-on activities addresses the following curriculum objectives from the SBI3U Grade 11 Science course:

#### *Big Ideas/Fundamental Concepts*

- Systems and Interactions
- Sustainability and Stewardship
- Change and Continuity

#### *Overall/Specific Expectations*

##### B. Diversity of Living Things

B1. Analyse the effects of various human activities on the diversity of living things.

B1.1 Analyse some of the risks and benefits of human intervention to the biodiversity of aquatic or terrestrial ecosystems.

B1.2 Analyse the impact that climate change might have on the diversity of living things.

Indigenous Knowledge and Science

Two-Eyed Seeing and Biodiversity – Grade 11 Science

## Learning Goals

At the completion of a series of lessons based on the following ideas, students will be able to:

- Relate biodiversity to cultural diversity and Indigenous language;
- Define biodiversity and provide examples of its value to all people;
- Compare and contrast Western science and Indigenous worldviews, using examples;
- Discuss major international and domestic initiatives that harness Indigenous knowledge and Western science to develop and implement biodiversity strategies;
- Consider the implications of a changing climate on both biological and cultural diversity;
- Create an artefact representing two-eyed seeing as it relates to biodiversity and an Indigenous knowledge case study;
- Contribute to the Ontario Biodiversity Council's program by creating a social media campaign focused on the slogan, 'Biodiversity makes us ...'.

## Activities

The following activities are divided into three sections: Minds On, Action, Consolidation (Table 1). While this outline approximates a traditional lesson plan, teachers are encouraged to mix and match the activities to meet their needs. It is expected that lessons on this topic will last more than one 70-minute period, although several of the activities can be modified to fit into a shorter time period, as necessary.

**Table 1. Summary of Biodiversity-Related Activities**

<b>Minds On</b>	<b>Action</b>	<b>Consolidation</b>
What is Biodiversity?	Two-Eyed Seeing	Case Example Artefact Creation
Field Trip		Social Media Campaign

## Minds On

### What is biodiversity?

Through prompts that reflect biological, cultural, and language diversity, students are encouraged to think about the interactions between culture and biodiversity, and to create a working definition of biodiversity that encompasses both ideas. The teacher could prepare a presentation that highlights the idea of biological, cultural, and linguistic diversity, with examples. Pictures of Ontario-specific ecosystems and First Nations' culture and language should be used in order to localize the discussion and link it to the recommended field trip (see next activity). This slide can remain on the screen while students are encouraged to work in small groups to come up with a working definition of biodiversity for the rest of the lessons using a Frayer Model template (Worksheet #1). The final definitions are presented by each group and written on large paper to hang on the wall.

NOTE: A working definition is a definition that is developed for a specific occasion. It may differ from other more established definitions.

### **Timing:**

Presentation with visual prompts and plenary discussion of images:

- 10 minutes

Explanation of activity: Create a working definition of biodiversity, allowing time for students to consider their own ideas:

- 10 minutes

Small group activity: Frayer Model and Definition:

- 10 minutes

Final presentations and discussion:

- 20 minutes

Creation of wall posters with definitions:

- 20 minutes

### **Outputs:**

- Small group posters summarizing working definitions of biodiversity

### **Prior Knowledge:**

Students will have been introduced to the concept of biological diversity in earlier science classes, as far back as primary school. The integration of cultural and linguistic diversity into their definition of biological diversity may be relatively new.

### **Accommodations and/or Modifications:**

The key accommodations in this exercise include opportunities for individual reflection, peer-to-peer learning, oral and visual activities to assist a variety of learners, as well as a scaffolded working definition exercise. The teacher may provide additional support by providing students with a copy of his/her presentation and notes and/or by providing additional reading material. Some students may want to

take the definition template home to work on it in a calmer setting; others may prefer to present the material orally to the teacher through questions and answers (see below).

***Assessment As/Of/For Learning:***

The teacher can use a class checklist to assess the discussions of the students and ask them questions, such as “Is concern for biodiversity only related to environmental issues?”, “What other aspects of our culture and communities are supported by biodiversity?” to assess whether or not the students have understood the overarching themes of the class. He/she can also use the checklist to determine who is and who is not engaged in the small group discussions as well as the larger class discussions. He/she can ask students to share some of the ideas they came up with individually before the small group discussions. The ensuing discussion will help students determine if they are ‘on track’ with the exercise. Assessment of learning can take place through the above mentioned one-to-one and small group discussions as well as through a review of the information and definition included in the Frayer Model worksheets. Assessment for learning includes the feedback provided by peer discussions as well as that provided by the teacher about the individual worksheets, the group presentations, and the similarities and differences between the working definitions of biodiversity of the various groups.



**Figure 1.** Examples of pictures that could be used to prompt a discussion about biological and cultural diversity

## Field Trip

A field trip to a local First Nations community could be arranged. The website [firstnations.ca](http://firstnations.ca) provides an interactive map showing the location of such communities in Ontario. The field trip would provide students with the opportunity to engage all their senses in a discussion of what biodiversity means in its fullest sense from people who have lived in the area for generations. The development and engagement of the local community should follow the principles for engagement outlined elsewhere in this resource. Alternatively, a representative of a local First Nation and/or a member of the Indigenous Council of Experts, the Ontario Biodiversity Council or the Biodiversity Education and Awareness Network could be invited to speak to the class, either virtually or in person.

Following the presentation or field trip, the class could be asked to prepare a formal paper/essay, booklet or poster summarizing what they have learned (Worksheet #2).

### Inquiry Questions:

- What is the relationship between biological, cultural, and linguistic diversity?
- How can it be protected/enhanced?
- What can we do?
- Reflect on how the field trip changed/deepened/broadened your understanding of the links between cultural, language, and biological diversity. Provide specific examples from the field trip to support your thoughts and ideas.

**Timing:** Various: Would require significant preparation and lead time and at least one full-period of class time (or one full-day in the event of a field trip)

### Output:

- Post-field trip written reflection

### Accommodations and/or Modifications:

If accommodations are required for physical disabilities, these should be discussed with the First Nations' partners prior to the field trip. Many students will benefit from the kinesthetic and social learning elements of the field trip. In preparation for the trip, additional scaffolding could be provided that specifies the specific learning goals for the trip, so that all students are aware of the learning expectations (including learning through all five senses). Providing students with choice regarding the format of their field trip report is another means of providing accommodation to different learners.

### Assessment As/Of/For Learning:

The teacher can use a class checklist to assess the discussions of the students and ask them questions before, during, and after the field trip to assess their learning and level of engagement with the exercise. Assessment of learning is facilitated by the preparation of a field trip report, and the choice provided to students regarding its final format and content. Depending on the final format, it can be assessed using a clear rubric. Assessment for learning could include a post-field trip debriefing with both the class and the First Nations partner to determine what went well and what could be improved. The partners could

also be provided with examples of the final reports, as well as the other materials generated as part of this session (i.e., examples of student artefacts; see below).

## Action

### Two-Eyed Seeing

To complete this activity, students should be provided with some background and context about the shift in international discussions and knowledge products related to biodiversity. For example, over the past few decades, the international community has begun to recognize the limitations of its knowledge of biodiversity, a system of knowledge that has been developed using Western science as its primary source of understanding. This is due in part to the difficulty and cost involved in the collection of high-quality species- and ecosystem-related data, the difficulty inherent in generalizing these local data sets to reflect global trends, the lack of knowledge about ‘baseline’ conditions for specific ecosystems, and the multitude of challenges being created by global climate change.

This is not to say that such work is not being done (see, for example, the Living Planet reports, [http://www.panda.org/knowledge\\_hub/all\\_publications/lpr\\_2016/](http://www.panda.org/knowledge_hub/all_publications/lpr_2016/) and/or the IUCN Red List (Endangered Species) <http://www.redlist.org/>) nor does it imply that the work is not valuable; it is simply a broad acknowledgement that the knowledge created is incomplete.

Indigenous and local knowledge is increasingly valued as a critical component of international efforts to protect and enhance biological and cultural diversity, and to complement scientific understandings (see Table 2). A brief presentation highlighting this shift in international biodiversity assessments that are embracing a wider diversity of knowledge systems (e.g., multiple evidence base approach, Figure 3, p8, below) can be followed by one or more videos that highlight the value of the knowledge gained and provide examples.

**Table 2.** Brief summary of links to Indigenous Knowledge in Major International Environmental Processes

Organization	Link to Indigenous Knowledge	Website
Convention on Biological Diversity	“Respect, preserve, and maintain the knowledge, innovations and practices of indigenous and local communities”	<a href="http://www.cbd.int">www.cbd.int</a>
Intergovernmental Platform on Biodiversity and Ecosystem Services	Busan Outcome: “Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems”	<a href="http://www.ipbes.net">www.ipbes.net</a>
Aichi Biodiversity Target 18	“Full and effective participation of indigenous and local communities, at all relevant levels”	<a href="http://www.cbd.int/sp/targets">www.cbd.int/sp/targets</a>

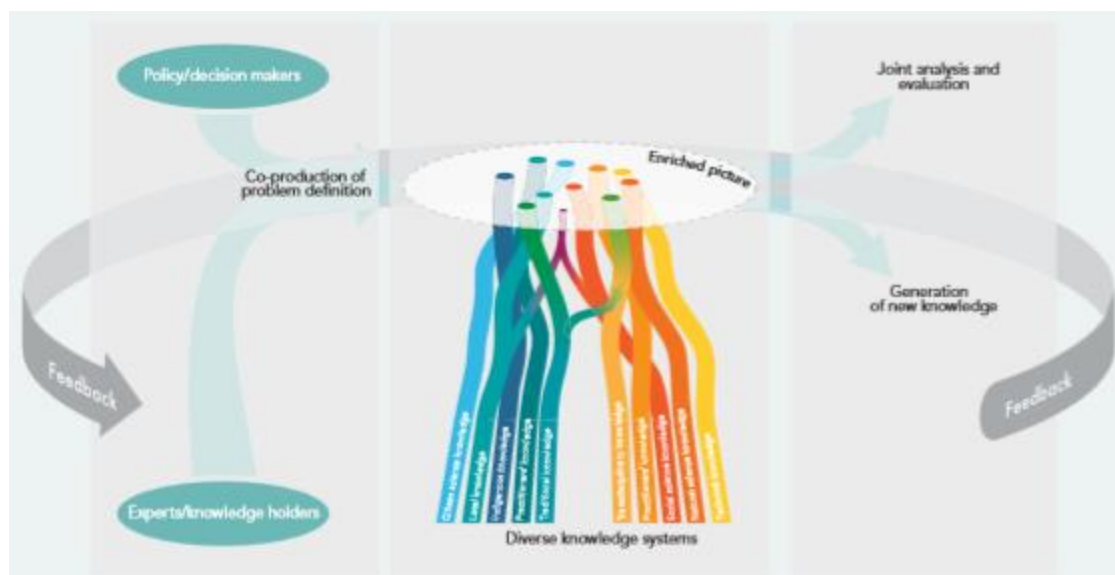
Intergovernmental Panel on Climate Change	Indigenous knowledge is “an invaluable basis for developing adaptation and natural resource management strategies in response to environmental and other forms of change”	<a href="http://www.ipcc.ch">www.ipcc.ch</a>
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Scaffolding in the form of a blank T-Chart with Indigenous Knowledge on the left and Western/Eurocentric Science on the right can be provided (see Worksheet #3) to help students take notes as they watch the videos and participate in the discussions. The videos should be stopped and discussed, as necessary, to facilitate students’ note-taking. The filled-in chart may contain information such as that summarized in Table 3, below.

**Table 3.** Example of Scaffolded Notes from Videos and Discussion Comparing Indigenous Knowledge with Eurocentric Science (Sources: Tsuji and Ho, 2002)

Indigenous Ways of Living in Nature	Western Science
Intuitive Holistic (cyclical) Moral, Spiritual Stewardship Subjective Qualitative Diachronic Slow and inclusive data collection Oral Storytelling Hands-on, Experimental Long-term outlook Decentralized, Grass Roots	Analytical (rational) Reductionist (linear) Neutral Ownership Objective Quantitative Synchronic Fast and selective data collection Written Didactic Reading, Experimental Short-term outlook Centralized, Bureaucratic





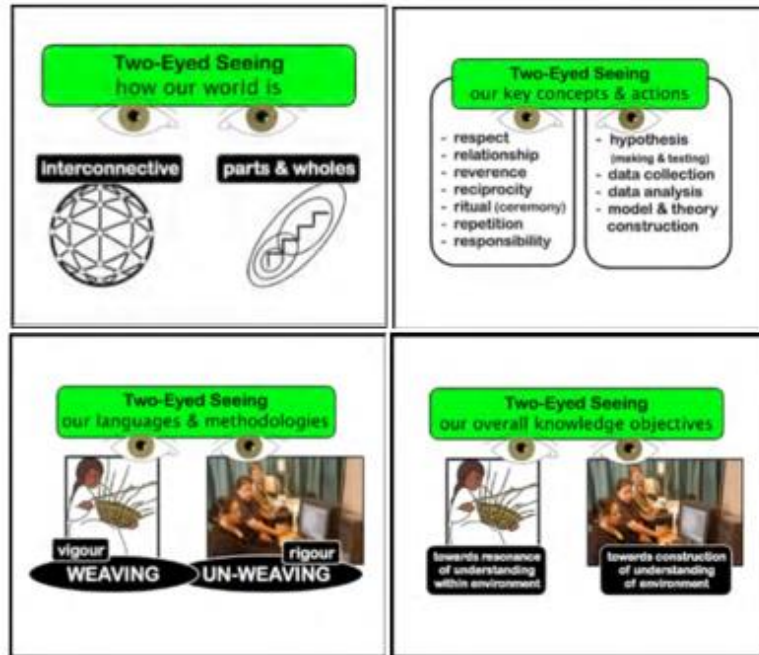
**Figure 3.** Multiple Evidence Base Approach highlighting the need for the co-production of problem definitions as well as a joint analysis and evaluation of the enriched picture created in the assessment process (Tengo et al. 2013)

From the discussion generated by the presentation, the concept of two-eyed seeing can be introduced. A Venn diagram representing this idea can be co-constructed with the students (Worksheet #4). The teacher can highlight the similarities and differences between the two worldviews using the information available in Figure 4 (p.10, below) and other sources, and can ask the students about the fuller picture that is available when both knowledge systems contribute to our understanding of biodiversity and place.

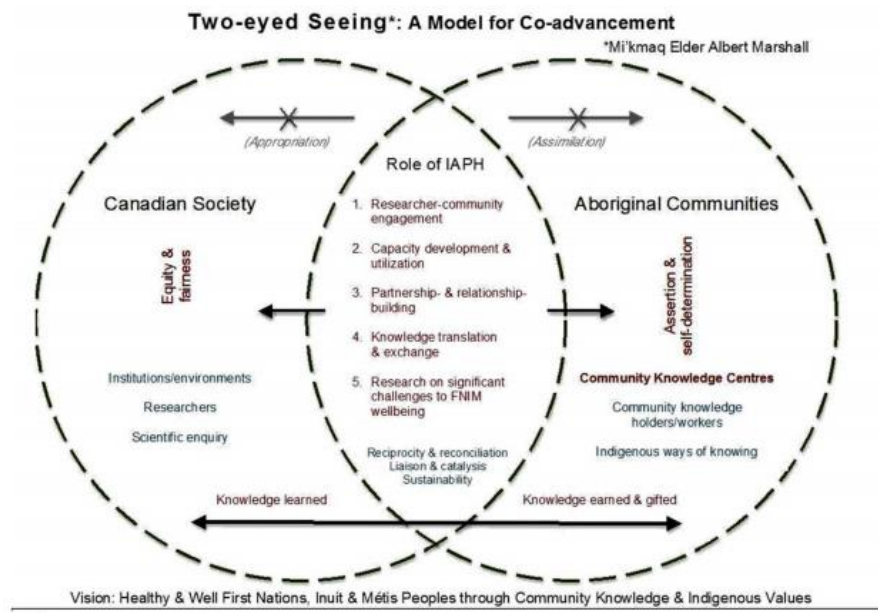
“Two-Eyed Seeing is the gift of multiple perspective treasured by many Aboriginal peoples and....refers to learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing, and to using both these eyes together, for the benefit of all.”

*Bartlett, Marshall & Marshall 2012, p. 335*

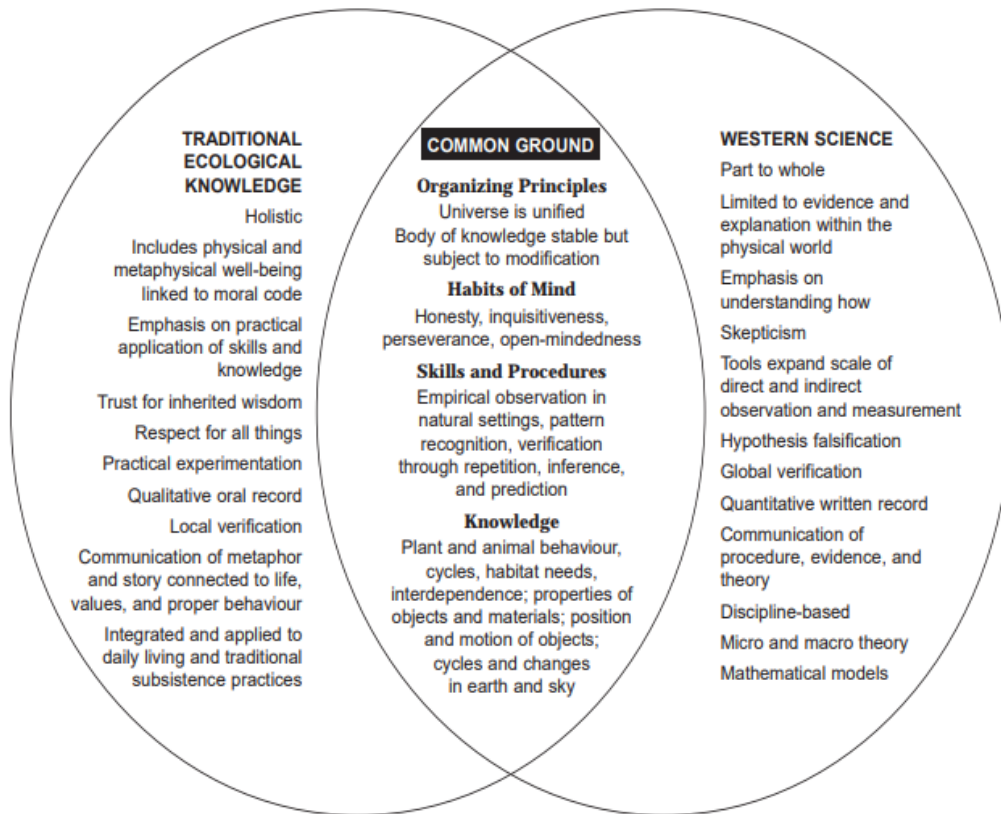
The co-constructed Venn Diagram can be hung on the wall of the classroom for the duration of the lessons. Figure 5, below, provides a Venn Diagram model of two-eyed seeing that was developed by the Institute of Aboriginal Peoples’ Health (IAPH); Figure 6 presents a Venn Diagram comparing and contrasting Traditional Ecological Knowledge and Western Science. These examples can be modified to help guide the discussion. Additional resources are also available (for example, Figure 7).



**Figure 4.** Big Patterns and Landmark Understandings in Two-Eyed Seeing Ways of Knowing (Source: Institute for Integrative Science and Health, 2007) [http://www.integrativescience.ca/uploads/activities/Two-Eyed-Seeing-Workshop-Integrative-Science-education-NSERC\(2\).pdf](http://www.integrativescience.ca/uploads/activities/Two-Eyed-Seeing-Workshop-Integrative-Science-education-NSERC(2).pdf))



**Figure 5.** Two-Eyed Seeing Venn Diagram developed by the Institute of Aboriginal Peoples' Health (Source: Institute for Integrative Science and Health, 2011, <http://www.integrativescience.ca/Activities/>)



**Figure 6.** Venn Diagram comparing and contrasting Traditional Ecological Knowledge and Western Science (Government of Manitoba, 2003)

### Key points

- Indigenous peoples live in all regions of the world and own, occupy or use resources on some 22% of the global land area, which in turn harbours 80% of the world's biological diversity. While there is no single definition for indigenous peoples, a core set of criteria guide the identification of this highly diverse group.
- Indigenous or traditional knowledge refers to the knowledge and know-how accumulated across generations, and renewed by each new generation, which guide human societies in their innumerable interactions with their surrounding environment.
- Although nascent in climate science, indigenous knowledge has been widely recognized in fields such as agroforestry, traditional medicine, biodiversity conservation, customary resource management, applied anthropology, impact assessment and natural disaster preparedness and response.
- Indigenous observations and interpretations of meteorological phenomena have guided seasonal and inter-annual activities of local communities for millennia. This knowledge contributes to climate science by offering observations and interpretations at a much finer spatial scale with considerable temporal depth, and by highlighting elements that may not be considered by climate scientists.
- Indigenous knowledge focuses on elements of significance for local livelihoods, security and well-being, and as a result is essential for climate change adaptation.

**Figure 7.** Indigenous knowledge as a foundation for climate change decision making, key points, Chapter 2 (Source: Nakashima et al., 2012)

The teacher may benefit from reading the following articles prior to leading the discussion:

- Aikenhead, G. and Mitchell, H. 2011. Bridging cultures: Indigenous and Scientific ways of knowing nature. Toronto: Pearson.
- Tengo, M. et al. 2017. Weaving knowledge systems in IPBES, CBD and beyond – lessons learned for sustainability. Current Opinion in Environmental Sustainability. 26-27:17-25. Available at: <https://www.sciencedirect.com/science/article/pii/S1877343517300039?via%3Dihub>
- Indigenous Circle of Experts. 2018. We Rise Together: Achieving pathway to Canada Target 1 through the creation of Indigenous protected and conserved areas in the spirit and practice of reconciliation. Report and Recommendations. Ottawa.
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### Timing:

Presentation of selected international program or programs

- 15 minutes

Videos and/or case examples

- 10 minutes
- How indigenous knowledge is changing what we know about the Arctic  
<https://www.youtube.com/watch?v=2XeUkz1D3nw>

OR Inuit Observations on Climate Change – Summary Version

<https://www.iisd.org/library/inuit-observations-climate-change-summary-version>

OR Journey of Awakening

<https://www.iisd.org/library/journey-awakening>

Two-Eyed Seeing Introduction

- 10 minutes

Two-Eyed Seeing Video (2006)

- Two-Eyed Seeing. <http://www.integrativescience.ca/Media/Video/> (8 minutes)

Co-Construction of Venn Diagram with examples

- 25 minutes)

**Outputs:**

- Venn Diagram for class outlining the concept of Two-Eyed Seeing

**Accommodations and/or Modifications:**

This exercise includes visual, written, oral, and listening components. These could be further developed depending on the needs of the class, and additional scaffolding in the form of the provision of notes or readings may be considered. The co-production of the Venn Diagram could occur in small groups or through a plenary session. Opportunities for small group discussions and peer-to-peer learning are key accommodations for some students. Wall posters featuring the key ideas related to Indigenous knowledge, Western science, and Two-Eyed Seeing could be developed prior to the lesson to provide additional scaffolding to the students.

**Assessment As/Of/For Learning:**

Assessment of learning can take place through teacher discussions with students and could be recorded on a class checklist. The Venn Diagrams will provide additional information related to an assessment of learning and will allow the teacher to have a good idea of how well the students have grasped the material. Assessment for learning can occur through the on-going in-class discussions related to this theme.

## Consolidation

### Case Example Artefact Creation

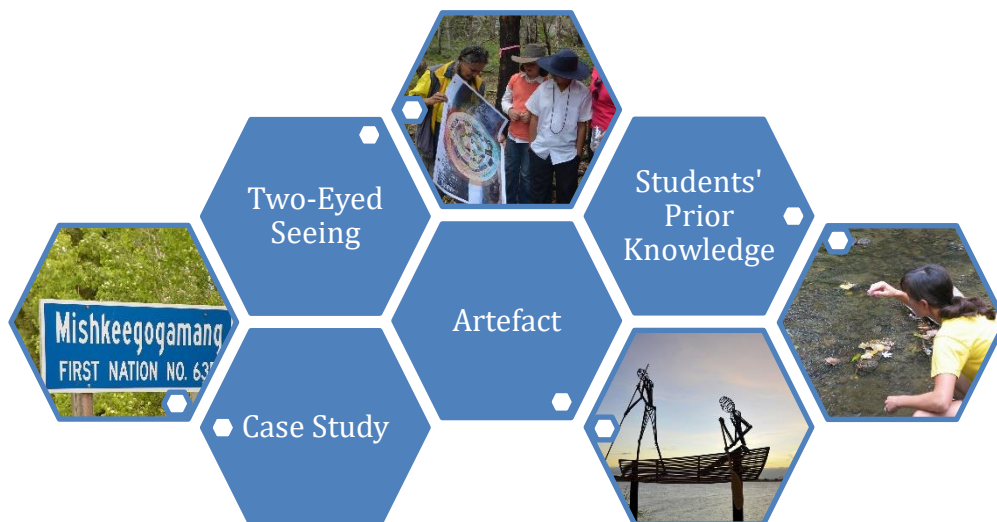
Working individually, in pairs or in small groups, students are asked to create an artefact that symbolizes or represents their understanding of two-eyed seeing. The examples can be gathered from a variety of sources, including the field trip, on-line research of existing case studies, on-line videos from reputable sources, personal experience, etc. (for example, Indigenous Circle of Experts, 2018; <https://sd73aboriginaleducation.weebly.com/science1.html> and international syntheses/reports).

Teachers can use a RAFT framework to differentiate, structure, and enable student choice with respect to this activity (Table 5). Students can choose their Role, Audience, Format, and Topic from the options provided (one per column).

**Table 5.** Draft RAFT template for Case Example Artefact Creation Assignment

Role	Audience	Format	Topic
The Environment/ Specific Natural Resource	Humans	Collage	Two-Eyed Seeing
A Child	Indigenous Groups	Sculpture	Two-Eyed Seeing
An Indigenous Person	Western Scientists	Comic Strip	Two-Eyed Seeing
A Western Scientist	Government Ministers	Poster	Two-Eyed Seeing

The students will read their case study closely and will also think about what they have learned about the case theme (i.e., pollinators, forests, etc.) from their other courses. Their artefact should integrate both their prior knowledge (based predominantly on Western Science) and the Indigenous knowledge highlighted in the case. The artefact can take any form (i.e., poster, song, sculpture, painting, collage, etc.) and should include a paragraph description of the piece and how it implements the concept of two-eyed seeing. A final gallery walk can showcase the final products, which may also be displayed with their accompanying text and the original case example, at a school event, such as parents' night or arts night.





### **Figure 8. Key Elements of Two-Eyed Seeing Gallery Walk**

#### ***Timing:***

- Various: This can be a culminating assignment for the biodiversity unit or an in-class project run over one or two classes.

#### ***Output:***

- A variety of artefacts suitable for a gallery walk on the theme of Biodiversity and Two-Eyed Seeing

#### ***Marking Rubric:***

- The criteria may be weighted or not, depending on the overall objectives of the teacher.

#### ***Accommodations and/or Modifications:***

Differentiated instruction through the use of the RAFT technique is central to this exercise. Additional accommodations, such as oral presentations or individually-tailored outputs, should be considered, depending on the needs of the individual students. Additional time may be required for some students to complete the task. All the elements of the RAFT could be changed, as necessary, to facilitate learning.

#### ***Assessment As/Of/For Learning:***

Assessment as learning could take place at various points in the process, from developing and (perhaps) presenting the initial idea, to small group brainstorming sessions to come up with or improve the ideas. The quality of these discussions could be assessed and recorded using a class checklist. Assessment of learning is based on the final product, but additional assessment could occur at other points along the way. An assessment for learning will take place at the gallery walk, particularly if parents and/or First Nations partners are invited to provide some feedback and comment related to the students' work. A debriefing of the artefact exercise and gallery walk with the students, perhaps including a formal or informal reflection, would also provide additional information about students' learning.

**Table 6.** Marking Rubric for Two-Eyed Seeing Gallery Walk Artefact Project

<b>Criteria</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Artefact Execution</b>	The artefact appears sloppy and/or unfinished.	The artefact is finished but not well executed.	The artefact is finished and the execution is good.	The artefact is very well-executed, generally free of error.
<b>Artefact Conceptual Design/Communication</b>	The concept for the artefact is poorly developed and fails to convey a clear statement or message. Artefact expresses and organizes ideas with limited effectiveness.	The concept is quite generic and the artefact fails to convey a compelling statement or message. Artefact expresses and organizes ideas with some effectiveness.	The artefact conveys a clear statement or message and the design is thoughtful. Artefact expresses and organizes ideas with considerable effectiveness.	The artefact is intriguing and thought-provoking. The message is complex and/or compelling. Artefact expresses and organizes ideas with a high degree of effectiveness.
<b>Paragraph Quality</b>	The written work is unclear or incomplete. Connections between artefact, case study, student's prior knowledge, and two-eyed seeing are of limited effectiveness.	The written work is complete. Connections between artefact, case study, student's prior knowledge, and two-eyed seeing is of some effectiveness (i.e., stated but is not compelling or convincing).	The written work is complete and of reasonable quality. Connections between artefact, case study, student's prior knowledge, and two-eyed seeing made with considerable effectiveness (i.e., clear and easy to understand).	Written work is clear, concise, and of good quality. Connections between artefact, case study, student's prior knowledge, and two-eyed seeing made with a high degree of effectiveness (i.e., clear and compelling).
<b>Link to Case Study</b>	Artefact does not reference, reflect or build on the case study. Knowledge transferred to unfamiliar	Artefact references to case study is a tokenistic fashion. Knowledge transferred to unfamiliar	Artefact references case study in a meaningful way. Knowledge transferred to unfamiliar context with	Artefact builds on or transcends the case study in a thoughtful way. Knowledge transferred to unfamiliar context with a



	context with limited effectiveness.	context with some effectiveness.	considerable effectiveness.	high degree of effectiveness.
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### Social Media Campaign

Students can be introduced to the Ontario Biodiversity Council's on-going #BiodiversityMakesUs campaign (Figure 8, below). They can be asked to use the on-line tool to create a series of images that reflect what they have learned about biological and cultural diversity and to justify their choices in a brief paragraph.

On-Line Tool: <http://ontariobiodiversitycouncil.ca/biodiversitymakesus/>

#### **Timing:**

- Various: Can be completed in class or assigned as homework. Tool available on-line.

#### **Output:**

- One or more OBC images and a paragraph of text, organized on a large poster



## Make your own #BiodiversityMakesUs image



We encourage all Ontarians to think about what biodiversity means to them and the many ways it makes us stronger, individually and collectively.

Upload a photo, choose a variety of colours, and change the wording below to create your own #BiodiversityMakesUs visual to share.

### Example Images



**Figure 8.** Screen shot of #BiodiversityMakesUs Social Media Campaign (Source: Ontario Biodiversity Council. 2018. <http://ontariobiodiversitycouncil.ca/biodiversitymakesus/>)

### ***Accommodations and/or Modifications:***

Students could be given additional choice as to how to undertake the exercise and what the outputs might be. This exercise could be modified by being done offline through a variety of creative ways, including hand drawing the final products. The overall idea and slogan could be changed by the teacher or the class to make the exercise more concrete. Additional opportunities for peer-exchange and learning could be integrated into the exercise. It could be scaffolded for some students through the use of a completion checklist.

***Assessment As/Of/For Learning:***

Assessment for learning will include teacher's discussions related to the assignment with the class and any modifications that are made to it, based on these discussions. The level of engagement and student knowledge of the topic and their ideas of how to engage could be assessed using a class checklist. On-going dialogue will allow for any mid-course corrections required by students as they work through the exercise. Students could be given the opportunity to present and/or peer-assess each other's work through a structured or less structured exercise in order to facilitate additional reflection and learning related to the key themes of the exercise. The final product can be assessed using a clear assessment rubric. It should include a written component that allows students to explain their thinking and their choices (i.e., of images, adjectives, etc.). The poster can be displayed in the classroom or hallway to generate additional discussion.

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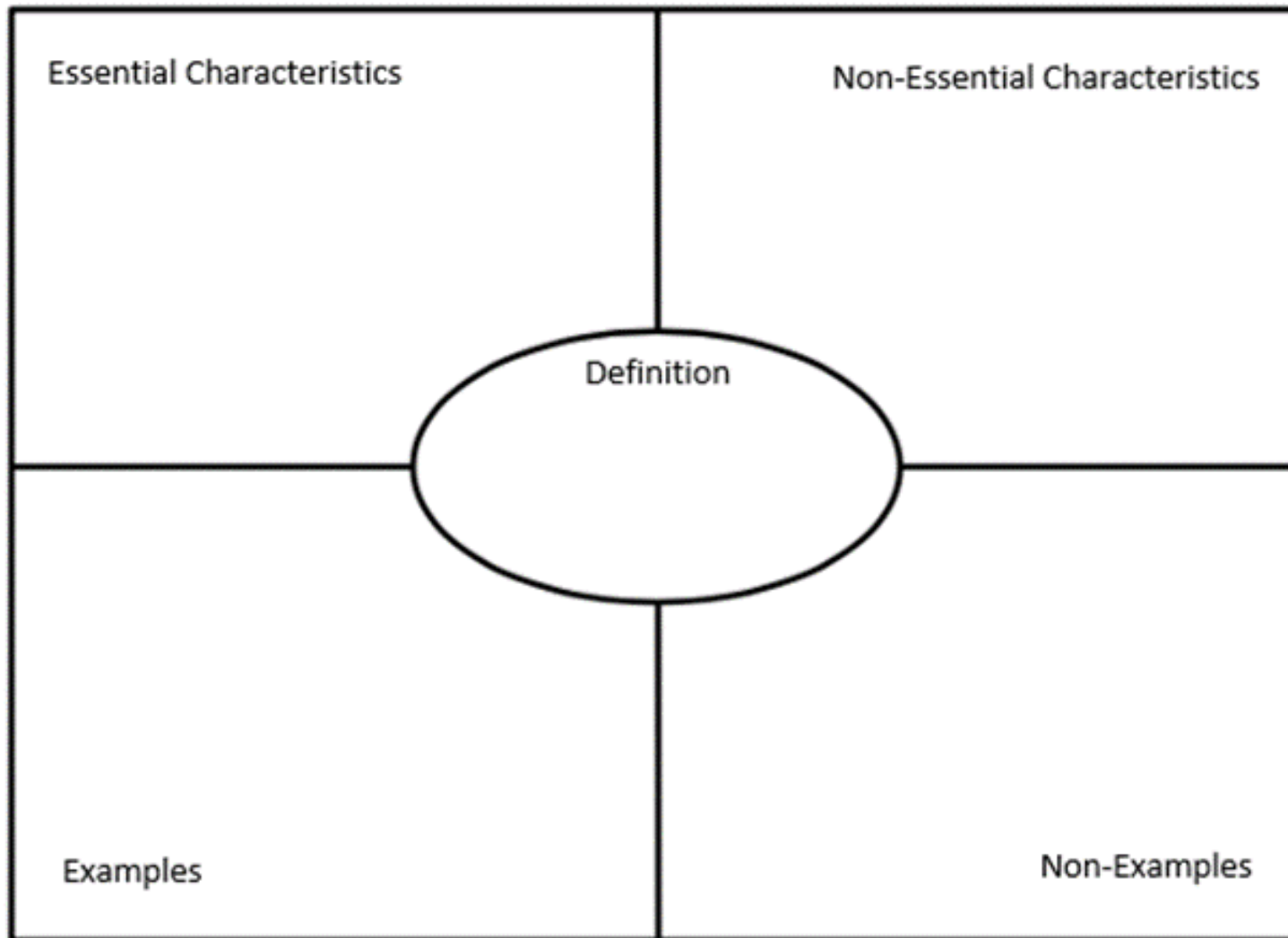
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Worksheet #1 - Frayer Model Template for Working Definition of Biodiversity



## Worksheet #2 - Field Trip Report, Booklet or Poster Outline

### Reflection Questions:

- In your own words, describe the relationship between biological, cultural, and linguistic diversity.
- How can they be protected/enhanced?
- What can we do?
- Reflect on how the field trip changed/deepened/broadened your understanding of the links between cultural, language, and biological diversity. Provide specific examples from the field trip to support your thoughts and ideas.

### Report:

Choose one of the following as a format for your field trip report:

- Formal Papers/Essay
- Booklet, or
- Poster

**Formal papers/essays** should draw on the literature and your personal experience to elaborate on a clear thesis statement, supported by a few key themes. The thesis statement and key themes should be supported by examples from the field trip and other resources, as appropriate.

**Booklets** should investigate two or more of the following concepts in detail and must include specific examples from the field trip to support and link the ideas: cultural diversity, language diversity or biological diversity.

**Posters** should highlight a key take-home message and action step related to the field trip and the themes of cultural diversity, language diversity, and biological diversity. It should communicate the key point and recommended action clearly at a glance and be enhanced by visual elements as well as text.

**Worksheet #3 - A Comparison of the Indigenous Ways of Living in Nature and Western Science**

<b>Indigenous Ways of Living in Nature</b>	<b>Western Science</b>

**Worksheet #4**

**Two-Eyed Seeing: Harnessing the Value of Both Indigenous Knowledge and Western Science to Protect and Restore Biodiversity**

