Iowa - The Rivers of Her Valleys 4.0

REAP Resource Enhancement and Protection

UNI University of Northern Iowa
Earth and Environmental Sciences

Title - Energy in Water
Audience - K-2, Formal to Informal Education, Teachers to Naturalists, students and their families, Iowa citizens
Lesson Description - Use a local stream Or stream table to manipulate sediment and water to increase or decrease the water's power. Manipulate resources to restrict or open flow. Stress the importance of adult supervision when working in natural streams. ***Big Ideas / Big Questions* - Iowa Core, NGSS and Earth Science Literacy http://www.earthscienceliteracy.org/document.html** **1. The Earth changes over space and time / Why does the Earth Change, Why is it important to track these changes?** **2. These Earth Changes occur at different scales (space and time, large to small)** **3. Human actions are capable of changing the Earth's surface at different scales (small to large) / How do human activities change the Earth's natural systems?**
Time Needed to Complete - Two to three, 50 minutes classes
Iowa Science Standards - 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happens quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.] 2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. * [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land. K–2–ETS1–2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Sustainability Implications & Practices
Asking Questions and Defining Problems Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. ● Ask questions based on observations to find more information about the natural and/or designed world. (K-2- ETS1-1) ● Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2- ETS1-1)	**ESS1.C:** The History of Planet Earth Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1) **ESS2.A**: Earth Materials and Systems Wind and water can change the shape of the land. (2-ESS2-1)	**Patterns** in the natural world can be observed. (2-ESS2-2),(2-ESS2-3) **Stability and Change** Things may change over different scales: space - (small or large) and time (slow or rapid) and (2-ESS1-1),(2-ESS2-1)	**Grade 2 HUMAN Interactions stds?**
Students will… **Identify the big ideas and big questions.**	**Students will** **Observe how the Earth changes over time.**	**Students will** **Identify Earth System patterns and changes through observations**	**Students will** **Apply knowledge to create sustainable practices**

Student Objectives
I-can statements

1. I can make water move faster or slower
2. I can move sediment with water
3. I understand that it takes less energy to move smaller sediment and more energy to move larger sediment.
4. I understand that changes to natural water systems may also affect the Earth's life systems.

Resources

1. local stream or stream table/visit to museum or interpretive center, final option virtual stream table
2. silt/clay, sand, gravel, cobble
3. Watch with second hand/Stopwatch
4. Tape measure

Evidence of Learning, Students will be able to produce drawings of stream settings, have discussions of earth surface processes, energy and products from an Earth Systems approach.

5-E Format

Engagement/ Excitement	Open discussion using Iowa's Rivers, Ideally, you have a stream near your school's campus where you can take a short hike near the stream and hold an outdoor nature talk with your students. Options for the nature talk may include: A. Asking students where the closest river to their house is. Is it big or small? What do the students think of our streams and rivers, what are they used for? Why are they important? What is in the river? Water, Ice? Could there be ice? Animals/plants? B. What are the differences between a puddle, pond, and river? Potential videos to start with could include: 1. https://youtu.be/uDSi8m06k_U , Paddling Iowa's Rivers, Iowa PBS 2. https://youtu.be/kQOiduQ28hs , Charles City Whitewater Park, Iowa PBS <u>Outdoor</u> Set up - 1. Identify a local, accessible stream within walking distance. We must insure learning opportunities for all, so make sure your local stream handicap accessible and/or engage students with the indoor option below. 2. Before the activity make sure the following stream characteristics are available A. Accessible bank/s, (not too high/tall, or steep, or cluttered with debris or hazardous plants/nettles, poison ivy, thorns etc.) B. Shallow water, ideally one foot or less, to increase safe access BUT be aware that water hazards exist even in shallow water, if you select the outdoor option please work with a classroom assistant, fellow teacher, pre-service teacher, someone else to make sure the students are safe while you work on safety and the lesson. C. Various sediment sizes cobble (X> 64mm dia.), pebble, sand, and clay. <u>Indoor*</u> Set up - 1. Set up stream table with varying sediment size pebble, sand, clay (4 to 64mm dia.), ideally run stream table for a few hours before the lesson to develop stream landforms: chanel, banks and bars * If you don't have a stream table or cannot visit a local Museum/Interpretive Center stream table, it may be possible to use this virtual stream table linked below. If you are industrious and your school can help with some funds, you can build your own stream table here is a link to get you stated. https://gislab.utk.edu/outreach/diy-stream-table/ <u>Online</u> http://www.fossweb.com/delegate/ssi-foss-ucm/Contribution%20Folders/FOSS/multimedia/SolidEarth_CA/geologylab/streamtable/stream_table.htm

Exploration	Outdoor and Indoor - Work with students to… A. Parts of a stream, before exploring a nearby stream, using a stream table or the online stream table option; Engage your students with common 'Stream parts' Obtain small (gallon ice cream containers) and fill them about halfway with sand, gravel/pebbles, dirt, and stream/pond water (water with sediment, insects, small plants, not just tap water). Lay out new paper under and around the containers then work with the students to describe the containers contents using important vocabulary that they may not have yet e.g. sediment/particles, different sediment size (clay to pebbles/small to large), stream vs tap water, etc. * Students may benefit from the precursor activity describing stream shapes, this activity may be found here, https://drive.google.com/file/d/1c_reJAhXffNXfHFozSVfLfnOIhiReG1g/view?usp=sharing B. Stream walk - Observe and characterize the stream systems - have students draw pictures, help students to 'see' what is there, and have them document and learn from the different stream segments (different channel shapes, water levels, life). *Ask questions such as:* *1. What are the channel/stream shapes, straight or curved?* *2. Where are the plants above the stream? On the bank? In the water?* *3. Which direction is the water moving, have them draw an arrow… Is it moving to the right or left..?* *Help them think about more advanced questions…* *4. What would cause sediments in the water to move? (small vs large) ?* *5. What would cause sediments to move faster or slower?* C. Have the student watch you measure out about one meter, you could use a yardstick, or branch that is about a meter long, on the outdoor or thirty cm on the indoor streams. For either option, you should locate or construct the stream section you want to use, go as far as adding stones to create the chute described in step E. D. Time how long it takes a leaf to travel on the water's surface (could be a good time to introduce time trials/averages/graphs), if this is too complicated, simply have your students watch, draw and discuss how the leaf moves with the help of the water. E. Construct a chute using larger stones to create a more narrow channel for the water to move. Then use the same scale as before: 1 meter, outdoors, 30 cm, indoors, (to save time you could construct one before the students arrive, on a different section of the stream or stream table). Here is a short video of a stream exhibiting wide to narrow channel differences. In the video the stream channels are natural with a minor amount of added stones to emphasize the 'chute'. Where the channel is wide water moves slowly, as channel size decreases the water's velocity increases as does the potential for erosion and movement. *Ask questions such as:* *1. How does this chute change the movement of water?* *2. Will this chute change how sediments move- faster or slower*? 3. Draw pictures of the chute and compare/contrast with the first drawing, discuss… F. Measure a leaf as it travels through the chute and compare data against the first trial (B). The leaf should be small enough to travel through the chute with limited interaction to the chute sides/rocks. Here is a video exhibiting an increase in water and leaf movement as the channel area is restricted. G. Biology connection, Discussion how might life be affected in both situations A and C? *Ask questions such as:* *1. Should we leave the chute in place or remove it?* *2. If we leave the chute in place, will it be there in one week, one month, one year?* *3. What type of force or natural disaster would cause the chute to move/change?*

Explanation	A. The walk should help the students to view and understand that there are different stream segments with different properties. Make it fun, characterize the different stream channel shapes (bends vs. linear), insects, plants, and animals (in or near water… Pick up a small buckets of stream sediment from different parts of the stream, ideally to show the variety of sediment size (large cobble to small silt clay), shape and surface of the larger particles (ideally diverse round vs oval, short vs long, rough vs smooth), have them record and draw as many of their senses as possible what do they smell, hear too:-). Have the students write and draw their observations in their field notes. If you are doing this indoors with a stream table, focus on what they see visually in the table. B. Try the leaf experiment first on a linear stream segment, leaves will generally move most quickly near the center and slower along the edges, unless branches or other obstructions create fast moving water. Water moving through bends/curves likely moves at different rates; the water on the inside of the bend likely moves slowly, whereas the water near the outside of the bend moves more quickly. You could take a leaf or leaves, place it on the bend-water and watch how the leaves are moving. There are a lot of concepts that back up the reasoning for water/leaf movement, but the important point to get a cross is that streams are dynamic and different parts of the stream move at different rates (Slow vs Fast). Have the students write and draw their observations in their field notes. C. The constriction/narrowing of the water should increase water's speed and discharge. Particles small to medium-sized should move more quickly than before along the chuttes stream bed and maybe in the water too. You could run the leaf test again. Compare these results to the original stream results (bend vs straight channel). You should see the original data/leaves/sediment moved more slowly and the newly created small chute more quickly. D. Discussion of how water interacts with the Earth's surface to enact change slow to fast. Use Google Earth to engage students with visual examples of rivers altering the Earth's surface (Mississippi River, Delta) and anthropogenic modifications that impact the movement of water (dams, levees).
Evaluation	Outdoor and Indoor options At the end of the week have the student draw what they remember. A. River shapes B. Associated sediments (different sizes small to large, clay to pebble to cobble if the students want to start using new terms), insects, plants, animals, sounds and smells C. Locations of slow vs fast water
Enrichment/ Elaboration/ Extension	A. How will the different sediment types/sizes move through natural setting (A) vs chute setting (C) vs a setting where water is more stationary e.g. a pond or lake? Are there other factors than size that might affect how sediment moves through each setting? B. Would the same principles apply to wind and sediment?

Rubric

‘Criteria’	Almost never 1	Rarely 2	Occasionally 3	Frequently 4	Almost Always 5
Stream shape understanding	Student does not remember the basic stream shapes.	Student is familiar with the idea of stream shapes and can explain some.	Basic understanding of stream shapes- can identify a few.	Can identify most of the stream shapes that were discussed.	Distinguishes different stream channel shapes
Relationship between life and stream	Student can not distinguish different life groups that live in specific streams.	Student can distinguish that there are differences, but can’t identify any.	Students can identify the most common types of relationships between streams and live.	Student can identify the majority of relationships between streams and lifeforms.	Identifies differences and relationships between stream shapes/ environments and life.
Water movement	Student does not understand that stream energy/velocity may change, if channel shape changes.	Student is familiar with the idea, but can’t distinguish the correlation between the idea and the activity.	Student is aware of movements causing change but, can’t relate it back to the activity	Student understand the idea, but cannot specifically point out those things in real life.	Understands that changes in stream shape and/or width affects the movement/speed of water, and can identify them in the activity.
Sediment movement	Student does not connect energy, to speed to power or a streams ability to move different sized sediment.	Student is slightly familiar with the idea of movement, but can’t give an example.	Student understands the basic idea of sediments moving, and can give an example.	Student is fairly confident with the idea of sediments moving, can give an example.	Student is aware that Increased energy leads to the water’s ability to move large sediment, and can give multiple examples.
Application	Student cannot recreate a slow vs. fast stream setting in a creek or water table.	Student can recreate few parts of a moving stream setting.	Student can recreate the key parts to movement in a stream setting	Student can recreate a majority of the components needed in a stream setting.	Can recreate a slow vs fast stream setting in a creek or water table.

Potential online resources

Stream table
http://www.fossweb.com/delegate/ssi-foss-ucm/Contribution%20Folders/FOSS/multimedia/SolidEarth_CA/geologylab/streamtable/stream_table.htm

Earth Science Literacy - Big Ideas Activities Page

https://www.earthsciweek.org/big-ideas