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How Place-Based Education Increases Student Interpretation of Minnesota's Landscape and Geologic Processes

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HOW PLACE-BASED EDUCATION INCREASES STUDENT INTERPRETATION OF
MINNESOTA'S LANDSCAPE AND GEOLOGIC PROCESSES

by

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A capstone project submitted in partial fulfillment of the requirements for the degree of Master
of Arts in Education: Natural Science and Environmental Education.

Hamline University

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Project Summary

This capstone project is a curriculum unit on Minnesota Landscape Interpretation for eighth grade students in an Earth Science class. I used place-based education (PBE) as my main content in developing this curriculum. Using PBE can help students develop a sense of place and connect to their surroundings. This unit should increase student's understanding of an area's past (scientific and cultural) and can help students make better educated decisions about how to take care of an area in the future. My curriculum addresses the question: *How can using place-based education help students interpret the landscape of Minnesota and increase their understanding of geology?* My goal is for students to increase their skills and ability to interpret an area and understand its story both scientific and cultural. This will enable them to make more effective decisions about the landscape and to take better care of it.

I formatted and made my curriculum using the framework of Understanding by Design developed by Wiggins and McTighe (2011). Understanding by Design recommends backwards curriculum design with the results in mind first so lessons have connections between each other and a purpose towards developing student understanding. To understand, a student must “make sense of and transfer their learning through authentic performance ... [and be able to] explain, interpret, apply, shift perspective, emphasize and self assess” (Wiggins & McTighe, 2011, pp. 3-4). This unit has students building background knowledge through observation and interpretation of data of their local landscape to understand the stories of the land better in order to decide how to care for it and live with and on it.

Understanding by Design has three stages - desired results, evidence, and the learning plan (Wiggins & McTighe, 2011). The desired results include what students will be able to do

independently after finishing the unit, how students will make meaning by showing understanding and answering essential questions, and what they will acquire both in knowledge and in skills. The evidence stage includes performance tasks and any other evidence to demonstrate the understanding. The learning plan is like the lesson plan section where the summary of key learning events and instruction goes. The unit plan also includes established goals, which in my case are both the current and proposed relevant middle school Earth science standards. The lesson plans follow the unit plan and are specific guidelines for each learning event.

This project is intended to be used by Minnesota eighth grade Earth science teachers, but as the Minnesota Academic Standards in Science are currently under review, sixth grade science teachers might find this helpful as well (Minnesota Department of Education, 2019). Some of these lessons might be applicable in a high school science course also, as the science standards update and change their focus. Minnesota is the state of focus in many of the lessons so the geology, ecology and community stories of Minnesota specifically will have to be adjusted to your present location if using this project in a different state. The skills of interpreting the landscape outside and on maps, researching and interviewing community members and designing solutions to local problems are universal, thus can be transferred to your state, if not Minnesota.

Students will assess what they know about their local landscape; what type of surface materials, glacial landforms, depth to bedrock and bedrock are under their home; how glaciers changed the landscape of Minnesota; how to interpret data on topographic maps and Google Earth to determine how landforms appear now and have changed over time; how to model

glacial landforms in a sand table; how to see patterns on biomes, glacial landforms and bedrock geology; what does natural land mean and where is it located near them; how humans interact with and influence Earth’s systems (land, water, ecosystems); how to research and interview people to determine what the landscape looked like and how it was used in the recent past; how to compile all of their understandings and evidence into a concept sketch; and how to design solutions to local environmental problems.

This unit will cumulate with a service learning community project. It could be an action that will change the environment for the better or an informational display to promote awareness of a topic of which students have a better understanding.

Stage 1 Desired Results		
ESTABLISHED GOALS Present standard: 8.3.1.2 “Landforms are the result of the combination of constructive and destructive processes.” and benchmarks: 8.3.1.2.1 Causes of Landforms “Explain how landforms result from the processes of crustal deformation, volcanic eruptions, weathering, erosion and deposition of sediment.” 8.3.1.2.2 Surface Processes in Minnesota “Explain the role of weathering, erosion and glacial activity in shaping Minnesota's current landscape.” Present standard: 8.3.4.1 “In order to maintain and improve their existence, humans	<i>Transfer</i>	
	<i>Students will be able to independently use their learning to...</i>	
	Understand where they live (geologic and ecologic landscape now and in the past). Develop a sense of place to their surroundings. Make educated decisions on how to live in and take care of the environment.	
	<i>Meaning</i>	
	UNDERSTANDINGS <i>Students will understand that...</i> <ul style="list-style-type: none"> ● Landforms are made by many geologic processes (weathering, erosion and glacial activity). ● Humans interact with and influence Earth’s systems (land, water, ecosystems). 	ESSENTIAL QUESTIONS <ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past? / How was the area used in the past? ● How much of the landscape is natural?

<p>interact with and influence Earth systems.” and benchmark: 8.3.4.1.2 Land & Water Uses “Recognize that land and water use practices can affect natural processes and that natural processes interfere and interact with human systems.”</p>		<ul style="list-style-type: none"> ● What should we do? / What are our responsibilities? ● Why should I care about the local environment? ● How can we monitor and minimize human impact on the environment?
Acquisition		
<p>Draft three standard: 4.1.1 “Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments” and benchmark: 6E.4.1.1.1 “Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales. (P: 7, CC: 3, CI: ESS2) Emphasis is on how processes like erosion, deposition, mountain building, and volcanism affect the surface of Earth. Some processes, like mountain building take a long time. Other processes, like landslides, happen quickly. Examples may include how weathering, erosion and glacial activity have shaped the surface of Minnesota.”</p> <p>Draft three standard: 3.2.1 “Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify</p>	<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● Causes of landscape formation. ● How the area looked like in the past (geologic history - glacial and bedrock, and biomes). / How the area was used in the past. ● How much of the landscape is natural. ● How to take care of the environment. 	<p><i>Students will be skilled at...</i></p> <ul style="list-style-type: none"> ● Interpreting data outside, on 3D maps, topographic maps and Google Earth to observe current and past landforms. ● Researching and/or interviewing people to determine what the landscape looked like and how it was used in the recent past. ● Designing solutions to local environmental problems.

<p>weaknesses in explanations developed by the students or others.”</p> <p>and benchmark: 6E.3.2.1.3</p> <p>“Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. *(P: 6, CC: 2, CI: ESS3, ETS1) Emphasis of the practice is on applying scientific principles about Earth’s natural processes (like how water moves through the ground and air) to designing solutions to problems caused by human activity. Emphasis of the core idea is on how human activity impacts Earth’s environments. Examples of parts of the design process may include assessing the kinds of solutions that are feasible, and designing and evaluating solutions that may reduce those impacts. Examples of human activities that impact the environment may include withdrawing too much water from aquifers, altering stream flow by building dams or levees, increasing runoff caused by impermeable surfaces like parking lots, or adding undesirable materials to the air, water or land.</p>		
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Stage 2 - Evidence

Evaluative Criteria	Assessment Evidence
<p>Scientifically accurate</p> <p>Good detail</p> <p>Clear explanation</p>	<p>PERFORMANCE TASK(S):</p> <ul style="list-style-type: none"> ● Explain how the local landscape formed (geology and biomes). ● Describe what the landscape looks like now and was like in the recent past.

- Design a solution to a local environmental problem and propose implementation.

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

- Pre-assess: Determine student’s current understanding of how Minnesota’s landscape came to look the way it does now; what rocks and minerals can be found in Minnesota and why; what types of plants and animals live in Minnesota; and how did people use to live in Minnesota in the past.
- Go outside on the school grounds to make observations of the local landscape and collect data.
- Determine what is under the ground in any location in Minnesota by looking it up in a student-friendly database to gain perspective on one’s local surroundings. Look up unknown words to build background knowledge (glacial landforms, bedrock ages and names).
- Read an article of glacial landform formation (The Glacier Did It, Minnesota Conservation Volunteer) and relate back to the What’s Under My Home activity and use to build background knowledge for the 3D map activity.
- Observe and interpret a 3D map of the Upper Midwest area to locate glacial landforms.
- Observe and interpret current and past topographic maps of the area to determine how the landscape has changed in recent times.
- Observe and interpret landforms in Google Earth of the local area and the state to increase student’s spatial thinking skills and connection of the local landscape to the landscape of the state as a whole.
- Use sand tables to model glacial landforms made by moving ice and melt water.
- Learn about the biomes of Minnesota, determine the local biome and biomes of places in Minnesota student’s have visited, and how much of the area and state is truly natural.
- Native American perspective and Pioneer/Settler perspective (PLT A Look at Lifestyles Activity 92 pages 401-406).
- Read an article on how Ojibwe people traditionally use the land (Ojibwe Lifeways, Minnesota Conservation Volunteer)
- Interview community members and contact the local historical societies to learn about a location’s past.
- Go back outside to make connections between the new understandings on landscape formation, geology and biomes and the school grounds. Construct a concept sketch.
- Determine how students influence and interact with the environment. Determine a local environmental problem and propose a solution or a way to demonstrate student understanding in a more public way.

Adapted from *Understanding by Design* template (Wiggins & McTighe, 2011).

Prior to this unit students should have developed an understanding of how common minerals and rocks formed, their names and be able to identify/classify them. Students should also know how and when important historical geology events occurred in the past, with specifics

on rocks and minerals that can be found locally and throughout the state. Less detail can be placed on the last 2 million years of the ice age as that is the main cause of the formation of the natural landscapes in the unit in this capstone project.

Day 1

Lesson Title:	Introduction to Minnesota’s landscape and local landscape
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past?

Understandings:	Students will understand what the landscape on the school grounds looks like, but not necessarily how it formed yet.
Knowledge:	Students will know their initial interpretation to the four pre-assessment questions and those of their classmates.
Skills:	Students will be skilled at making observations and collecting evidence from the landscape on the school grounds.

Materials:	Science notebook, pencil, 4 large poster sized paper, markers, “Initial Outside Observations” graphic organizer, suitable place on the school grounds and clear tape.
Preparation:	Print copies “Initial Outside Observations” one per student. Students will need to be put in table groups of 4 for the discussion and have a partner to go outside. Check areas on the school grounds for hazards such as excess litter, broken glass, poisonous plants and unstable ground. Check for outdoor allergies of the students and adjust the location as necessary. Find a spot on

	the school grounds where there is a view of varied topography (example: ravine, wetland, hill, flat soccer field, forest).
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Learning Plan:

1. (15 minutes) Pre-assessment/Opening Questions: Determine student's current understanding of unit topics by asking students to answer the following questions. Students will do this in a think/pair/share, where students will write their responses in their science notebook, share with their table partner and then share out in a class discussion to determine student's initial understanding of this topic. Have four students be in charge of writing responses for the question on a large poster with markers.
 - a. How did Minnesota's landscape come to look the way it does now?
 - b. What rocks and minerals can be found in Minnesota and why?
 - c. What types of plants and animals live in Minnesota?
 - d. How did people use to live in Minnesota in the past?

2. (5 minutes) Discuss objective and behavior/safety expectations for going outside.
 - a. Objective: Make observations, collect evidence and ask wonderings and questions to enhance your responses to the 4 opening questions. See Appendix A for the graphic organizer "Initial Outside Observations." This will be taped into students' science notebooks.
 - b. Behavior/Safety: Stay with your table group. Stay in the boundaries. Respect the experience for your classmates outside - leave sticks and rocks on the ground and not to be used as weapons. Avoid loud noises to hear nature's sounds. Be respectful to wildlife and observe at a distance. Leave what you find unless asked to collect objects. Know what time to come back together before going back inside.

3. (15 minutes) Outside.
 - a. Students will go outside in table groups and make observations to continue to answer the 4 opening questions. Students should write what they see and also ask wonderings and questions to go deeper in their interpretations.

4. (10 minutes) Debrief back inside.
 - a. Ask students to share out what they observed and what wonderings and questions they now have. Continue to add responses to the questions on the posters, but use a new color to designate new information.

Modifications/Accommodations:

Have the opening questions typed out on paper and space for the students to write in their answers.

Make sure there are suitable paths for students in wheelchairs to be on.

Initial Outside Observations

<p>How did Minnesota's landscape come to look the way it does now?</p>	<p>What rocks and minerals can be found in Minnesota and why?</p>
<p>What types of plants and animals live in Minnesota?</p>	<p>How did people use to live in Minnesota in the past?</p>

Day 2

Lesson Title:	What's Under My Home? and Glacial Landforms
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past?

Understandings:	<p>Students will understand that different parts of the state have different surface materials, glacial landforms, depth to bedrock and bedrock.</p> <p>Students will gain perspective on their local surroundings and the state as a whole to start developing a sense of place.</p>
Knowledge:	<p>Students will know what new-to-them surficial and glacial words mean (example: loam, end moraine, bedrock).</p> <p>Students will know the definition and formation of the following vocabulary: glacier, glacial till, kettle lake, esker, moraine, stiations, erratic, glacial lake and drumlin.</p>
Skills:	<p>Students will be skilled at finding patterns in the surficial, glacial and bedrock data.</p>

Materials:	<p>“What's Under My Home” data table and questions, pencil, computer, “The Glacier Did It” article and questions.</p>
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Preparation:	Print copies of “What’s Under My Home” and “The Glacier Did It” article and questions one per student. Make “The Glacier Did It” also available online so students can see the color pictures. Have extra computers available.
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Learning Plan:

1. (5 minutes) Have students review their answers to the 4 opening questions - specifically reviewing the questions on Minnesota’s landscape and rocks and minerals. Have them make a prediction to what types of materials they can find under their homes and share it at their table.
2. (20 minutes) Students will determine what is under the ground in any location in Minnesota by looking it up in the Minnesota DNR’s What’s Under My House? online application.
 - a. Look up unknown words to build background knowledge (glacial landforms, bedrock ages and names).
3. (20 minutes) Ask students what glacial geology terms they discovered in the ground and their initial interpretation to what they are and how they got there. Then read the first page of the article “The Glacier Did It” aloud. Students will independently read the rest of the article. Students will relate the glacial landforms back to the “What’s Under My Home?” activity and to build background knowledge for the 3d map of the Upper Midwest for the next day. They will have the article and a series of questions to answer. If they don’t finish reading the article and answering the questions, it will be homework for the next day.

Modifications/Accommodations:

Students can choose three locations instead of six for the “What’s Under My Home?”

Students will be read aloud to in a small group as needed.

The amount of questions for the article “The Glacier Did It” will be shortened.

1. What words are new to you? Choose 3, list them and look up what they mean.
2. What surprised you about this data?
3. What patterns can you see in this data? Draw a labeled diagram or describe them.
4. How does this data help you understand Minnesota's landscape?
5. What is one question you can ask using this data?

The Glacier Did It questions

Background - the latest ice age that affected Minnesota began about 2 million years ago. The climate was cooler which caused snowfall to not melt and pile up year after year.

1. What is a glacier?
2. How does a glacier move?
3. What are three effects from a moving glacier?
4. Define glacial till:
5. How does a kettle lake form?
6. What kind of lakes are most of the lakes in Minnesota?
7. What is an esker and how does it form?
8. How does a terminal moraine form and what does it tell us?
9. Name one moraine in Minnesota:
10. What are striations and how do they form?
11. What are erratics and how do they move?
12. What is Glacial Lake Agassiz?
13. How big was Glacial Lake Agassiz and how did it compare to the Great Lakes?
14. What do drumlins look like?
15. What area of the state escaped the most recent glaciers?
16. What is your biggest takeaway from this information?
17. What is one question you can ask after reading this article?

Day 3

Lesson Title:	Glacial Landforms Observation Lab with 3D maps
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past?

Understandings:	Students will understand that most of Minnesota’s landscape was made by glacial activity.
Knowledge:	Students will know where to find prominent glacial landforms in Minnesota (lateral moraine, terminal moraine, kettle lakes and driftless area).
Skills:	Students will be skilled at interpreting data on 3D maps to observe the current landscape.

Materials:	“Glacial Landforms Observation Lab,” pencil, Upper Midwest 3D map, red/blue 3D glasses and “Minnesota at a Glance: Quaternary Glacial Geology” article .
Preparation:	Print copies of “Glacial Landforms Observation Lab” one per student. Set out one 3D map per set of two partners and enough 3D glasses where you want students to acquire materials.

Learning Plan:

1. (5 minutes) Have students take out their “The Glacier Did It” article and questions. Have each table group discuss their answers and their biggest takeaway.
2. (30 minutes) Students will work through the “Glacial Landforms Observation Lab” as a table group. Read the introductory paragraph and Part 1 aloud. Remind students to use their new background knowledge on glacial landforms to help them find the landforms on the map. Each set of partners should share 1 map, but the four students should work together to observe the landforms. If students don’t finish the summary paragraph at the end, they should do so for homework for the next day. Walk around and assist students as needed.
3. (10 minutes) Have the class help you label where the prominent glacial landforms are on the SMARTBoard or whiteboard. Help students see where these locations are on the 3D map. Use the “Minnesota at a Glance: Quaternary Glacial Geology” to show locations of ice lobe movement, moraine and glacial lake locations.

Modifications/Accommodations:

Not every student will feel comfortable using the 3D red/blue glasses. They are not necessary, so they don’t have to use them.

Students will be read aloud to in a small group as needed.

Glacial Landforms Observation Lab (3D Maps)

Over the last 2 million years, there have been 4 major glacial advances covering large parts of Minnesota and the upper Midwest. The last of these glacial advances ended about 10,000 years ago. Many of the surface landforms visible in Minnesota today were formed during this time. This activity will give you a unique opportunity to view 3D maps of our part of the world and search for clues that these ancient glaciers have left behind.

Part 1- Preliminary Investigation: Use the 3D glasses to check out the map of the upper Midwest. As a group, discuss and then find 3 different landforms that you think might have been formed by glaciers or the water from melting ice. Number these sites 1, 2, and 3 on your blank Minnesota map on the last page. In the space below, describe each of these formations and explain how you think they may have formed.

Location	Description of Landform	Hypothesis – how do you think this formed?
1		
2		
3		

Now try to find a location that seems to have escaped the effects of glaciation. Choose this location and number it 4 on your blank Minnesota map. Then fill in the table below.

Location	Description of Landform	Hypothesis– why do you think glaciers missed this?
4		

Now it's time to think about direction! Find 2 places on the map where you think you can tell which way the glaciers were moving. Draw arrows on the blank Minnesota map and number the arrows 5 and 6.

Location	Direction you think glacier was moving	Evidence for this direction of movement
5		
6		

Part 2 – Learning about Glacial Features: Now we need to learn a bit about some of the specific landforms that are created by glacial activity. Read the description of each of the formations below. Then find one spot on the map where this type of formation seems to be present and give it the appropriate label. It’s ok if some of these use the same sites as you located in Part 1.

Lateral Moraine: A moraine is a large pile of glacial debris left behind by a glacier. Lateral moraines are ones that form on the side of the glacier. These formations mark the edges of where the glacier once was – kind of like a riverbank marks the edges of a river. Find the spot where you think a lateral moraine has formed and *label it “Lateral Moraine”* on your blank Minnesota map.

Terminal (end) Moraine: This type of moraine forms along the front of the glacier, kind of like a bulldozer that pushes a pile of material in front of it. The terminal moraine marks the farthest advance of the glacier. Find the spot where you think a terminal moraine has formed and *label it “Terminal Moraine”* on your blank Minnesota map.

What is the difference between a **Lateral Moraine** and a **Terminal Moraine**?

Answer:	
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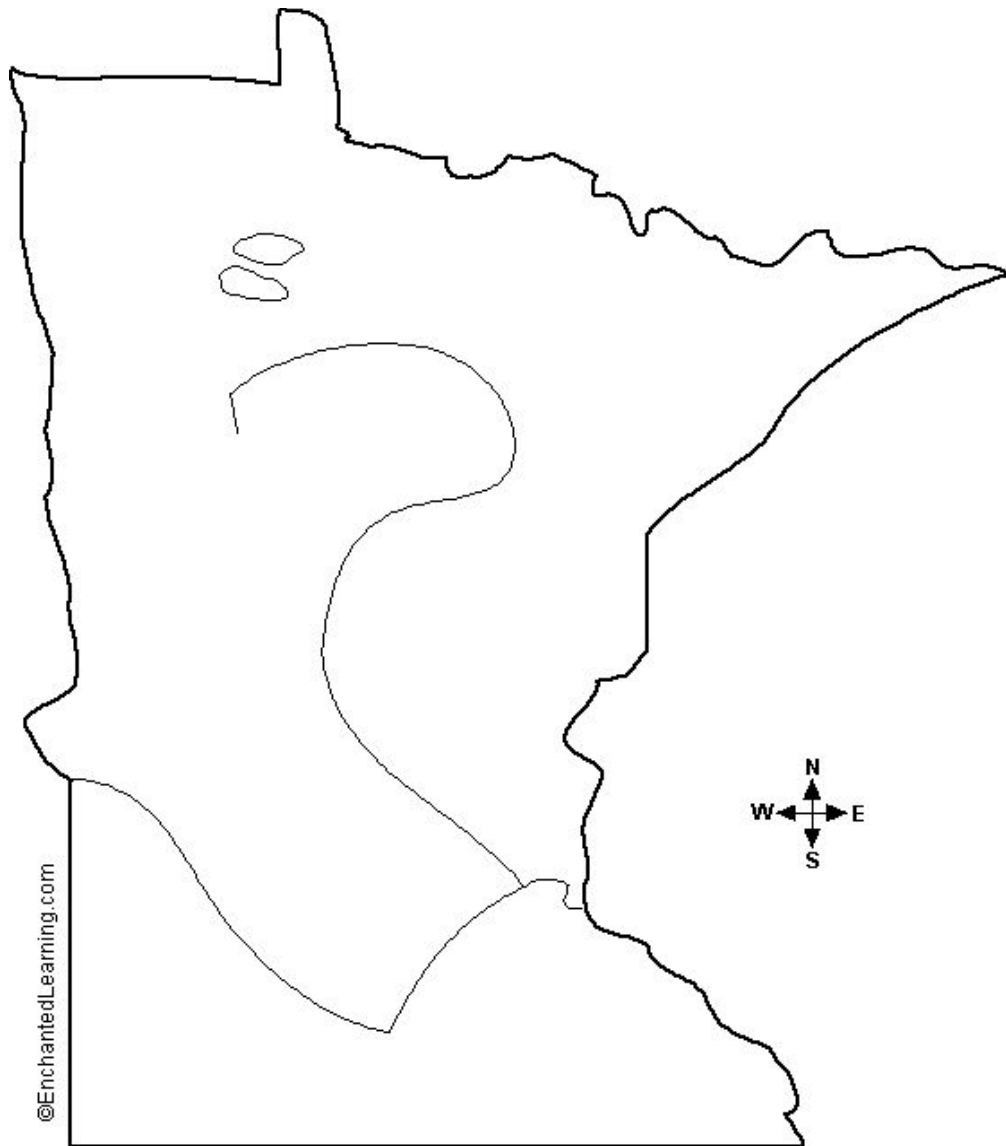
Kettle Lakes: As glaciers melt and break up, they often leave behind enormous blocks of ice partially buried in the ground. As the ice blocks melt, they leave behind depressions in the landscape. The holes fill with snowmelt and rainwater to produce kettle lakes. In the satellite view, this will look like a region with a bunch of small, shallow lakes. Find the area where you think kettle lakes are located and *label it “Kettle Lakes”* on your blank Minnesota map.

Driftless Area: Southeastern Minnesota, Southwestern Wisconsin and Northeastern Iowa make up the driftless area. This is an area that has not been glaciated during the last few million years. Circle this area on the map and *label it “Driftless Area”* on your blank Minnesota map. What evidence do you see that this is an area that hasn’t been glaciated?

Evidence:	
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Mesabi Range: The Mesabi Range is not a glacial feature. Instead, this is a ridge of iron-bearing taconite ore. This is actually one of the most important iron deposits on Earth! Taconite is very hard, so glaciers tended to split around this formation instead of scraping it away. This formation is very visible in the satellite photo. Look for a very narrow, snake like formation that runs SW to NE about halfway between Duluth and Canada. Find and *label the “Mesabi Range”* on your blank Minnesota map.

Blank Minnesota Map



Summary

Using what you now know about glaciers, write **at least** a 3 sentence conclusion describing how you think the landscape in Minnesota formed. Include how exactly Minnesota looks different from Southwestern Iowa, Western North Dakota and Western-Central South Dakota. Make a guess as to why Minnesota's landscape looks different than those of the surrounding states.

Adapted from Minnesota Earth Science Teaching Association. (2019). Teacher Resources/Activities/Links. Retrieved from https://mnearthscience.weebly.com/uploads/2/5/7/7/25773641/glacier_lab.docx

Day 4

Lesson Title:	Current and Past Topographic Maps
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales
Essential Questions:	<ul style="list-style-type: none">• What causes the landscape to get its shape?• What did the area look like in the past?• How much of the landscape is natural?

Understandings:	Students will understand that the local landscape was greatly modified by human influence.
Knowledge:	Students will know how the area looked like in the past and how it looks now.
Skills:	Students will be skilled at interpreting data on topographic maps to determine how landforms appear now and have changed over time.

Materials:	Topographic Map database , “Current and Past Topographic Maps,” pencil and computer.
Preparation:	Print copies of “Current and Past Topographic Maps” one per student. Have extra computers available.

Learning Plan:

1. (5 minutes) Review the “Glacial Landforms Observation Lab” and 3D map to see what landforms are near to the school grounds.
2. (30 minutes) Use the “Current and Past Topographic Maps” question sheet to help the students explore the Topographic Map database by comparing past and present topographic maps.
3. (10 minutes) In a class discussion, determine what patterns and changes students observed in the topographic maps. Help students develop an understanding of human influence on the local landscape.

Modifications/Accommodations:

Print copies of each map location.

Current and Past Topographic Maps

Today you will be exploring topographic maps. A topographic map is a map that shows the shape and elevations of landforms using contour lines, meaning you can see the shape of three-dimensional landscapes on a two-dimensional surface.

Go to <https://ngmdb.usgs.gov/topoview/viewer/> . In the location box, type the name of the city you are in. In the records, find the oldest record and click “SHOW.” Zoom into where the school should be.

1. What year is the map from?
2. What symbol is there instead of the school (as the school hasn't been built yet)? What do you think that symbol is?
3. What places do you recognize? What else do you observe about the area?

The brown squiggly lines are contour lines. When they are close together, there is a steep hill. When they are far apart, it shows a flat area.

4. Is the area where the school should be hilly or flat? How do you know?
5. What is the landscape like around the school grounds?

The black squares are homes.

6. Where do you notice many homes?
7. Where are there few homes?

Open a new tab and go to the same website. Choose a map at least 50 years later.

8. What year is the next map from?

Toggle between the two tabs. Try to line them up so they appear to overlap each other when you switch tabs.

9. How does the newer map compare to the older one? What changes have occurred? Consider the contour lines, landscape topography, location and amount of homes, other features.

Open one more new tab and go to the same website. Now choose the most recent map and toggle between all three tabs.

10. How does the newest map compare to the older two? What changes have occurred?

11. What do you predict the map will look like in 50 years?

Now find your home. Go through three different time periods of maps. How did the landscape appear in each map?

12. Oldest:

13. Middle:

14. Newest:

Conclusion

15. Why do you think the landscape is different in each time period map?

16. What is a question you can make using the data from these maps?

Day 5

Lesson Title:	Google Earth Exploration
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past? ● How much of the landscape is natural?

Understandings:	Students will understand that the local landscape was greatly modified by human influence.
Knowledge:	Students will know how the area looked like in the past and how it looks now.
Skills:	Students will be skilled at interpreting data on Google Earth to determine how landforms appear now and have changed over time.

Materials:	Google Earth Pro enabled computers, “Google Earth Exploration” and pencil.
Preparation:	Print copies of “Google Earth Exploration” one per student. Request use of a computer lab if each student’s computer does not have a desktop (ex. Chromebook). Google Earth Pro running from a desktop will have more features than Google Earth on Chrome.

Learning Plan:

1. (5 minutes) Review the “Current and Past Topographic Maps” to see what observations, questions and wonderings students had while using the topographic map database.
2. (30 minutes) Use the question sheet to help the students use Google Earth to explore what the school area looked like back in time with older satellite images, how the elevation changes by drawing paths of elevation profiles, and layering a topographic map on top of the school area to see how the two systems relate to each other.
3. (10 minutes) In a class discussion, determine what patterns students observed in Google Earth and how it compared to the topographic map database from the previous day. Help students develop an understanding of human influence on the local landscape.

Modifications/Accommodations:

Print copies of each screenshot of the different uses of Google Earth.

Google Earth

Today you will be extending your learning through developing your spatial thinking skills using Google Earth. You will explore what the school area looked like back in time with older satellite images, how the elevation changes by drawing paths of elevation profiles, and layering a topographic map on top of the school area to see how the two systems relate to each other.

Go to the location of the school.

To view back in time - click the historical imagery button and go to where the school is now. What was there?

Click through the years and summarize the changes you see:

Draw a few paths going from the school outward. Click to show the elevation profile. What do you notice about how the elevation changes around the school? Be specific in your directions.

Add the USGS Topo map on top of Google Earth by going to <http://www.earthpoint.us/TopoMap.aspx> and click the button that says "View on Google Earth."

Back on Google Earth, select the folder called "Earth Point Topo Map" and select the sidebar to change how transparent the map is on top of Google Earth. Go back to the school and summarize how things have changed since the topographic map was made:

Which online database did you find more helpful in your interpretation of the local landscape - the Topographic Map viewer or Google Earth? Why?

Day 6

Lesson Title:	Modeling Glacial Landforms
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past?

Understandings:	Students will understand that glaciers can change the landscape.
Knowledge:	Students will know how landforms are made by glaciers.
Skills:	Students will be skilled at modeling glacial landforms.

Materials:	“Modeling Glacial Landforms” and pencil. For each group: sand table, sand, books to prop it up underneath on one side, a styrofoam “glacier,” wooden “ice chunks” and larger rocks.
Preparation:	This will require significant time to set up. Put the sand in each sand table and put the rest of the supplies near the sand table at each lab station. Be ready for spills so have a clean broom and dustpan nearby. Print copies of “Modeling Glacial Landforms” one per student.

Learning Plan:

1. (5 minutes) Have students review their “The Glacier Did It” and “Glacial Landforms Observation Lab” sheets to review how landforms are made by glacial movement.
2. (20 minutes) Go over the directions of the “Modeling Glacial Landforms” activity with the students. Emphasize the pictures taken should be of a small size so they can upload online quickly and should be in focus to show the landform.
3. (20 minutes) Give students a few minutes to clean up their station and upload their photos. They then should work together on a group shared word document or slideshow to show and explain how each landform was made. If this is not completed during the class period, it can be homework for the next day.

Modifications/Accommodations:

Students can choose four of the eight landforms to make.

Modeling Glacial Landforms

Today you will to model glacial landforms. You will use a sand table full of sand, books to prop it up underneath on one side, a styrofoam “glacier,” wooden “ice chunks,” larger rocks, and any other tools you think you might need to make these landforms.

You will cut out the terms and place the label on the formation. You will then take a small picture of each labeled landform and save it into a table in a shared group online document describing how you made each landform.

Glacial Till	Kettle Lake
Glacial Valley	Striations
Terminal/End Moraine	Erratic
Lateral/Side Moraine	Driftless Area

Day 7

Lesson Title:	Minnesota Biomes and Natural Resources
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales</p>
Essential Questions:	<ul style="list-style-type: none"> ● What did the area look like in the past? ● How much of the landscape is natural?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	<p>Students will know how the area looked like in the past by studying maps of Minnesota to learn the biomes.</p> <p>Students will know how much of the landscape is natural (not changed by human influence).</p>
Skills:	Students will be skilled at finding patterns between multiple maps to see how the area has changed over time.

Materials:	<p>Minnesota Department of Natural Resources map of Natural vegetation and biomes: https://files.dnr.state.mn.us/eco/mcbs/natural_vegetation_of_mn.pdf</p> <p>Minnesota Geological Survey map of Quaternary geology of Minnesota https://conservancy.umn.edu/bitstream/handle/11299/60085/umn22618%5b1%5d.pdf?sequence=2&isAllowed=y</p> <p>Minnesota Geological Survey map of Bedrock geology of Minnesota:</p>
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	<p>https://conservancy.umn.edu/bitstream/handle/11299/101466/S21_map.pdf?sequence=2&isAllowed=y</p> <p>Hennepin County Natural Resources Interactive website: https://gis.hennepin.us/naturalresources/map/</p> <p>Minnesota County Biological Survey map of Natural Communities of Hennepin, Carver and Scott counties: https://files.dnr.state.mn.us/eco/mcbs/maps/carver_hennepin_scott.pdf</p>
Preparation:	<p>Either print or make available online the first three maps (but not the last one until the end of the lesson as it gives the answer to the second essential question). Print copies of the “Three Map Patterns” and “Natural Resources Exploration” one per student. The second one is specific to Hennepin County in Minnesota, so if you are in a different county, find your county’s resources and change the link.</p>

Learning Plan:

1. (5 minutes) Have students list local places that are in a natural state (parks, lakes, etc). Also have students predict what percentage of the county they are in is in this natural state (not greatly altered by modern human activity or introduced plants or animals). Do this in a think/pair/share format and make a class list of the responses on a poster.
2. (15 minutes) Students will make observations of three different paper maps (biomes of pre-European settlement, glacial landforms and bedrock geology). Students will look for big picture connections/patterns/overlaps across the state and then local connections near where they are and write them on the “Three Map Patterns.” Students will try and determine what biome they would have been in pre-European settlement. They will see if any trees/plants near their home and school would also be found in that biome type.
 - a. An example of a connection students should see is since the school is in the Deciduous Forest biome, with the forest type of Maple-Basswood the trees in this forest type are very sensitive to fire and its boundaries were controlled by fire in the past not being able to cross rivers, lakes or rough topography. This rough topography is due to the glacial deposits of landforms such as hilly moraines. Connections like these will help students see how geology can influence the biology.

3. (15 minutes) Students will be given the “Natural Resources Exploration” activity and will be directed to go the local County Natural Resources Interactive map website to investigate their home, the school grounds and a random location (if they don’t live in the county, they can pick an additional random location or pair up with a classmate who lives in the county instead). They will learn about the land cover, ecologically significant land, natural resource corridors, soil types, floodplains, wetlands and wells.

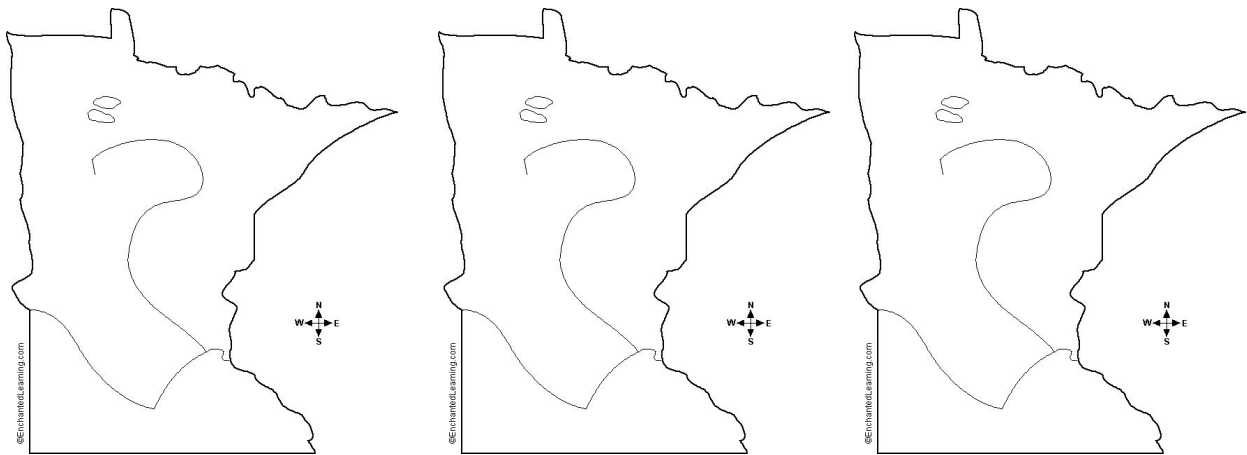
4. (5 minutes) Ask students to share out their takeaways from either part. If they are not done with the “Natural Resources Exploration” have them finish it for homework. Divulge how much of the area is truly natural: the percentage of true natural land in Hennepin, Scott and Carver Counties combined is 2.3%. Now make available the Natural Communities map to see the locations of these places.

Modifications/Accommodations:

Students can choose two instead of three locations on the “Natural Resources Exploration.”

Three Map Patterns

On each of the three blank Minnesota maps below, label the title of the map and find interesting information to put onto each of your blank maps.



What do you notice about our local area from each of the maps?

What biome are we in?

What are the other two biomes?

Pick another city in Minnesota that you have been to or would like to go to:

What biome is it in?

List any patterns you see between two maps or all three maps:

Natural Resources Exploration

Go to the school first. Fill in the appropriate data. If you live in Hennepin County, then find your home. Then pick one more random location. If you don't live in Hennepin County, work with someone who does, or pick two random locations. Use the back if necessary.

Website: <https://gis.hennepin.us/naturalresources/map/>

Location	1st: School	2nd:	3rd:
Dominant Land Covers present			
Ecologically Significant Areas			
Natural Resource Corridor	Yes or No	Yes or No	Yes or No
Dominant Soils present			
Floodplain present	Yes or No	Yes or No	Yes or No
Number of Potential Wetlands amount and acres			
Number of Probable Wetlands amount and acres			
Wells present (if yes, how many)	Yes or No	Yes or No	Yes or No

Day 8-9

Lesson Title:	Lifestyles
Grade Level:	8th grade
Timeframe:	two 45 minute class periods

State Standards/Benchmarks:	Current: 8.3.4.1.2 Land & Water Uses New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales
Essential Questions:	<ul style="list-style-type: none">• What did the area look like in the past?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	Students will know how the area looked like in the past (geologic history - glacial and bedrock, and biomes).
Skills:	Students will be skilled at discussing to infer what the landscape looked like in the recent past.

Materials:	“The White Buffalo Calf Woman and the Sacred Pipe” article , “Pioneers in the Wilderness” worksheet and pencil.
Preparation:	Print copies of “The White Buffalo Calf Woman and the Sacred Pipe” article and “Pioneers in the Wilderness” worksheet one per student.

Learning Plan:

First day:

1. (10 minutes) Explain to students that over the next two class periods, they will be exploring how traditional Native Americans and early settlers viewed and used natural

resources in their lives. Have the students consider what things they use in their own lives in order to survive and how they come from natural resources.

2. (35 minutes) The D(L)akota give us the legend of the sacred pipe and the circle. The legend describes the unity of all things, and the balance of the cycles of life and death, the seasons and stars, of all living and nonliving things. It reminds us that the cycles of the Earth system were established long before humans first appeared and that humans are both a part of the cycles and an influence of change. Read to the students “The White Buffalo Calf Woman and the Sacred Pipe” while they follow along on their own copy. Discuss the following questions:
 - a. What do you think the story is about?
 - b. What are the parts of the White Buffalo Calf Woman’s sacred pipe? What do these parts stand for?
 - c. What does she mean when she tells the people to take the right direction of the Good Red Road?
 - d. She shows the people how to offer the pipe to six places: the sky, Earth, and the Four Sacred Directions. What do you think these places represent? Why do you think these places are important?
 - e. What does it mean when the story says the people lived happily and well when they remembered that all things around them are connected like the parts of a pipe?
 - f. How can we affect plants, animals, people, and the rest of the Earth by the things we do? What can we do to take care of the Earth and keep the Earth strong and healthy in the future?

Second day:

3. (10 minutes) Explain to students that today they will be focusing on early pioneers. In a class discussion, ask the students to describe a pioneer. What role did pioneers have in building America? Discuss the following questions:
 - a. Did pioneers settle in the forest? If so, what were they first things they probably did when they got there?
 - b. Did they use the same forest resources as traditional Native Americans?
 - c. What sources of energy did the pioneers rely on?
 - d. What kind of homes did they build?
 - e. Do you think pioneers harvested forest products for their own use? Did they trade or sell them? If so, which ones?
4. (30 minutes) Explain to students that they are going to work in groups to explore some of the attitudes toward natural resources that the pioneer settlers had. Each group will

assume the role of a pioneer family. Each student should get a copy of the “Pioneers in the Wilderness” and each student should assume a role. In addition to the questions on the worksheet, students should discuss the following questions:

- a. In your role as a pioneer, how would you describe your attitude toward natural resources when you began establishing your homestead?
 - b. What impact do you think you would have made on the environment?
 - c. How does your real-life attitude toward natural resources compare with the attitude you held when you imagined yourself an early settler?
 - d. What factors do you think have contributed to changes in Americans’ attitudes toward the environment since the 1840s?
 - e. Can we criticize early American pioneers or industrialists for exploiting the environment? Why or why not?
 - f. Do you believe the practices and traditions of the past are representative of present behavior of society and industry? Why or why not?
 - g. How can we more effectively judge how our actions affect the environment?
5. (5 minutes) Ask students to share out their takeaways from either day.

Modifications/Accommodations:

Students can answer less of the discussion questions.

For the readings, the important information should be highlighted or noted in some way.

Adapted from American Forest Foundation. (2013). *Project Learning Tree environmental education activity guide Pre K-8*. Washington D.C: American Forest Foundation.

Day 10

Lesson Title:	Native American Research
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales, 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p>
Essential Questions:	<ul style="list-style-type: none">• What did the area look like in the past? / How was the area used in the past?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	Students will know how the area was used in the past.
Skills:	Students will be skilled at researching to determine what the landscape looked like and how it was used in the recent past.

Materials:	“Ojibwe Lifeways” article and questions, “Minnesota Native American Treaties” and pencil.
Preparation:	Print copies of “Ojibwe Lifeways “article and questions and “Minnesota Native American Treaties” one per student.

Learning Plan:

1. (5 minutes) Ask students what they know about the Native American's who lived and still live in Minnesota. Make sure they know there are two main tribes in Minnesota: the D(L)akota and Ojibwe. Explain that today they will get more background knowledge of how traditional Ojibwe lived and still live.
2. (25 minutes) Read the first page of the article "Ojibwe Lifeways" aloud. Students will independently read the rest of the article and answer the questions.
3. (15 minutes) Land acknowledgement / Treaties
 - a. Help students see when different parts of Minnesota were ceded.
 - b. What was the treaty that affected the land we are on right now?
 - c. How do we acknowledge the land respectfully?

Modifications/Accommodations:

Students will be read aloud to in a small group as needed.

The amount of questions for the article "Ojibwe Lifeways" will be shortened.

Native American Research

Read "Ojibwe Lifeways."

Describe how the Ojibwe thought of and used Minnesota's natural resources:

Why is maple syrup or maple sugar important to the Ojibwe people?

What are at least three food items gathered in the summer and how are they gathered?

How are these foods saved for the rest of the year?

What is the most important food for the first Ojibwe in Minnesota?

Why?

How is it harvested?

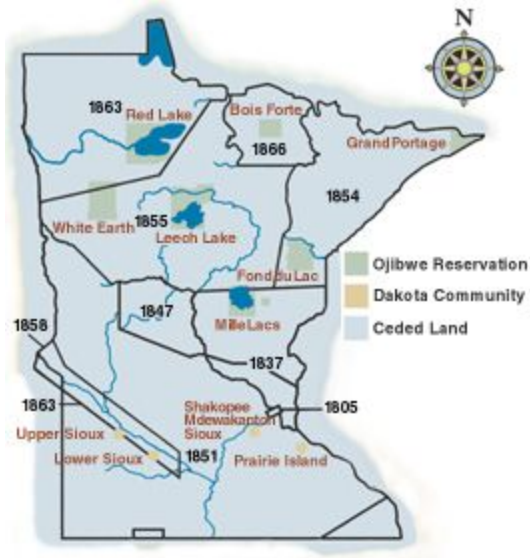
What did the Ojibwe people eat in the winter?

What marks the first transition from childhood to adulthood?

Why?

Compare and contrast how the traditional Ojibwe found food and how your family finds food:

Minnesota Native American Treaties



Minnesota Historical Society. (2019). Minnesota Territory - The Treaty Story. Retrieved from <https://www.mnhs.org/talesoftheterritory/territory/treaty/treaty13.php>

Day 11

Lesson Title:	Interviewing Local People
Grade Level:	8th grade
Timeframe:	one 45 minute class period, with time to conduct the interviews

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales, 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p>
Essential Questions:	<ul style="list-style-type: none"> ● What did the area look like in the past? / How was the area used in the past? ● Why should I care about the local environment?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	Students will know how the area was used in the past.
Skills:	Students will be skilled at researching and/or interviewing people to determine what the landscape looked like and how it was used in the recent past.

Materials:	Science notebook, pencil.
Preparation:	Contact local historical societies, state history center, local members of Native American bands, senior living facilities, etc to explain this project and ask if they would be okay with students interviews.

Learning Plan:

1. (45 minutes) Explain that students are now going to prepare to obtain a first-hand account of what the area was like in the past by interviewing someone who has lived in the community for many years. This person could be a parent, grandparent, neighbor, or anyone who has lived in the area long enough to see many changes. Have the class brainstorm a list of questions to ask. Here are some suggestions:
 - a. How long have you lived in the community?
 - b. How has the landscape within the community changed during that time?
 - c. Have the changes helped you in any way?
 - d. Have the changes hurt you in any way?
 - e. How have the changes helped or hurt the community?
2. Students should practice their interviewing skills with a partner and decide who they will interview for homework.
3. Give the students extended time to conduct their interviews. Tell them not to feel bound by their list of questions. Encourage them to ask other questions that they may think of during the interview. If students don't feel comfortable asking people they know or want to branch out an interview someone they don't know, provide them with ways to get in touch with the local historical societies, local members of Native American bands, senior living facilities, etc.
4. Give students time in class at the end of the unit to share their interview takeaways either with their small group or in a class discussion.

Modifications/Accommodations:

Provide a list of questions with spaces to write in answers.

Adapted from American Forest Foundation. (2013). *Project Learning Tree environmental education activity guide Pre K-8*. Washington D.C: American Forest Foundation.

Day 12-13

Lesson Title:	Concept Sketch
Grade Level:	8th grade
Timeframe:	two 45 minute class periods

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales, 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past? / How was the area used in the past? ● How much of the landscape is natural?

Understandings:	<p>Students will understand that landforms are made by many geologic processes (weathering, erosion and glacial activity).</p> <p>Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).</p>
Knowledge:	<p>Students will know causes of landscape formation.</p> <p>Students will know how the area looked like in the past (geologic history - glacial and bedrock, and biomes). / How the area was used in the past.</p> <p>Students will know how much of the landscape is natural.</p>
Skills:	<p>Students will be skilled at compiling all of their understandings and evidence into a concept sketch.</p>

Materials:	Science notebooks, pencils, “Concept Sketch Guidelines and Rubric” and large paper.
Preparation:	Print “Concept Sketch Guidelines and Rubric” one per student.

Learning Plan:

First day:

1. (10 minutes) Explain to students that they will go back outside today to make connections between their new understandings on landscape formation, geology and biomes and the school grounds. Their goal is to add to their initial observations from the first day of the unit and to construct a concept sketch. A concept sketch is a labeled diagram demonstrating a comprehensive picture of student’s understanding of the local area. It should include four parts: identification, processes, interactions, and predictions for the future, which goes beyond just basic knowledge. Provide each student with the “Concept Sketch Guidelines and Rubric.”
2. (25 minutes) Time outside to collect observations / refine understanding of the landscape of the area.
3. (10 minutes) Back inside to summarize of observations and questions in small groups.

Second day:

4. (5 minutes) Review of expectations with the full class.
5. (35 minutes) Students have time to work on concept sketch. They can discuss their ideas with their table partners, but each student should make their own, unique concept sketch.
6. (5 minutes) Share out in small groups part they are most proud of or confident in.

Modifications/Accommodations:

Provide a graphic organizer for students who need help with keeping their observations organized.

Concept Sketch Guidelines and Rubric

Over the past few weeks you have developed an understanding of the local landscape. Now you will demonstrate your understanding in a concept sketch. Your overarching goals are to a) explain how the local landscape formed, focusing on the geologic processes and b) describe what the landscape looks like now and what it was like in the recent past. You need to be scientifically accurate, have good detail and clear explanations. Review your notes in your Science notebook and any accompanying worksheets and web resources to choose five features to highlight your current understanding of the place you live.

Each caption should include four levels of thinking:

1. The caption should identify the geologic landform in precise vocabulary.
2. The caption should explain the relevant processes of formation and/or history of change.
3. The caption should identify relationships between other features.
4. The caption should make predictions about the future of the landform.

Feature number	Sketch present (1 pt)	Feature identified (2 pts)	Process described (4 pts)	Interactions discussed (1 pt)	Predictions made (2 pts)	Total (10 pts) and Comments
1						
2						
3						
4						
5						

Adapted from Reusser, L. J., Corbett, L. B., & Bierman, P. R. (2012). Incorporating concept sketching into teaching undergraduate geomorphology. *Journal of Geoscience Education*, 60(1), 3-9. Retrieved from EBSCO database.

Day 14-15

Lesson Title:	Local Environmental Problem and Solution
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales, 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p>
Essential Questions:	<ul style="list-style-type: none">• What should we do? / What are our responsibilities?• Why should I care about the local environment?• How can we monitor and minimize human impact on the environment?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	Students will know how to take care of the environment.
Skills:	Students will be skilled at designing solutions to local environmental problems.

Materials:	"Web Resources for Community Service"
Preparation:	Make available online "Web Resources for Community Service." Contact the facility and grounds crew of the school, the local city hall and local environmental groups and give them a heads up that students might reach out

	to them about community service ideas.
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Learning Plan:

First day:

1. (10 minutes) Explain to students that today and tomorrow they will be designing a solution to a local environmental problem and propose implementation. This will be based on their enhanced understanding of their local landscape, their increased development of their sense of place and feeling connected to the local area. They should reread the responses from their interviewee, consider what the landscape used to look like and decide what would be helpful in the community. The solution could be on or near the school grounds or near their own home. It could be an action to help the environment or a way to provide awareness to something students now understand about the area. Examples include creating a rain garden, an informational display, a native planting area, etc.
2. (35 minutes) Time to brainstorm and develop an action plan.

Second day:

3. (5 minutes) Answer questions, remind expectations.
4. (40 minutes) Time to write the action plan.

Modifications/Accommodations:

Scaffold the brainstorming process with students and provide examples of actions for those that struggle thinking of any on their own.

Web Resources for Community Service

<https://www.50waystohelp.com/>

<https://www.epa.gov/students/community-service-environmental-project-ideas-students-and-educators>

What trees to plant where:

<https://extension.umn.edu/tree-selection-and-care/recommended-trees-minnesota>

Detect AIS:

<https://extension.umn.edu/natural-resources-volunteers/aquatic-invasive-species-volunteers>

Identify forest pests:

<https://extension.umn.edu/natural-resources-volunteers/forest-pest-first-detector>

Track emerald ash borer:

<https://extension.umn.edu/natural-resources-volunteers/wasp-watchers>

Identify invasive and non-native species:

<https://extension.umn.edu/invasive-species/identify-invasive-species>

Caring for shoreline landscapes:

<https://extension.umn.edu/water-resources/shoreland-property-owners>

How to use water wisely in your own backyard:

<https://extension.umn.edu/how/water-wisely-start-your-own-backyard>

Day 16

Lesson Title:	Sharing of Solutions, Reflection
Grade Level:	8th grade
Timeframe:	one 45 minute class period

State Standards/Benchmarks:	<p>Current: 8.3.1.2.1 Causes of Landforms, 8.3.1.2.2 Surface Processes in Minnesota, 8.3.4.1.2 Land & Water Uses</p> <p>New draft: 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales, 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p>
Essential Questions:	<ul style="list-style-type: none"> ● What causes the landscape to get its shape? ● What did the area look like in the past? / How was the area used in the past? ● How much of the landscape is natural? ● What should we do? / What are our responsibilities? ● Why should I care about the local environment? ● How can we monitor and minimize human impact on the environment?

Understandings:	Students will understand that humans interact with and influence Earth's systems (land, water, ecosystems).
Knowledge:	Students will know how to take care of the environment.
Skills:	Students will be skilled at designing solutions to local environmental problems.

Materials:	Student solutions, Science notebook, pencil.
Preparation:	Decide the small groups ahead of time

Learning Plan:

1. (30 minutes) In small groups, have students share their solution to a local environmental concern.

2. (15 minutes) Students should go back to their initial responses to these four questions and consider how their understanding has changed over the past three weeks:
 - a. How did Minnesota's landscape come to look the way it does now?
 - b. What rocks and minerals can be found in Minnesota and why?
 - c. What types of plants and animals live in Minnesota?
 - d. How did people use to live in Minnesota in the past?

Modifications/Accommodations:

Students who need more time to prepare or need to present in a less formal setting will be given the option to do so.

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