Cycle of Enactment: Science Inquiry Revised Protocol 3E learning plan

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1. Overview and Context

Overview of Science Inquiry:	**Intended Audience:**
This lesson teaches students about how amphibians survive the winter; specifically studying toad and frog hibernation. In this lesson students will build a toad hibernation nest ("a toad's winter den") using elements found in nature (leaves, sticks, rocks). This lesson is part of a larger unit on hibernation. The unit discusses the tools and strategies that different animals that hibernate use to survive long Canadian winters. This lesson will be divided into seven sections; it will begin (1) a large group discussion on various strategies humans and large mammals use to survive the winter. Prior to this lesson, students will have had several classes on identifying different types of amphibians and their differences from mammals. They will also have been introduced to the notion/phenomenon of evolution. Following their discussion of how humans and mammals survive the winter (2) there will be a quick review of the common characteristics and traits of amphibians. Proceeding this (3), students will create an amphibian who is ready to survive the winter and hypothesize the strategies they have adapted to use. The class will then come back together (4) and discuss their beliefs/hypothesis on how different amphibians strategize to survive the winter. The teacher will then (5) introduce the students to the different components of a toad hibernation nest and its structure. In groups of 3-4, (6) the students will build hibernation nests using materials found outside, which will be provided by the teacher. The model will be surrounded by an ice pack and the students will be asked to record the temperature difference at the start and end of the lesson to observe if hibernation nest insulates toads. The class will end (7) in a large group discussion about temperature changes, how it impacts the toad, and how evolution impacts amphibian survival. Students will take the internal temperature of the hibernation nest to see how the toad remains insulated. The group discussion will also review the importance of hibernation nests, or aquatic structures used for hibernation of different types of amphibians through an indigenous perspective. The students will be encouraged to reflect on the reciprocal relationship they have with the land and the interconnectedness between humans and the land. The students will also follow the discussion by labeling a diagram of the toad hibernation nest. This lesson aligns itself with big ideas of science 8 (organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms) because to survive the winter amphibians must conserve their energy through hibernation. However, they can only do so with the help of the land and humans. This lesson also fits into big idea number 10 (The diversity of organisms, living and extinct, is the result of evolution) as evolution played a key role in the adaptation of winter survival through hibernation. This lesson can lead to further lessons on how reptiles survive the winter and how birds migrate south in the fall. Students can also do group presentations identifying an amphibian and their unique hibernation process that is a result of evolution. Finally, this lesson connects to sustainability because toads play a crucial role in insectct regulation, which plays in maintaining balance in the ecosystem. Engage: Students will reflect on differentiating amphibians, drawing them and hypothesizing some key "superpowers"/traits that help them survive the winter. Then discuss in pairs and lead to a large group discussion.	Grade 3 (cycle 2) students

Explore: students will build a toast hibernation nest to study how amphibians survive the winter. They will learn/'practice how to use a thermometer by measuring the temperature within and outside the toad hibernation nest and comparing it from the start of hibernation to the end. Explain: students will explain how toads prepare themselves to survive the winter. They will also study the topic of hibernation through an indigenous and explain the role of evolution on amphibian hibernation.	
Phenomenon: Students will learn how amphibians survive the winter by building a toad hibernation nest. They will observe the structure of the nest as they build it, this will allow them to understand how toads prepare themselves to survive the winter. This is linked to the larger idea of how living things interact with the environment and how evolution plays a key role in the hibernation process of the amphibians.	**Driving Question:** How do amphibians survive the winter?

2. Resources and Materials

Lesson Source:

Junior Eco Engineers. (n.d.). *Hibernation unit - what do Frogs & Toads do in the Winter*. Teachers pay teachers. https://www.teacherspayteachers.com/Product/Hibernation-Unit-What-do-Frogs-Toads-do-in-the-winter-4205218

This lesson was inspired by the above-mentioned reference; however, it was adapted to incorporate an indigenous perspective and make it a little bit more accessible to all students.

This resource is a unit plan therefore it extends itself over several classes. Therefore, we have chosen specific components of individual lessons to complete one 30–45-minute activity on toad hibernation, and general amphibian winter survival.

In the original resource, the **engage phase** was based on a teacher-led whole group discussion about how students believe amphibians survive the winter, and how it their strategies differ from those humans use to survive the winter. We felt as though by going straight into the main idea of the course through a teacher led discussion it limited students' opportunity to reflect and connect to the content. We decided to add a hands-on creative activity as students have different learning preferences; by designing/drawing their superpowered amphibian the students are thinking about the unique features of the amphibian through creative visual aids, reading, writing, and connecting to the material. The students are reflecting on the driving question (how amphibians survive the winter?) without directly answering the question in a teacher led discussion. During this time, the teachers will incorporate different talk moves including revoicing and orienting students thinking.

In the original resource, the **explore phase,** building the toad hibernation nest took place outdoors. To make this more accessible students will be using teacher collected materials (leaves, rocks, sticks, soil) to create their toad hibernation nest in a teacher-provided plastic container. The ice surrounding the container will mimic the cold temperature of late fall and winter. The teacher's role is to act as a cultural and content facilitator, we will be circulating around the class and using different talk moves to promote students' observation, reasoning, creativity and critical thinking.

In the **explain phase,** we will be emphasizing how living things interact with the environment through an indigenous perspective of interconnectedness and reciprocal relationships. The students will follow along with a worksheet diagram that labels the toad hibernation nest. The teachers will also discuss how evolution plays a key role in amphibian, specifically toad hibernation.

To further improve our lesson, we will be including an additional, simple overview of how the amphibians body composition allows them to combat difficult winters through hibernation. Several talk moves will be included in the lesson; there will be a specific emphasis on challenging student thinking as students are often taught about science through a western perspective, therefore it might be difficult for them to open their understanding through different perspectives, that being an indigenous perspective in this case.

Lesson Resources & References

These resources provided examples of how amphibians hibernate during the winter, different hibernation nests and strategies. These resources also provide insight into how the frogs' internal make up allows them to survive the winter.

Williams, W. L., & Snively, G. (2016). Chapter 3 – "Coming to Know": A Framework for Indigenous Science Education. In *Knowing Home: Braiding Indigenous Science with Western Science, Book 1*. University of Victoria.

Hamilton Conservation Authority. (2022, January 31). *Reptile and amphibian hibernation*. Hamilton Conservation Authority. https://conservationhamilton.ca/blog/reptile-and-amphibian-hibernation/#:~:text=They%20can%20produce%20natural%20antifreeze,breathing%2C%20and%20brain%20functions%20cease.

Make a house for frogs and toads. RSPB Nature on your doorstep. (n.d.). https://www.rspb.org.uk/helping-nature/what-you-can-do/activities/make-a-house-for-frogs-and-toads

McBride, A. (2024, February 29). *Crossing paths with a frog is actually a pretty powerful sign from the cosmos that big changes are coming*. Well+Good. https://www.wellandgood.com/spiritual-meaning-frogs/

National Geographic. (n.d.). *Amphibian Pictures & Facts*. National Geographic. https://www.nationalgeographic.com/animals/amphibians

National Geographic. (2019). *Frogs Come Alive After Winter Thaw | National Geographic*. YouTube. https://www.youtube.com/watch?v=139NSc53RqQ

Materials:

Items:	Quantity:	For students or teacher?	Providing Own supplies	Need to borrow from lab supplies
Plastic container (24 oz)	1	For students	X	
Plastic bowl	1	For students	X	
Leaves	35	For students	X	
Sticks	10	For students	X	
Rocks	10	For students	X	
Potting soil	1-2 cups	For students	X	
Plastic toad	1	For students	X	
Teacher model of hibernation nest	1	For teacher	X	
Thermometer	2	For students	X	
Ice pack	1	For students	X	
Paper to name nest	1	For students	X	

White board	1	For teacher		X (found in conference room)
Colouring pencils/crayons/pencils	1 pack to share	For students	X	
Superpowered Amphibian teacher created worksheet	3	For students	X	
Toad hibernation nest diagram teacher created worksheet	3	For students	X	
Superpowered Amphibian teacher created worksheet-teacher example	1	For teachers	X	
Toad hibernation nest diagram teacher created worksheet-Teacher answer key	1	For teachers	X	
Temperature data worksheet	3	For students	X	
Instructional steps for hibernation nest	1	For students	X	
Evolution model diagram	1	For teachers and students on whiteboard	X	

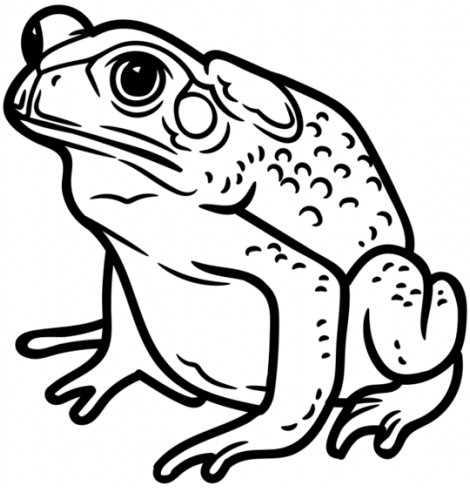
https://www.canva.com/design/DAGSQVu1txc/5yqG8bURk121c0Kpdfy6HA/edit?utm_content=DAGSQVu1txc&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

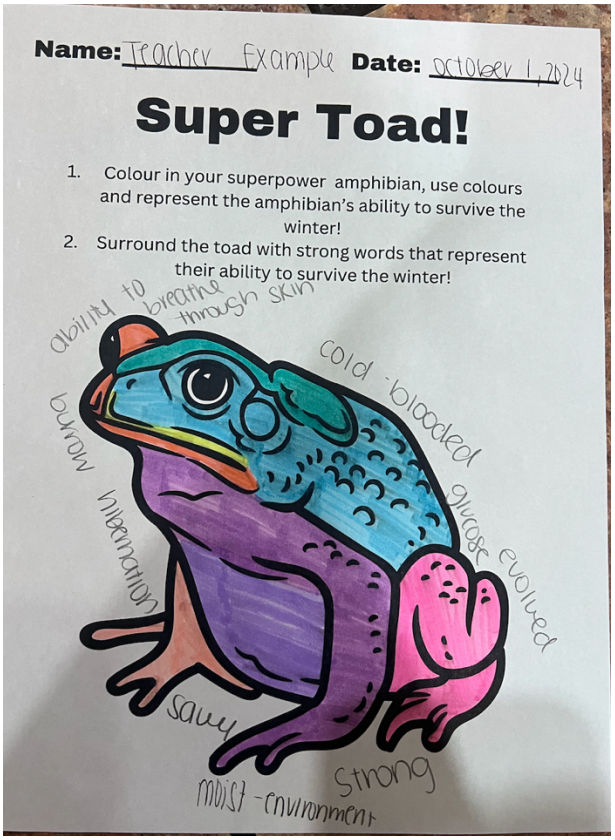
https://www.canva.com/design/DAGSSZNKbeE/LYwyhAh4QzcMnjDr4wkAUQ/edit?utm_content=DAGSSZNKbeE&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

Name:_____ **Date:** _____

Super Toad!

1. Colour in your superpower amphibian, use colours and represent the amphibian's ability to survive the winter!
2. Surround the toad with strong words that represent their ability to survive the winter!





TOAD HIBERNATION NEST INSTRUCTIONS:

1. Fill the 24 oz container with 1/2 cup of potting soil. ☐
2. Layer the potting soil with some rock and leaves. ☐
3. Place the plastic toad in the potting soil. ☐
4. Cover the toad with another 1/2 cup of soil, layer with leaves, branches, rock. ☐
5. Use the first thermometer to measure the temperature inside the hibernation nest. ☐
6. Record this temperature on the provided sheet. ☐
7. Close with container with the lid. ☐
8. Place the container on the red ice pack and place the blue ice pack on the lid. ☐
9. Use the second thermometer, under the ice pack to measure the temperature of the environment outside the hibernation nest. ☐
10. Record this temperature on the provided sheet. Hint: it should be around 0°C (remember, ice is frozen water – think back to our lesson on the freezing point of liquids). ☐
11. Look at example model. ☐
12. Measure the temperature outside the hibernation nest using the teacher example. ☐
13. Record this data on the provided sheet. ☐
14. Open the lid. Measure the temperature inside the hibernation nest with the example model. ☐
15. Record the data on the provided sheet. ☐

Great work! You have given back to the land by helping the toad survive a cold Canadian winter!

Name:_____ **Date:** _____

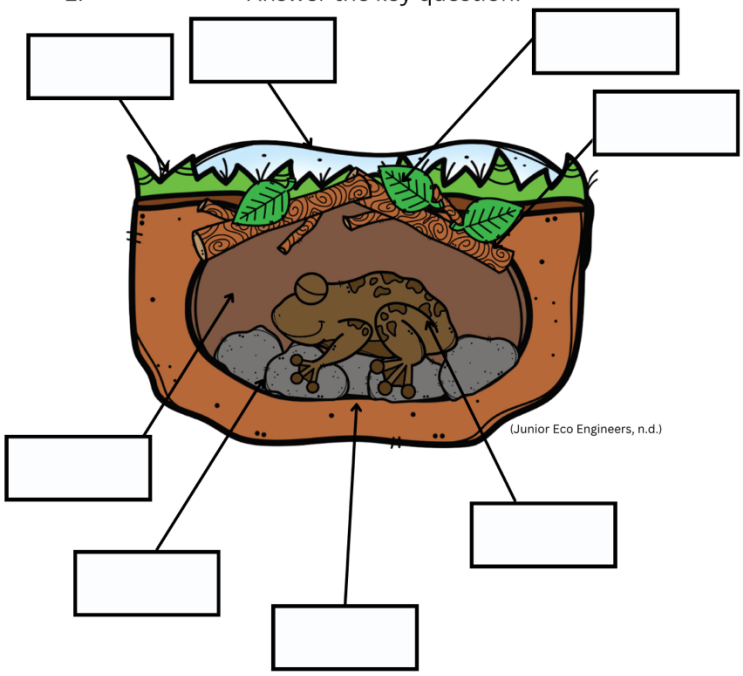
LET'S RECORD THE TEMPERATURE

TEMPERATURE OUTSIDE THE HIBERNATION NEST	TEMPERATURE INSIDE THE HIBERNATION NEST
START: _____ °C	START: _____ °C
END: _____ °C	END: _____ °C

Name:_____ **Date:** _____

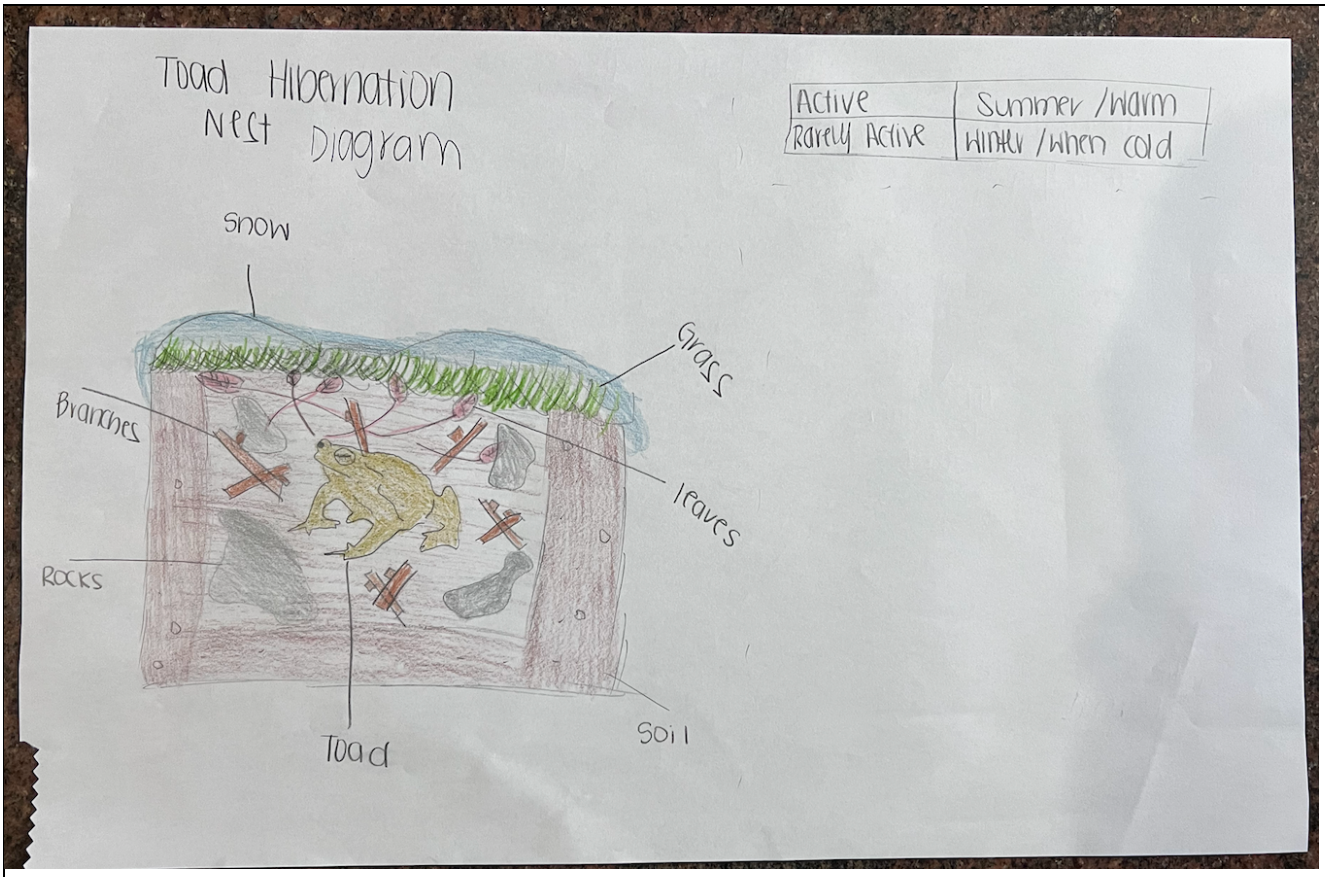
Toad Hibernation Nest

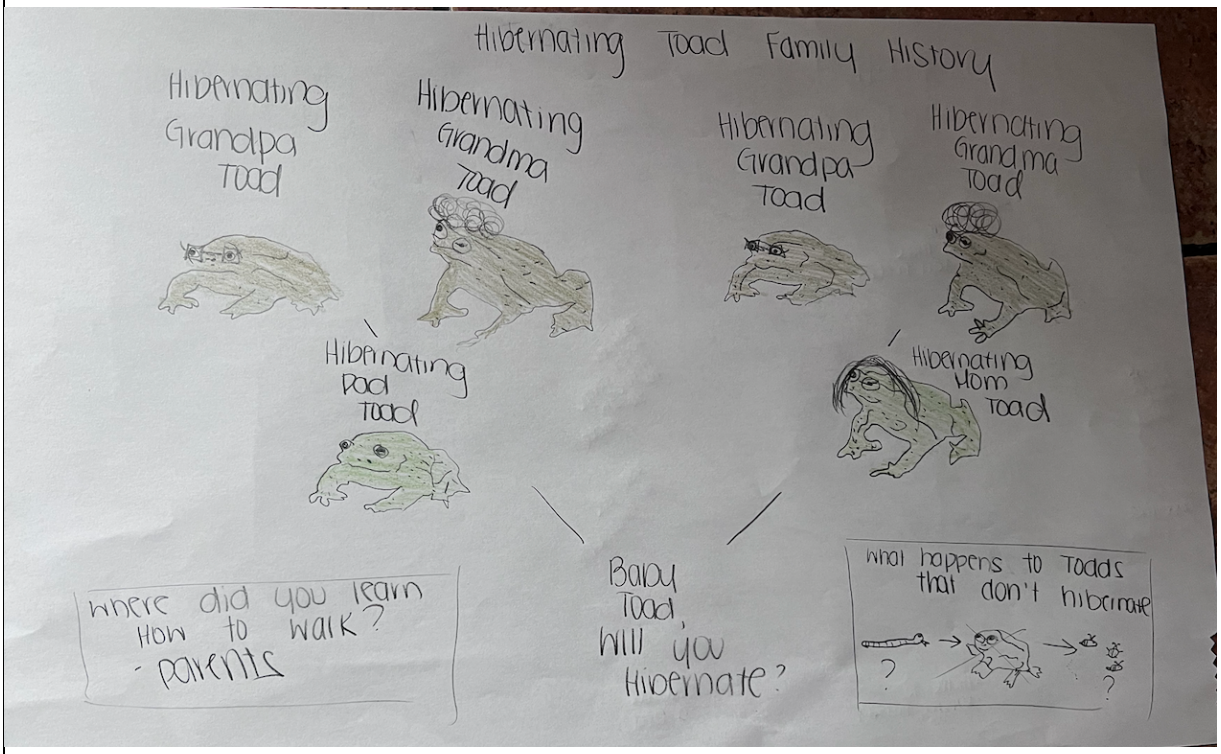
1. Label each part of the toad hibernation nest!
2. Answer the key question!



(Junior Eco Engineers, n.d.)

Inspiration: Junior Eco Engineers. (n.d.). Hibernation unit - what do Frogs & Toads do in the Winter. Teachers pay teachers . https://www.teacherspayteachers.com/Product/Hibernation-Unit-What-do-Frogs-Toads-do-in-the-winter-4205218


Toad Hibernation Nest Diagram
Active | Summer / Warm
Rarely Active | Winter / When cold
Snow
Grass
Branches
Leaves
Rocks
Toad
Soil


Hibernating Toad Family History
Hibernating Grandpa Toad
Hibernating Grandma Toad
Hibernating Grandpa Toad
Hibernating Grandma Toad
Hibernating Dad Toad
Hibernating Mom Toad
Where did you learn How to walk? - Parents
Baby Toad, will you Hibernate?
What happens to Toads that don't hibernate
?
?

3. Learning Goals *(removed some learning goals)*

HEAD

Students will know:

- What an amphibian is
- What the different types of amphibians are
- What a toad hibernation nest looks like
- What are the components of a toad hibernation nest
- What evolution is

Students will understand:

- How amphibians survive the winter
- Why toad hibernation nests are important
- How evolution influences amphibian hibernation
- How we are all interconnected with the land (indigenous perspective)
- How to use scientific language (hypotheses, observations, inferences)
- What an indigenous perspective on nature is

HANDS

Students will be able to:

- complete a creative worksheet on an amphibian
- describe the process of toad hibernation
- assemble a toad hibernation nest
- label a diagram of a toad hibernation nest
- measure and record the temperature in and outside the toad hibernation nest with a thermometer

HEART:

Students will:

- reflect on how amphibians, humans and mammals in general survive winter differently yet are interconnected (emphasizing and incorporating an indigenous perspective); this will also allow students to develop a respect for nature
- connect to how living things interact with their environment
- think about how the land helps humans and amphibians survive, this will allow them to reflect on they can treat the land better
- reflect on how evolution has contributed to human development

Connections to the QEP – Progression of Learning:
LIVING THINGS

D. Systems and interaction	1	2	3	4	5	6
1. Interaction between living organisms and their environment						
a. **Describes the physical characteristics that demonstrate how animals adapt to their environment**	→	★				
b. **Describes the behaviours of familiar animals that enable them to adapt to their environment**	→	★				
c. Identifies habitats and the animal and plant populations found in them			→	★		
d. Describes how animals meet their basic needs within their habitat			→	★		
e. Describes relationships between living things (parasitism, predation)			→	★		
f. Explains how animals and plants adapt to increase their chances of survival (e.g. mimicry, camouflage)			→	★		

(Éducation, Loisir et Sport Québec, 2009, p.12)

- This topic emphasizes the amphibian's interaction with the environment when adapting to survive the winter through hibernation.
- The students will be able to name the process amphibians use to survive the winter.
- The students will be able to build a toad amphibian nest and label its components
- The students will be able to describe the important role each element of the land plays in helping the toad survive the winter, and how the toad contributes to the land in return
- The students will be able to describe how amphibians, specifically toads have adapted and evolved to survive the winter

E. Techniques and instrumentation	1	2	3	4	5	6
1. Use of simple observational instruments						
a. **Appropriately uses simple observational instruments (e.g. magnifying glass, binoculars)**			→	→	→	★
2. Use of simple measuring instruments						
a. **Appropriately uses simple measuring instruments (e.g. rulers, dropper, graduated cylinder, balance, thermometer)**			→	→	→	★
3. Design and manufacture of environments						
a. Designs and manufactures environments[1] (e.g. aquarium, terrarium, incubator, greenhouse)			→	→	→	★

(Éducation, Loisir et Sport Québec, 2009, p.13)

- Students will use simple instruments like measuring cups, plastic containers, plastic bowls, and a thermometer to build the toad hibernation nest
- Students will be designed a simple environment for a toad to live in using natural materials

Éducation, Loisir et Sport Québec. (2009, August 24). *Progression of learning - science and technology* . Gouvernement du Québec. https://www.quebec.ca/en/education/preschool-elementary-and-secondary-schools/quebec-education-program/elementary

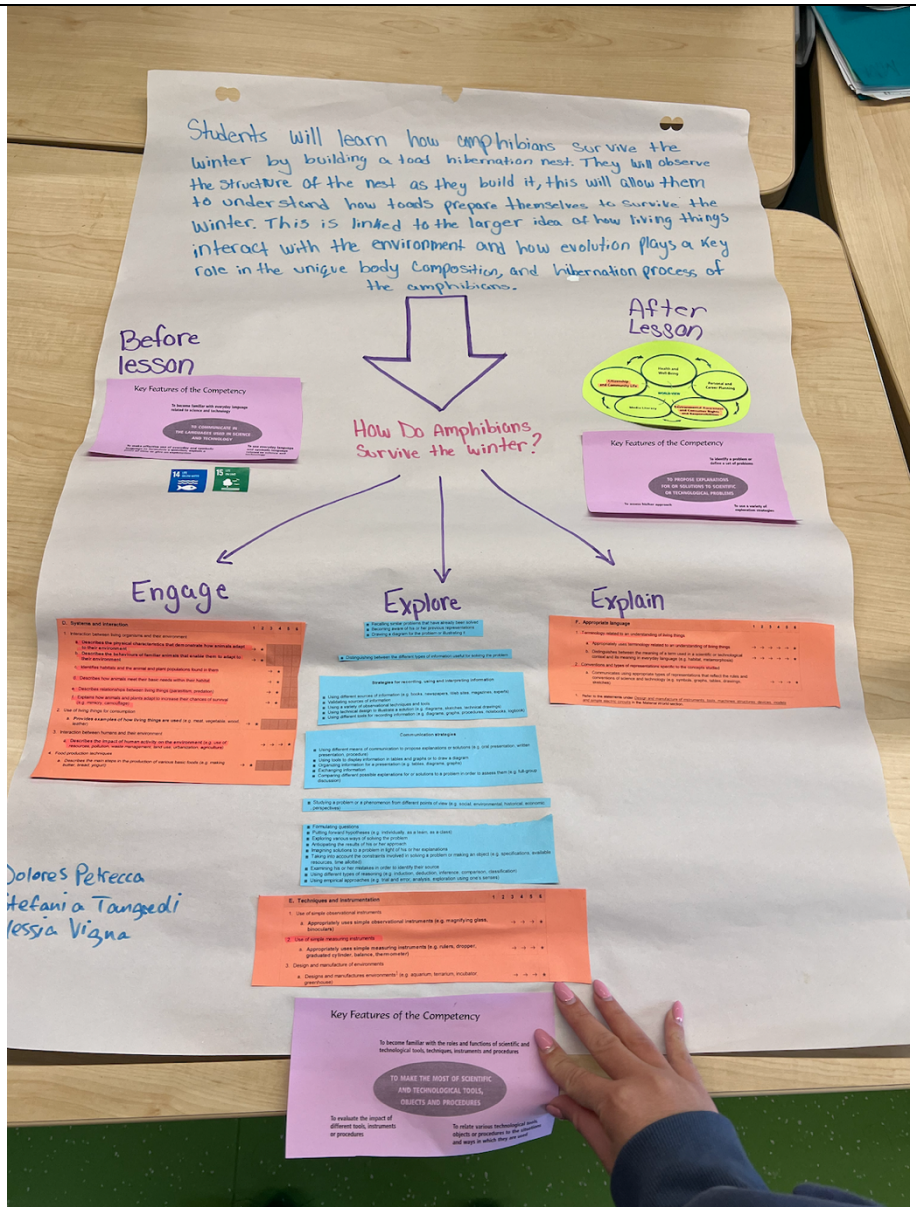
QEP Competencies cycle 2:

1. To propose explanations for or solutions to scientific or technological problems
    - Students will be able to explain the role of evolution in an amphibian's ability to survive the winter. They will understand how this impacts the amphibian's relationship to the land. Amphibians are faced with a stress to protect themselves from the freezing winter; students will understand how they strategize to conquer this stress.

2. To make the most of scientific and technological tools, objects and procedures
    - Students will manipulate a thermometer effectively
    - Elements of nature: leaves, sticks, rocks are scientific tools, students must use them appropriately to build a toad hibernation nest that protects the toad from freezing.

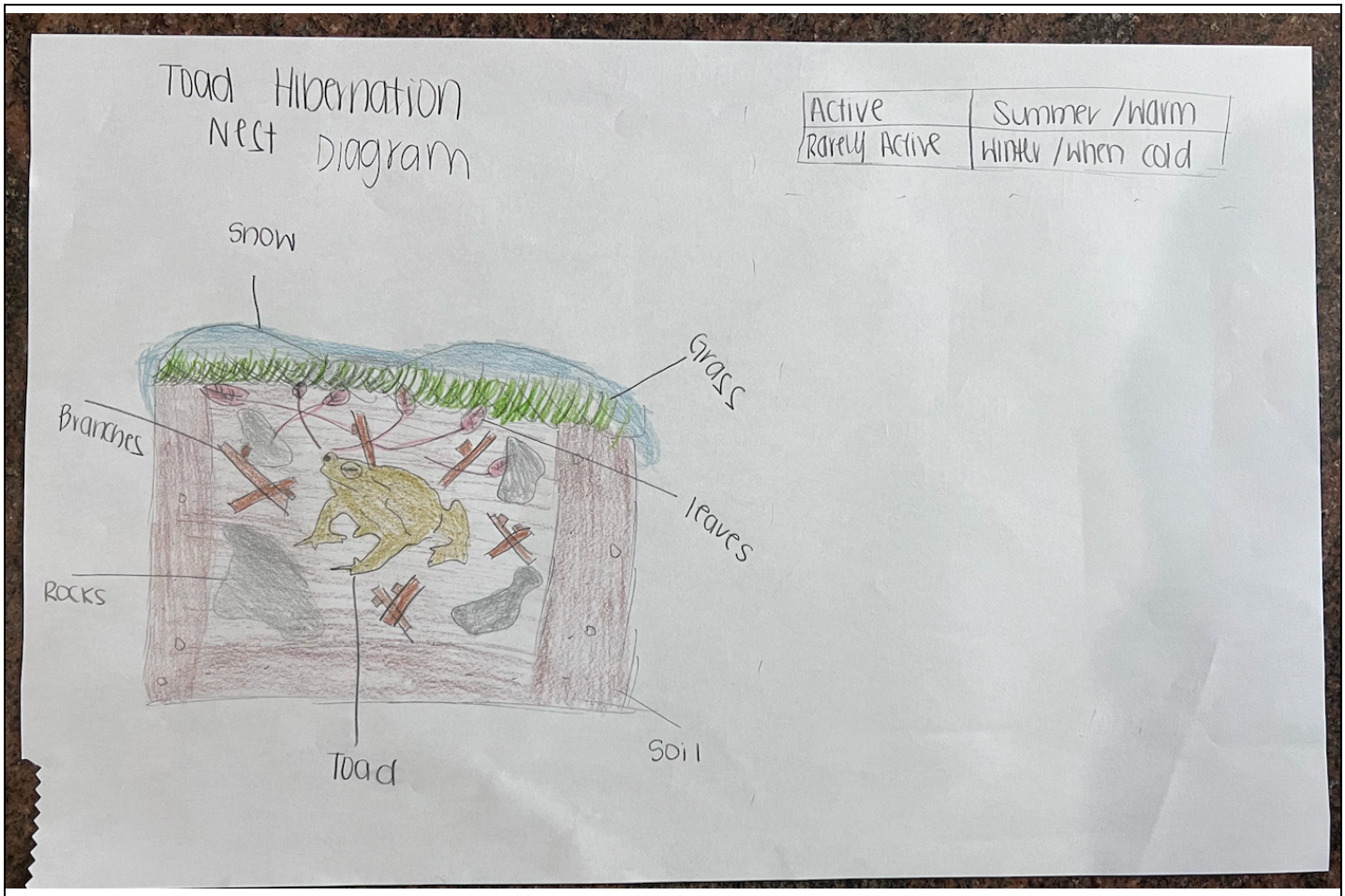
3. To communicate in the languages used in science and technology
    - Students will learn key concepts, defining terms (hibernation, amphibian, leopard frog, gray tree frog, toad). Students will use these terms appropriately in discussion
    - Students will be able to identify elements of a toad hibernation nest and define the importance of each role.
    - Students will be able to identify three main features of the amphibian body which protects them from freezing during the winters.

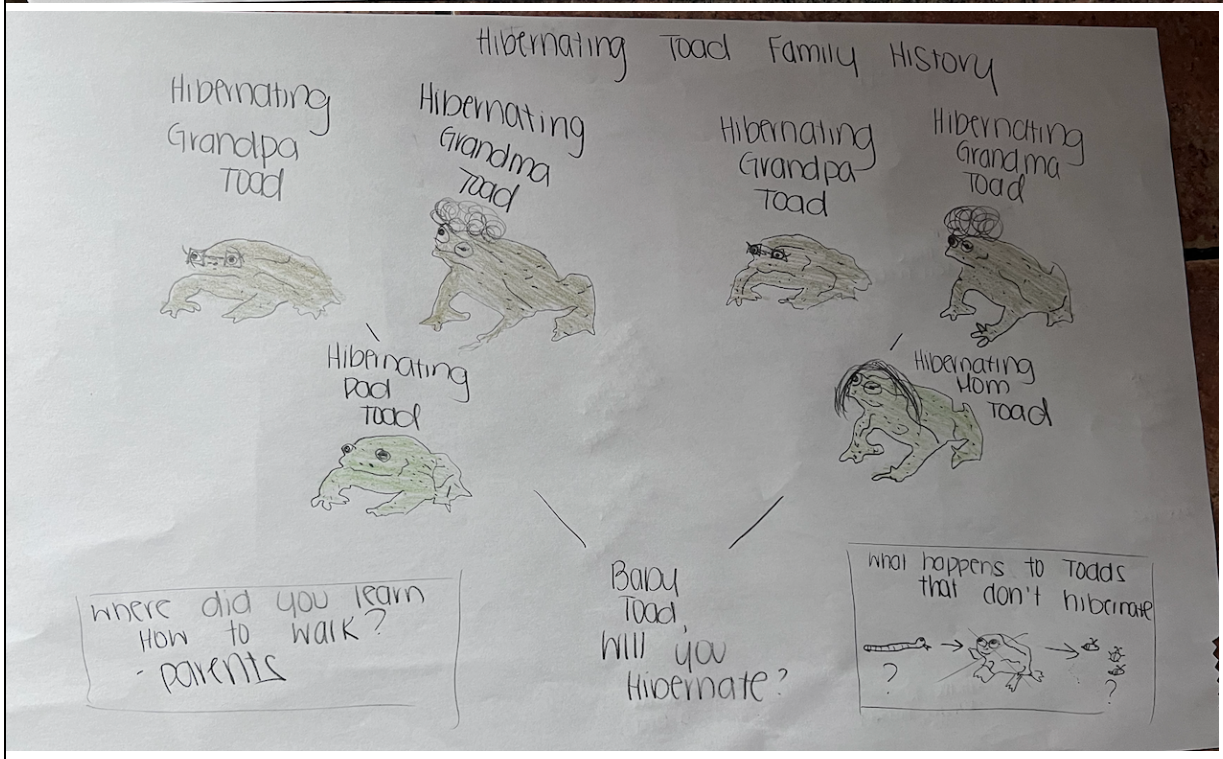
Ministry of Education. (2002). *Québec Education Program - Elementary Education*. Gouvernement du Québec. https://www.quebec.ca/en/education/preschool-elementary-and-secondary-schools/quebec-education-program/elementary



Scientific model

This model demonstrates an inside-view of a toad-hibernation nest, each component is accompanied by a description of the potential role it plays in keeping the toad safe to survive the winter. In attempt to prob student thinking for the cruciality of amphibian winter hibernation, a small chart about the toad's activity levels and how they are impacted by environmental factors is placed next to the diagram.





Attached is a model for discussing evolution in the third-grade classroom.

Junior Eco Engineers. (n.d.). *Hibernation unit - what do Frogs & Toads do in the Winter*. Teachers pay teachers. https://www.teacherspayteachers.com/Product/Hibernation-Unit-What-do-Frogs-Toads-do-in-the-winter-4205218

- In our lesson the toad hibernation nest will be created in a plastic container, and an ice pack will be used to mimic the snow.
- Students will measure the temperature inside and outside the toad hibernation nest and record the data on a teacher provided worksheet. The purpose of this experiment is for students to observe how toad hibernation nests are one of the factors that allow amphibians to survive the winter.

Evidence based thinking explanations:

Claim: I think that amphibians can survive the winter because their bodies have evolved to dig through the soil and remain underground throughout the winter.

I think this because in nature toads hibernate in burrows under leafy landfills to protect themselves from predators and freezing throughout the winter. As a result of evolution, the amphibians' major organs have adapted to have a large amount of glucose (sugar); and breathe underground. This is a result of evolution; the toads have learned that if they toad hibernate throughout the winter they will die. If the toads die, there will be a higher population of insects as they toads are not there to eat it. Snakes, fish and birds who normally eat toads will lose out on one of their main food supplies. This will cause a disruption in the entire ecosystem. The evolution to high blood glucose levels, ability to breathe through their skin and adaptation of strategic hibernation to combat the cold winters demonstrates their interaction with the environment. This explains why the temperature within the container might decrease slightly; however, not to an equivalent freezing point to the outside temperature. This is explained and justified by the science principles of hibernation: how amphibians evolve to interact with the environment and find strategies to survive the cold winters. This principle will help us use the evidence to support the claim because evolution has helped amphibians strategize on the importance of hibernation, they will remain protected from the cold and predators.

4. Anticipating Students Ideas

Students' everyday experiences and ideas related to this phenomenon:

In this lesson, students will explore the process of evolution and adaptation through amphibian hibernation. Students will enter the classroom with prior knowledge based on cultural, and personal experiences:

- Some students may be entering the classroom with a cultural, spiritual or religious perspective of amphibians. For instance, in the Egyptian culture, frogs symbolize fertility, growth, and new adventures. This can be incorporated in discussion to spark curiosity and carried over on an interdisciplinary level.
- When thinking about evolution, some students may only think about how humans have evolved, rather than other species. We would work through this by incorporating an indigenous perspective in the classroom, highlighting the importance of cycles, circles and interconnectedness.
- Students might categorize all amphibians into one category. We work through this by quickly reviewing the different types of amphibians in previous lessons.
- Some students may think the hibernation process for mammals such as bears is the same for amphibians. We would work through this by identifying key features of the amphibian's unique body composition.
- Students may assume that toads and frogs are the same.
- The students may assume that toads' complete daily activities in the hibernation nest (eating, drinking, metabolizing).
- Some students may assume that even if toads die, there will not be a disruption in the ecosystem, reducing the importance of toad hibernation. This may impact student motivation to learn.

Public record of student thinking:

White board set up:

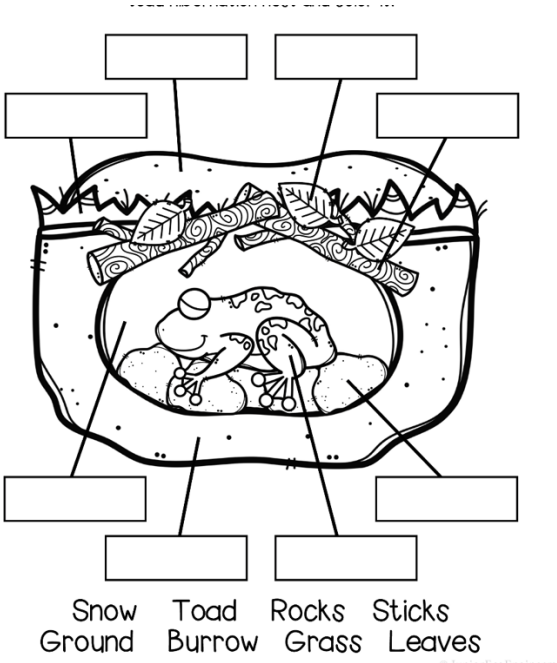
Engage phase:

How do you survive the winter? What are some of your winter essentials? (to be discussed prior to review of amphibians) How do bears survive the winter? What are amphibians?	How do amphibians survive the winter? What do they need to survive the winter? (review of amphibians, teacher the above-mentioned questions to class, students will reflect on these questions by completing the amphibian work sheet-*superpowered amphibians*, the students will then share with one peer, and then a large group discussion to fill out the white board)

Explore:

What steps did you complete? Which ones were easy, which were more difficult? What would you do differently next time?

Explain Phase:
One side of the board will have a model diagram to label, the other side will have space for students to suggest the importance of toad hibernation. The students will also be encouraged to share how building a hibernation nest paves the way for interconnectedness and interactions with the land; is impacted by evolution and how it the amphibians body composition helps them survive the winter.



What happened to the temperature inside and outside of the hibernation nest we built?
What materials did we use? Let's label and list their importance on the diagram
Where did Toads learn to hibernate?
What happens if the toads don't hibernate?
How does this experiment connect to the indigenous perspective?

Junior Eco Engineers. (n.d.). *Hibernation unit - what do Frogs & Toads do in the Winter*. Teachers pay teachers. https://www.teacherspayteachers.com/Product/Hibernation-Unit-What-do-Frogs-Toads-do-in-the-winter-4205218

5. Instructional Sequence

ENGAGE
Management considerations: In this phase students will reflect on how humans survive the winter to open the discussion on amphibian hibernation. The students will be seated in groups of 3-4. The teacher will use wait time (1 minute) to allow students to reflect on this idea as many students often struggle with coming up with answers quickly. The teacher will ask students to put their thumb in the air and remain silent when they have thought of an idea. Once most students have their thumb in the air, the teacher will ask volunteers to share some essentials that humans need to survive the winter. The teacher will take about 2-3 suggestions. Proceeding this, the teacher will ask students about how bears survive the winter (this is a review from previous lessons about hibernation). The teacher will again use wait time to give students the opportunity to reflect on previous lessons; when they are ready the students will put their thumb in the air. The teacher will then take about 2-3 student volunteer suggestions. They will then ask the students, what about amphibians; how do they survive the winter? *[3 minutes]* The teacher will initiate a small review of amphibians by prompting the students to think back to previous courses/lessons on this topic through different talk moves. They will ask students to volunteer and share some key characteristics of amphibians, how they hypothesize amphibians survive the winter and how they differ from humans. The teacher will again use wait time to give students the opportunity to reflect on previous lessons; when they are ready the students will put their thumb in the air. The teacher will take about 3-4 student volunteered suggestions. The teacher will then ask the students to complete the teacher-created worksheet *superpowered amphibian*. Here, the students will be designing an amphibian that is prepared to survive winter, they will also surround the amphibian in some key words to hypothesize their winter experience. The students will each work on their own sheet, as this will later be added to their student portfolio, however they will be asked to hypothesize and discuss some key features as a group *[6 minutes].* The teachers will be circulating the class and have an example copy they created on the board. The teacher will ask three student volunteers from each group to describe 1-2 key features of their *superpowered amphibian* and hypothesize how they can survive the winter; teachers will prompt students to think about why they chose those features. The teacher will write these ideas on the white board. The teacher will review these key features and introduce students to the toad hibernation nest and its components. They will then instruct the students on some key features of toad hibernation nests without giving them the direct instructions as student creativity is encouraged *[3 minutes]*.

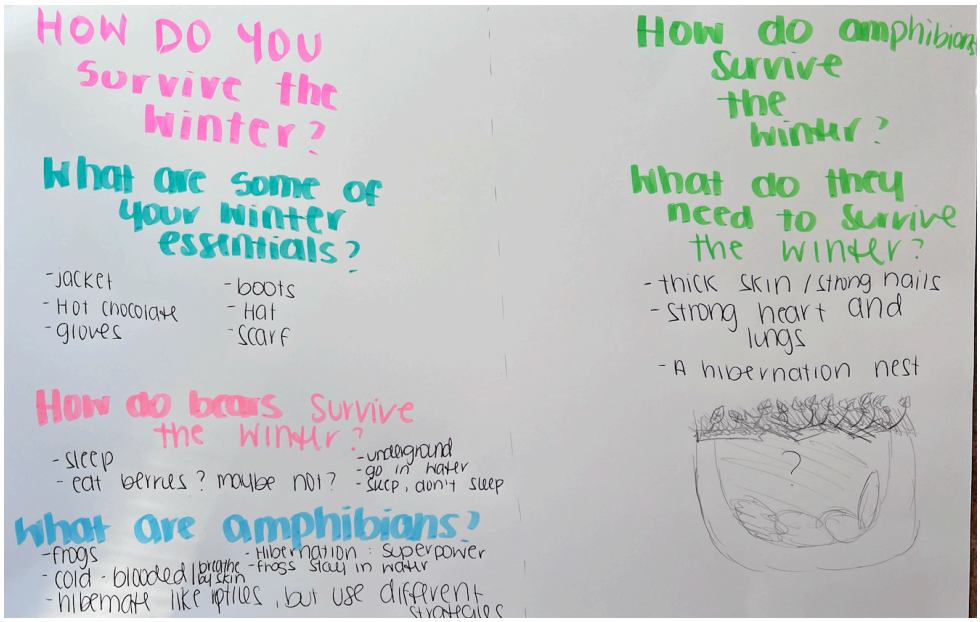
The teacher will:	**The students will:**
Begin the lesson with a question that all students can resonate with in their unique ways. Teacher: “How do you survive the winter? What are some of your winter essentials?” (uses wait time) Teacher: “These are excellent answers, I love that we are talking about winter wear but also some of our favorite drinks like hot chocolate (revoicing) that keep us cozy in the winter.”	Students will put one thumb in the air when they have an idea, and they might say: Student 1: “you need a jacket, or you will freeze” Student 2: “I need hot chocolate on snow days, it keeps me warm and happy” Student 3: “I need gloves” Student 1: “I need boots to make sure my feet don’t get soaked in the snow” Student 2: “You need a hat” Student 3: “When it’s cold my mom forces me to wear a scarf”
Teacher: “What about bears? Do we remember learning about bears? How do they survive the winter? (uses wait time)”	Students will put one thumb in the air when they have an idea, and they might say: Student 1: “they sleep” Student 2: “they bring berries with them and eat all those berries throughout the winter” Student 3: “no, actually I don’t think they eat” Student 1: “they stay underground” Student 2: “depends on the type of bear, maybe they go in the water”
Teacher: “Yes, these are excellent ideas. Let’s recall from our previous lesson that during the winter bears do hibernate; they do not eat or drink and do spend a lot of time sleeping.” Teacher: “Now, do we remember what amphibians are from our last class?”	Students might answer: Student 3: “they are frogs” Student 1: “yes, all amphibians are frogs” Student 2: “they are cold-blooded, they are reptiles.” Student 3: “they breathe through their skin” Student 1: “they all go in the water”
Teacher: “yes, frogs are one type of amphibian (revoicing). Can anyone add to what students 1 and 2 said, what other types of amphibians did we discuss? What are their key features? (orienting students to each other’s thinking).” [3 minutes]	Student 2: “Right, they hibernate differently. Like a frog hibernates in the water and snakes, reptiles

	hibernate underground."
Teacher: "They are like reptiles (revoicing), but they do have some different features. Some amphibians hibernate in the water, while others hibernate on land."	
Teacher: "I love this word! Hibernation. What does hibernation mean? When does it happen?"	Students might say: Student 3: "Hibernation is when an animal goes to sleep and brings food with them, that's the food they eat throughout the whole winter." Student 1: "Hibernation is like a superpower that keeps animals safe and away from the winter." Student 2: "I wonder how different species learned how to hibernate, I wonder if one animal just got super cold and went to hide."
Teacher: "These are all fantastic ideas about hibernation, you're all on the right track, hibernation is an excellent strategy that amphibians developed over time. It keeps them safe through the winter. This is something they have inherited, over time, remember the big word we talked about evolution. How species adapt to their environment overtime to get stronger and stronger." [Teacher pulls out example worksheet] Teacher: "Now class, you will use this handout to design, write and hypothesize all the features/characteristics you think an amphibian needs to survive the winter. We will come back to our large group discussion in 6 minutes. Discuss with your group how your superpowered amphibian will survive the winter." *[6 minutes later]* Teacher: "Okay class, great work. Now I would like one volunteer per group to tell me one to two characteristics of amphibian winter survival."	

	Students might answer: Student 3: “they need to have thick skin” Student 1: “they need to have a strong heart and lungs. That’s why I used red.” Student 2: “strong nails to dig through the grass”
Teacher: “That is a great point! Does anyone think of a different way amphibians can survive the winter.” (pressing for explanations)	Student 3: “I remember going camping with my family last fall and my dad spotted a toad nest.”
. Teacher: “Really! A toad nest, can you give an example of what is was made of? What did it look like? (probing for thinking)”	Student might answer Student 1: “It was filled with leaves, branches and rocks and dirt. A lot of leaves and my dad said maybe there was a real toad inside because it was getting super cold!”
Teacher: “Very interesting! [teacher draws on board] so something like this?”	Student 1: “Yes, something like that”
Teacher: “Yes, toads hibernate underground. Today, we will be building a toad hibernation nest. Infront you will find all the materials you need.” *[3 minutes]*	
Instructional sequence for experiment will be provided at the start of explore phase: 5-minute instructional sequence and model.	Other questions students might have: 1. “How are humans and amphibians similar?” 2. “How did evolution impact humans?” 3. “Why do amphibians hibernate but humans do not?” 4. “How can humans help prevent toads from freezing in the winter?”
The teacher will (do) o Use talk moves to challenge students thinking and evoke curiosity o Encourage students to use their creative side when completing the handout and participating in group discussions	The students will (do) o Participate in large group discussions. o Participate in small group discussion. o Reflect on their connections to amphibian hibernation. o Participate in small group discussion.

○ Ask students to participate in large group discussions ○ Encourage students to participate in a positive manner without making students feel comfortable. Using the thumb in the air single is a way students can participate non-verbally.	○ Ask peers questions regarding evolution, amphibian's internal composition, and how the two interact. ○ Ask their peers about how bears, humans and amphibians survive winter differently.

White board after engage phase:



EXPLORE

Parts were changed

Management considerations: In this phase students will get the opportunity to create and build their own hibernation nest to further study how amphibians survive the cold winter. To build these nests, students will stay in their groups of 3-4 classmates. Prior to our nest building class and once the groups had been made, the students divided the materials amongst each other to bring in. Once the actual building begins, there would be a rotation amongst the students so everyone can get a chance at completing an important step for the nests. Students will come up with a hypothesis of that they believe will happen to the toad during hibernation (1 minute). The next step would be to go over all the instructions on how to build the nest. We will go over the instructions as a class and then the students will have a couple seconds to write the name of the person who will be doing each step. At the same time, we will also list all the materials to ensure everyone has everything they need. (5 minutes) Next, we will build the nest. We will all do the steps together with the teacher reading out loud each step at a time to ensure everyone stays on task. (5 minutes) Once the nest has been made and we've added our toad, it is time to take the temperature inside the nest, outside the nest (the ice pack).After a little bit of time and a little discussion we will regroup and record the new temperatures inside and outside the nests. (2 minutes) Once we are done with the nests, students will quickly clean up the materials they didn't use. After they're done cleaning up, the students will then go on to complete the next part of the worksheet where they explain what they have experienced and if their hypothesis was correct.

Instructional steps for hibernation nest
Sample check list of steps:

1. Fill the 24 oz container with 1/3 potting soil.
2. Layer the potting soil with some rock and leaves.
3. Place the plastic toad in the potting soil
4. Cover the toad with 2/3 cup of soil, layer with leaves, branches, rock.
5. Use the first thermometer to measure the temperature inside the hibernation nest.
6. Record this temperature on the provided sheet.
7. Close with container with the lid.
8. Place the container on an ice pack.
9. Use the second thermometer, under the ice pack to measure the temperature of the environment outside the hibernation nest.
10. Record this temperature on the provided sheet.
11. Measure the temperature outside the hibernation nest.
12. Record this data on the provided sheet.
13. Open the lid. Measure the temperature inside the hibernation nest
14. Record the data on the provided sheet.

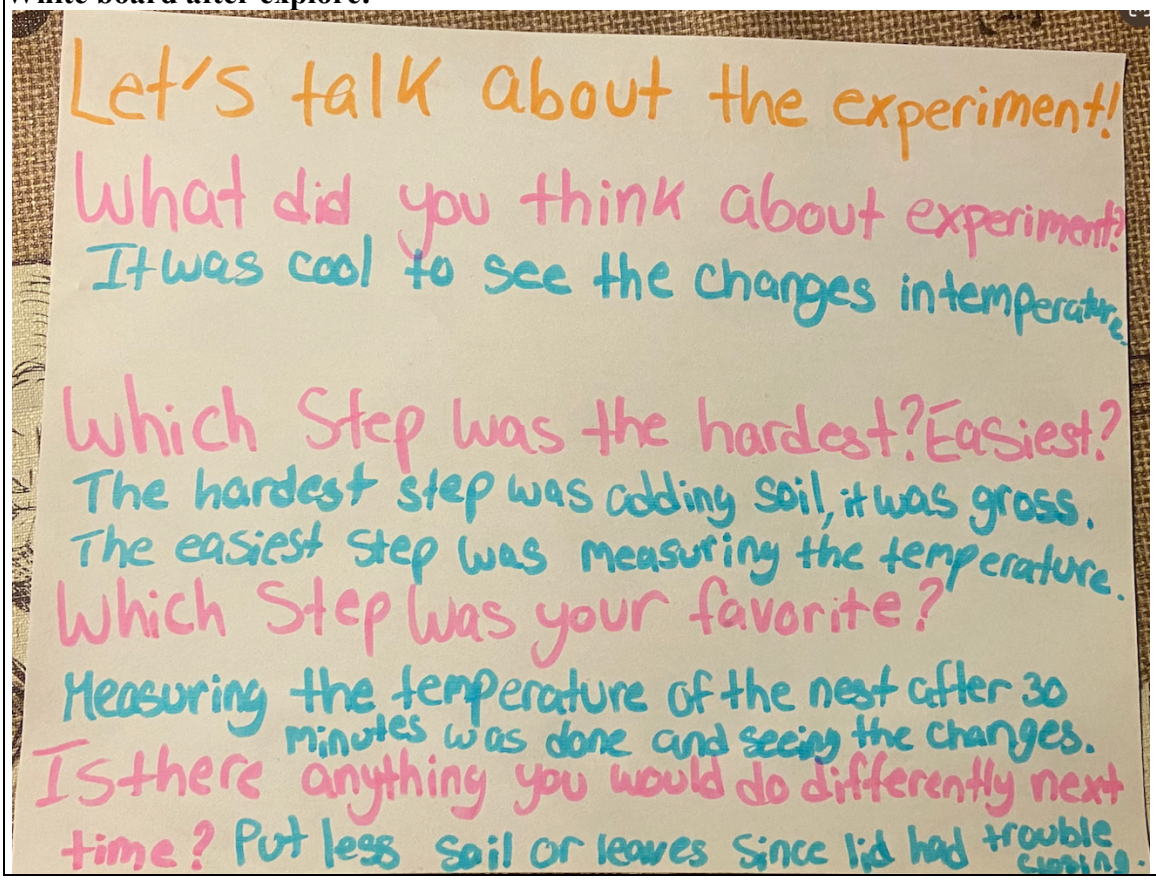
See above temperature data sheet under materials.

The teacher will:	**The students will:**
Display all the materials needed for the experiment. They will provide extra materials to students in case a group is missing anything needed. They will show the class their nest that they built themselves to showcase an example of the nest.	
The teacher will: Display all the materials needed for the experiment. They will show the class their nest that they built themselves to showcase an example of the nest.	**Students will raise their hands and show the teacher a thumbs up.** **Student 3: "I forgot something at home"**
Teacher: "Can everyone show me the materials they have?"	
[Shows worksheet checklist] Teacher: "I love how we all worked together as a group to bring everything we needed for today, and that we all helped each other. Can we now all look at our checklist and check off all the materials we must make sure we really aren't missing anything one last time."	
5 minutes later	**Student 1: "Can we split the steps so I do 5 steps, then they do the next 5 steps and then the last person will do the last 5 steps?"**
Teacher: "Ok now we will read the steps together then with your group you will reread the steps and add the name of the person who will oversee doing the step. (Goes oversteps) Ok now you guys will be able to decide who will do which part."	**Student 2: "How about we each take a turn each one step at a time?"**
Teacher: "I'm hearing some great communication between teammates about how to split up the group work."	**Student1: "What's a hypothesis?"**
Teacher: "Ok now it's time to put your thinking caps on and come up with a hypothesis!"	**Student2: "I think the frog will become an ice cube from how cold it is"**
Teacher: "excellent question, a hypothesis is a smart guess that you will make. You will guess the temperature of the nest before and after the "hibernation process". Does anyone have any hypothesis in mind?"	**Student 3: "I think the frog is going to use the leaves like a blanket to keep warm, that's what I do when I go to sleep."**

Teacher: “I love hearing about our active imaginations, how about you guys discuss with your teammates to come up with a hypothesis for your group and write it down on our worksheets”	**Student 1: “this feels weird, and smells weird too”**
5 minutes later Teacher: “ok everyone now it’s time to create the nests first thing we need to do is for one member of each group to come with their container and well put some soil in there”.	**Student 1: “I hate the feeling of leaves; they feel so dirty”**
Teacher: great use of our senses!	**Student 2: “Bye Mr. toad”** **Student 3: “Are real toad’s this hard or are they squishy?”**
Once soil is done Teacher: “Ok now we need to take our rocks and leaves and putting it on top of the soil, then put the plastic toad in the soil. Next, we must cover the toad with some soil, leaves and branches.”	
Teacher: “Ok now we will each take a turn to come up and I will use the thermometer to measure the temperature inside of the hibernation nest, once it’s done, you can write it down on your paper”.	**Student 2: “These are cold”**
Once temperature taking is done Teacher: “ok now we will need to close our containers and bring our containers to the ice packs laid out in the back of the classroom. Now let’s take our thermometer and test the ice packs to know what's the temperature outside the container. Once we take the temperature please note it on your sheets.”	**Student 2: “it’s so cold inside”** **Other questions:** **1. How did using our different senses (touch, sight, smell) make learning more fun?** **2. What other ways do amphibians hibernate? How would we create these different hibernation nests** **3. What can we add to make the hibernation nest better for the toad to survive winter?**
Teacher: “Ok class, lets once again take the temperature of the ice packs to see the outside temperature of the hibernation nest, now that our toad has been hibernating. Now let's open the lids and measure the temperature of the inside of the hibernation nest. Please write down both numbers on your sheets then go sit down with your group.”	

Teacher: “ok now that we're back at our stations it's time to clean up and put away anything we didn't use for the nest.” Children will clean up stations Teacher: “now let’s discuss what we’ve seen”	

White board after explore:



EXPLAIN

To manage the transition from the explore phase of the amphibian hibernation lesson, the teacher will reintroduce the initial question—*"How do amphibians survive the winter?"*—to help students connect their observations with their initial ideas. The teacher will revisit the initial white board to discuss the ideas. The teacher will encourage students to revise their hypothesis based on new evidence, allowing them to compare and refine their ideas collaboratively [3 minutes]. The teacher will also introduce an Indigenous perspective on the connection between amphibians and the land, explaining how many Indigenous cultures observe the natural behaviour of animals, like amphibians, as an indicator of environmental health and seasonal changes. This highlights the interconnectedness between humans, animals, and the land [3 minutes]. To incorporate an understanding of evolution, the teacher will explain how over many generations, amphibians have adapted to survive cold winters by hibernating, an evolutionary trait that helps them regulate body functions in response to environmental conditions, ensuring their survival [6 minutes].

One side of the board will display a model diagram that students can label, while the other side will have space for students to suggest the story of evolution and the importance of toad hibernation. They will also be encouraged to share how building a hibernation nest fosters interconnectedness with the land, is impacted by evolution, and how the amphibians' body composition helps them survive the winter. The teacher will facilitate a larger discussion and record key ideas on the board to highlight patterns and trends. Throughout, the teacher will manage time by setting limits for each activity and guiding students with probing questions that focus on the evidence, helping them build consensus through respectful discussion and critical thinking, without directly providing answers. This structured approach will keep students engaged and ensure a smooth flow of the lesson.

The Teacher Will Say/Ask…	Students Will Ask/Say…
• "Let's revisit our initial ideas: do humans and toads survive the winter the same way?"	• Student 1: "Sort of, they both try to stay warm." • Student 2: "Right, but they have different ways of staying warm"
• Talk move: "Thank you for sharing student 1 and 2, student 3, can you add to what students 1 & 2 said by naming a strategy or way toads survive the winter?"	• Student 3: "When making our toad hibernation nests the toads went underground and we gave them a leaf blanket, the bears don't really do that."
• Talk move: "Thank you for sharing Student 3, student 1, can you tell me what student 3 said in your own words." • Thank you for sharing, everyone, now what changes in temperature do we see outside of the toad hibernation nest we built, let's look at the example I prepared.	• Student 1: "Yes, the toads have a leaf blanket and stay underground throughout the winter."
• "Good efforts everyone. When a temperature goes lower it means it got colder. So, we see that the outdoor temperature got colder." • "What happened inside the toad hibernation nest? What happened to the temperature?"	• Student 2: "it started at 21°C" • Student 3: "it changed to 18°C after" • Student 1: "so it got warmer outside?" • Student 2: "it didn't change, it's still at 23°"
• Talk move: "Does anyone think something different happened within the nest?"	• Student 1: "No, I agree, nothing changed but I think that if our toad would sit in the nest longer it would get colder, or if we take out the lid of the container it would get cold inside the nest.
• Talk move: "Thank you for sharing Student 1. Why do you think that?"	• Student 1: "Well because the toad would have more time spent in the cold, it would get colder"

• Talk move: "Student 2, can you explain what student 1 said in your own words?"	• Student 2: "yes, they are saying that if we would've left the container lid open, so the toad would get more cold air in they would get cold."
• "Do you think they would freeze?"	• Student 3: "No, but I'm not sure why they wouldn't"
• "Interesting question to think about, let's hold this thought because we will get back to it later."	
• "So I see that our evidence and results is in line with our original hypothesis: that toad did not freeze, and the temperature didn't change. How do we think the materials we use played an important role in keeping the toads warm. Let's label our diagram of the toad and explain how each part plays an important role in keeping the toad warm. Now, when we are discussing these different components, I want us to reflect on the indigenous perspective of land that we discussed in previous classes. Remember, we are one with the land, the land is our friend, the way we treat the land, the land will treat us back."	• Student 1: "We can label the soil, the soil helps the toad keep warm, if on the weekends we make a soil nest for the toad to stay in we are giving back to the land and the toad."
	• Student 2: "right and we can also put some rocks so the toad has some pillows"
	• Student 3: "Yes, and the tree branches can help shield the toad from the wind and cold weather"
[3 minutes to review results]	• Student 1: "we forgot, the leaf blanket. The leaves fall off the tree, but they are still useful, they help the toad stay warm."
• "Great sharing everyone, Student 1, what do you mean the leaves still have a purpose? How can we use the idea of the land as our friend to explain this?" (talk move)	• Student 1: "the leaves are helping the toad by keeping them warm, and the toad is helping the land by using all the things on it. And if we prepare the nests, we are also helping the land and if we treat the land good, the land will treat us good."
[3 minutes to label diagram	

• "Now I have another question for you class. Where did you learn how to walk?" • "Interesting, a lot of what we learn comes from our parents, who learned from their parents, who learned from their parents and so on! Where do we think the toads learned to hibernate?"	• Student 2: "I don't remember probably my mom and dad?" • Student 3: "From their parents who learned from their parents, and their parents, and their parents." • Student 1: "Oh yeah, I remember talking about this in our previous class, this is called evolution"
• "Exactly, evolution is responsible for teaching the toads how to survive the winter. What would happen if toads didn't hibernate?"	• Student 2: "They would die" • Student 3: "yes, and then the animals that eat toads or need toads to live would die."
• "Exactly, it would disrupt many parts of nature so its important that they hibernate." • "Nice sharing, what about the insects, bees, lady bugs, all the snacks the toads love, what would happen to them?" • "Thank you, does anyone want to add?"	• Student 1: "Nothing, they don't need the toads to live, the toads need them" • Student 2: there will be more of them • Student 3: "I think there would be the same amount"
• "There would be a lot more insects because more toads would be dying if they didn't hibernate so a lot more insects would be around since there are less toads to eat them. **[3 minutes story of evolution]**	
• "Now let's review all these ideas: How do toads survive the winter?"	• Student 1: "they hibernate" • Student 2: "yes, but not all amphibians hibernate, but toads do"
• "Thank you for sharing, now where did the toads learn how to hibernate? What is it a result of?	• Student 3: "their parents and the evolution"
• "Right, and how do we play an important role in helping toads hibernate?"	• Student 1: "If we think back to the indigenous perspective, we are treating the land as our friend by giving back to it by using some of

	the materials from the land to help the toad survive”
• “Exactly, so hibernating toads don’t run around in the soil, they stay still, they don’t eat much. • "What patterns do we see in how amphibians’ environments affect their hibernation? How could this help us explain their behavior?"	• Student 2: "I’ve noticed that amphibians are more active when it’s warmer outside, so when it gets cold, they must rest." Student 3: "They go underground or underwater, so they’re not out in the cold." Student 1: "They seem to do whatever they can to keep from freezing, which is why they hibernate."
• “Great work everyone, now next class we will be looking deeply at how frogs survive the winter in mud and in the water!” **[3 minutes to review]** **12 minutes total**	
The Teacher Will Do… • Revisit initial ideas from the engage phase and encouraged students to add to their initial inferences to build larger concepts • Help students build on the notion of toad hibernation by leading a large group discussion, labeling a toad hibernation nest diagram as a group and explaining how much material plays a vital role in helping toads survive the winter. • Identify patterns in data: the temperature outside the hibernation nest may decrease, however inside the nest it does not experience the same drastic decrease, how does this impact the toad. What patterns in amphibian winter survival do we see. • Promote model comparison and discussion: The teacher will have students explain how their knowledge as expanded once they have built the nest. They will share a “toad family history” story on evolution to help students	Other student questions: 1. “What do you think happens to amphibians when the temperature drops below freezing?” 2. “Why do some amphibians hibernate while other stay active during the winter?” 3. “How do amphibians know when it’s time to hibernate?” 4. “What happens to their bodies when they hibernate?” 5. “How does the environment around them affect the hibernation process?” Students Will Do… • Work in a large group to share their ideas about amphibian hibernation and revise their models based on new evidence. • Label a simple model of a toad hibernation nest and explain how each component is crucial in helping toads survive the winter. • Use a table to show amphibian behaviors in different temperatures and identify patterns.

understand where hibernation comes from and what the world would look like if toads didn't hibernate • Guide students in building consensus: The teacher will facilitate a class discussion on which model seems most accurate and why. The teacher will let them argue based on the evidence gathered (e.g., amphibians being buried underground in cold temperatures). • Incorporate Indigenous Perspectives and Evolution: One side of the board will display a model diagram for students to label, while the other side will have space for them to suggest the importance of toad hibernation. The teacher will encourage students to share how building a hibernation nest fosters interconnectedness with the land, is impacted by evolution, and how the amphibians' body composition helps them survive the winter. This highlights how many Indigenous cultures observe the natural behavior of animals as an indicator of environmental health and seasonal changes, demonstrating the interdependence between humans, animals, and the land. • Guide toward explanations without giving them: Instead of answering questions directly, the teacher will point them to their data and to what their peers think. For example, "Someone earlier mentioned that if toads don't hibernate, we would have too many insects around. How does that fit with what we've learned about their hibernation?"	• Participate in discussions to compare their initial and revised hypothesis, explaining the changes they made. • Contribute to the "toad family history" by explaining the role of evolution on a toad hibernation nest • Discuss how building a hibernation nest connects amphibians to the land, as well as how evolution

White board after explain: