

5E Arts Integrated STEM Lesson Plan –

Lesson Title: Rivers: Source to Mouth

Author: Lauren Wolford

Topic: Model Mountains, Stream Flow and Paper Bridge Building

Targeted Grade Level: 2nd and 3rd appropriate

Time Needed: 3-5 hour long class periods

Subject Integration: Engineering, Social Studies (if applicable), Drama

Justification: Rivers are bodies of water that are constantly moving. When looking at a flat map you notice that all major rivers flow into the ocean. It is not until you look at a relief map that you notice that the origin of all rivers is in mountainous or hilly region and flow to landforms that are lower than the origin. By creating a model of the earth's surface students will be able to see the movement from “rain” to “rivers” as well as source to mouth.

Students will then be able to take what they have learned from lesson 1 and what they are learning or have learned in Social Studies about Ancient Civilizations and their relationship to water. Then apply it to their world today. By following a river from its source to the mouth students will be able to compare the amount of water from their hometown to the area that they have chosen to research. They then will be able to predict why there is a discrepancy.

Since the beginning of time humans have been able to cross bodies of water. It has been important to reach other landmasses in order to reach food, safety or even just out of curiosity. However building a bridge is hard work and engineers must learn to communicate with one another and work within their constraints. When testing their designs students must learn to learn from their mistakes and improve their design when building paper bridges in lesson 3.

Standards:

NGSS Performance Expectations

2-ESS2-2

2-ESS2-3 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
develop a model carry out an investigation construct an explanation define a problem design multiple solutions. carry out investigations	ESS2.B ESS2.C ETS1.A ETS1.B ETS1.C	patterns structure and function
ITEEA Standards		

K-2 B. All people use tools and techniques to help them do things.

National Art Standards

Drama Theater and the Arts 3. Critically Respond 1. Identify basic structures and relationships in space a. Identify beginning middle and end of theatrical scenes

Measurable Student Learning Objectives:

Students will develop a model of earth's surface.

Students will explore patterns of rivers.

Students will investigate and discover how rivers flow.

Students will be able to explain where rivers start and where they end.

Students will investigate the river that is closest to where they live.

Students will trace that river from its source to its mouth.

Students will compare water flow from where they live to different location on their river.

Students will define a problem

Students will explore the relationship between structure and function.

Students will design and test multiple solutions to that problem by improving their design.

Students will work together as engineers.

Nature of STEM:

The empirical nature of science

The inferential, imaginative and creative nature of science

The subjective and theory-laden nature of science

Technology is constrained by laws of nature, such as gravity.

Scientists are concerned with what exists in nature; engineers modify natural materials to meet human needs and wants.

Technological development involves creative thinking.

Tools help people do things efficiently, accurately, and safely.

Engaging Context/Phenomena: How many of you played in or sat next to the river this summer? What did you notice about the water? Did it ever stop moving? Where did all that water come from? Where is all that water going? How do people, cars and trucks cross the water? What makes bridges so strong? How are they able to hold up so much weight?

Data Integration: In Lesson 2 students are collecting Stream Flow data to analyze similarities and differences in stream flow within the same river. Students will be making predictions about the differences in the gage readings what could be causing such differences. Streamer is a public website that is always being updated.

Differentiation of Instruction: Depending on your class and their technology ability you may want to do lesson #2 as a class. There are several places where students must really follow directions or they may get very lost in the web site. Both lesson 1 and 3 have built in points to check for understanding so that students can come to you for help or just for a double check to make sure they are on the right track.

Real-life Connection:

2nd grade social studies standards include looking at Ancient Asian Civilizations and how the Civilizations started around rivers and how the rivers were the lifeblood of the community. If this lesson is done around the time you talk about ancient civilizations students can make cross-curricular connections.

Also rivers are great real life connections because all students have at least seen a river or stream and or played or floated in one at some point in their life. Students will be able to deepen their understanding of rivers and hopefully be able to teach a parent or sibling after lessons 1 and 2.

Possible Misconceptions:

Lazy Rivers: The fact that rivers cannot in fact flow in a circle, flow happens because of loss of elevation.

Tides: if students live near a place that has a river flowing into or near an ocean they may be familiar with tidal fluctuations. When it is high tide the ocean rises and often times fill the rivers, making it look like the water is flowing back up the river, and swelling its banks, when in reality the water is still flowing down stream but the water from the ocean now needs a place to go.

Lesson Procedure:

5E Model	5E Objectives
<p><u>Lesson 1</u></p> <p>Paper Mountains (use provided PPT)</p> <p>1 hour long science lesson.</p>	<p>Procedure:</p> <p>Paper Mountains (use provided PPT)</p> <p>Engage: How many of you played in or sat next to the river this summer? What did you notice about the water? Did it ever stop moving? Where did all that water come from? Where is all that water going? How do people, cars and trucks cross the water? What makes bridges so strong? How are they able to hold up so much weight?</p> <p>Show the students the video of the tubers going down the river. Ask: What did they notice? What is happening? How is the water constantly moving? Write down student's ideas on board or chart paper for later referencing.</p> <p>Explore and Explain:</p> <p>Show map of North America and where the major rivers are located. Ask: What do you notice? Next</p>

show the start of where all the rivers start. Ask: what do students notice? Add in where all the rivers end. Ask: What do the students notice? If they end up in the Ocean where do rivers start? What makes them move?

After conversation on where rivers start make paper mountains model.

- Students should partner up.
 - Each group needs:
 - 3 sheets of computer paper
 - 4 stickers or pieces of tape
 - 1 water-soluble marker or magic marker
 - Each table group needs:
 - 1 spray bottle
1. Each partner group will need 2 pieces of paper laid on top of each other.
 2. Wrap the paper (2pieces) around your partners fist.
 3. Take paper off fist and crumple paper a bit more keeping a high center.
 4. Un-crumple paper enough to tape to the remaining sheet of paper with about ½ inch border on the top and bottom. (See photo in power point). Now you have our paper mountains and a base for them to sit on.
 5. Ask: What do the students notice about their landforms? (Mountains, Valleys, Plains, ect.)
 6. Ask: If it were to rain on your model where would the water go?
 7. Next have the students find the highest points on their model and color them using lots of ink.
 8. Once all models have been colored have each group spray their model 5 times with the spray bottle. (The models will be sprayed again so each student will get a chance to spray)
 9. Have students watch (30 seconds to 1 minute) Have students share their noticing's (write students ideas on board or chart paper to compare to earlier ideas.)
 10. Complete step 9 again.
 11. Complete step 9 for a third time. ("rivers" should be flowing by the third time.)
 12. Ask: Did "rivers" form on your model?
 - Where did they start?
 - Were your predictions correct about where rivers started?

13. Show final slide of where mountains are located on the North American Map.
Discuss: What the students learned and weather or not student's ideas were correct from the start, if original ideas were incorrect why?

Have a student state why rivers flow?

Have students dramatize their ideas of how and why rivers flow in a minute to 30-second performance in small groups. Dramatizations should include a beginning middle and end.

Modifications

Standards Addressed: 2-ESS2-2 , 2-ESS2-3 Theater and Drama 3.1.a

Formative/Summative Assessments: after each phase of the experiment the teacher will be able to do a visual assessment to make sure that all their students are completing each task. Teacher should step in if S/He notices a straggling group. At the end of the experiment students will be assessed by presenting their knowledge of flowing rivers by creating a 30 second or less dramatization of their ideas of how and why rivers flow to the ocean.

Resources power point is attached to the Endeavor discussion board.

Lesson has been adapted from MysteryScience:

If you floated down a river, where would you end up? (n.d.). Retrieved July 7, 2020, from <https://mysteryscience.com/water/mystery-1/mapping-earth-s-surface-features/112?r=4904206>

Lesson 2

Duration: 2-5 class periods depending on how tech savvy your group is

Procedure:

Following a River Source to Mouth

Elaborate: Ask: What are some of the rivers in or around our community?

What are they used for? Where do they start? Where do they go?

In today's lesson show the students the USGS website and how they will use it. Show students that they can find a river and either trace it up to its source or down to the ocean it empties into. Show them how rivers empty into others to form an even bigger river. You will also show them how to find gages to find the amount of water that is currently flowing also known as Stream Flow.

<https://txpub.usgs.gov/DSS/streamer/web/>

Be sure to play around with the website before you teach the lesson so you can show the students how it works!

To find your location click on the icon that looks like a sight and crosshairs on the far right of the page. Then click trace report and it will get the information for the first 4 questions on the note catcher.

To finish the note catcher you will still have to have your river highlighted. Now click on identify. If you click on your town name and gaging station then click on NWISWeb homepage for gaging data.

To find the amount of water that is currently flowing through the gage click on Daily Data. The site shows a great graph that shows the trend in water over the last year (great for visual people). But to get numbered data change the output format to table and it will show you the daily flow. To just get the Stream flow data in real time click the “realtime” tab. This will tell the real time data but will not give you any trends or previous data.

To find information on another gage follow your river up or down and find another green dot and follow the same steps as above.

Independently or in partner group, students are to find information asked on note catcher.

Modifications

Depending on your class and their technology ability you may want to do this lesson as a class. There are several places where students must really follow directions or they may get very lost in the web site.

Standards Addressed 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3

Resources :

<https://txpub.usgs.gov/DSS/streamer/web/>

Note catcher questions:

	<p>Name the River that runs through your Community.</p> <p>What ocean does this river empty into?</p> <p>How many States does this river run through?</p> <p>How many cities does this river run through?</p> <p>What is the discharge or stream flow through the gage in your community?</p> <p>Now find a different town or city that your river runs through.</p> <p>What is the name of this town or city?</p> <p>What state is this city or town located in?</p> <p>What is the Discharge or Stream flow in this new town or City?</p> <p>Is that more or less water than the stream flow in your community?</p> <p>By looking at the map and what you have learned about rivers make a prediction as to why there is more or less water in this location than where you live.</p>
<p><u>Lesson 3</u></p> <p>Duration: 1- 2 class periods depending on</p>	<p>Procedure:</p> <p>Bridge Building</p>

your kiddo's.

Explain the challenge: You and your friends are looking for a place to build a fort. Your annoying brothers and sisters have invaded the last two forts that you have built because they were too close to your house. After exploring the area you found the perfect place. BUT there is a stream that runs between you and the perfect place. The stream is too wide to jump across and your parents don't like it when you come home with wet clothes and shoes. So you and your friends are going to have to build a bridge to get to your new fort.

Today you are going to practice your bridge building strategies by building a bridge out of paper. Your bridge must:

- only build using 2 sheets of paper
- span 6 inches across
- be 3 inches wide
- hold 50 or more pennies.

Search bridge images online and discuss what the students notice? (You could start the conversation with famous bridges they may already know about.) How might they be able to create something that can hold at least 50 pennies?

If students are having difficulties starting their bridge building you can show them a piece of paper suspended between 2 desks or textbooks 6 inches apart. Place one penny on the center. Show them that it can't support much weight. Ask for ideas? Make a crease in the center of the paper, to show that the paper has been made stronger by putting a crease in it. Paper should be able to hold about 5 pennies now.

Materials needed for bridge building.

- Plenty of computer paper
- About \$5 worth of pennies

Each group of students will need:

- 1 ruler
- 2 textbooks (to create a gap to build bridge across)

Each student will need:

- Bridge Builder note catcher

Send students on their way. Be sure to have students design a “bridge” and sketch it before they test it on provided hand out. If their bridge does not hold 50 + pennies they need to draw/ write how they are going to improve their structure and have a teacher check to get new supplies.

Modifications: Modifications can be made as you see fit.

Standards Addressed: ITEEA K-2 B. All people use tools and techniques to help them do things.

Formative/Summative Assessments: Your students will be objectively assessed by testing their bridge to make sure that it can hold 50 pennies.

Resources:

This lesson was adapted from MysteryScience.com

Open-and-go lessons that inspire kids to love science. (n.d.). Retrieved July 7, 2020, from <https://mysteryscience.com/lessons?query=What makes bridges so strong?>

Teacher Background: In order to teach these lessons teachers need to know that water flows from high to low places. Rivers and streams start in mountainous or hilly places and flow down in elevation until they meet up with the ocean. Along the way rivers merge and combine to form bigger rivers (usually more well known). But water from rivers can also be diverted from the river to be used to water crops or for different municipalities. There for the stream flow (or the amount of

water) can change depending on weather or not water is being added or taken away. That is why the gauges on the streamer website can be different along the same river.

For Lesson 3: Bridge Building, teachers need to know that different shapes are stronger than others. The “Strongest” or most weight bearing shape is a triangle so if students and incorporate a triangle into their bridge building design they’re bridges may become stronger. Also when thinking about placing a board across the stream when you get to the middle it will sag or even break and your feet will still get wet. However if you place that board on its side it becomes more ridged and is able to hold more weight.