Iowa - The Rivers of Her Valleys 4.0

Title - Playground - Energy, actions and shapes
Audience - Grades K and 3, Formal to Informal Education, Teachers to Naturalists, students and their families, Iowa citizens
Lesson Description - ***Big Ideas / Big Questions* - Iowa Core, NGSS and Earth Science Literacy** http://www.earthscienceliteracy.org/document.html 1. **Energy shapes patterns on the Earth's surface. - How does energy shape the Earth's Surface?** 2. **Earth is a complex system of interacting rock, water, air and life. - What types of shapes are formed on the Earth's Surface?** 3. **Shapes and patterns on the Earth's Surface - How can shapes help us learn about the Earth's history?**
Time Needed to Complete - One to three 50 minute sessions
Iowa Science Standards - 2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Sustainability Implications & Practices
Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. Develop a model to represent patterns in the natural world.	ESS2.B: Plate Tectonics and Large-Scale System Interactions Maps show where things are located. One can map the shapes and kinkinds of land and water in any area.	**Patterns** Patterns in the natural world can be observed.	**?**
Students will… **Create a model to mimic the Earth's surface.**	**Students will** **Use energy to model landscape change over space and time.**	**Students will** **Identify common shapes and patterns from land to water.**	**Students will** **Apply knowledge to create sustainable practices**

Student Objectives / I-can statements

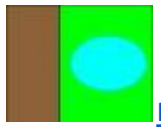
1. I understand common shapes may be used to interpret patterns on the Earth's surface.
2. I can move sediments and water from uphill to downhill.

Resources

1. Playground and equipment (slides, merry-go-round, climbing wall, sandbox, sediment)
2. Tape (duct), small used boxes,
3. Various size 'sediment' (small to medium) A) playground/classroom marbles to dodge balls, B) classroom blocks
4. Water or conduct activity after a rainfall
5. Student journals
6. Playdough Models/maps - for comparative purposes

Evidence of Learning Development of models that accurately portray the natural land surface.

5-E Format

Engagement/ Excitement	**<u>Indoors</u>** 1. Have a discussion about Iowa's surface its energy, processes and products/shapes Optional videos to help students visualize what landforms are and how they group together to shape/form our landscapes a. Iowa landforms video https://youtu.be/fWlQx0tZk9g (48 seconds) b. Iowa's land geology and biology combined https://youtu.be/je8U7fgpGxA (4min 15sec) 2. Provide students with the three activity maps, A) linear , B) curved and C) circular. You may want to break the students into small groups (3 to 5) have them address question 3.  Playground1 vs Stream1  Playground2 vs Stream2  Playground3 vs Stream3 3. Based on the class discussion and/or videos ask the students how they would describe the pictures/ maps, what do they see? Have another discussion on the differences between pictures and maps.
Exploration	**<u>Outdoors</u>** Primary exploration 1. Have the students take their maps, the science journals and writing tools to the playground. 2. Ask students to find/draw/map similar shapes line, curvy line, circle from the playground using their journals. 3. After about ten minutes, bring the students back as a group to hold a discovery meeting. Secondary exploration 1. Ideally some or all of the students used the playground slides as a linear and curvy comparative feature. Walk over to the slides and ask for a volunteer or two to go down the slides at the same time. 2. Have a discussion a. How do the maps imitate the slides? b. Do the slides and maps imitate anything in nature? From the videos? 3. Ideally there is a small hole/depression at the base of one of the slides. If there isn't a small depression at the bottom of the slide from kids going down and it is OK, dig out a small/shallow depression. a. How will balls vs blocks move down the slide? - Thought processes and student 'lead-in questions' = "*Allow the students to drop various objects down the slide and make observations. Lead a conversation about how the different objects (balls vs blocks) move down the slide.How are the moving balls and blocks like or unlike soil, sediment, or liter moving down-slope? Do all of the objects move the same? Why not? How is this like in nature?*" i. Students, balls and blocks are examples of sediment moving downslope. ii. Sediment with different properties (size, shape, density) move differently b. Will all of the balls and/or blocks end up in the same place? c. Does the size of the ball or block matter? i. the heavier/more dense sediment likely will stay in the depression ii. the lighter/less dense sediment likely will move beyond the depression d. Ask the students what they think will happen if you spill water down the slide. - Address their answer

	4. Poor upto 5 gallons of water down a slide, if it has not rained in a while you may need to pre-wet the depression. The goal is for the water moving down the slide to collect/stay in the depression. Help students map the water pathways linear down the slides to elliptical/circular in depressions. 5. If it has recently rained, a hike around campus or a nearby park identifying, measuring and mapping puddle locations as the compare to to the three activity maps 6. Journal entry discussion - ENERGY and FORM/SHAPE are key - Did we use any energy creating our model? Where was energy used? Which was more work, getting a ball to the top of the slide or to the bottom? During rain, which takes more energy to move, a single piece of dirt or a basketball? **Indoor options** - If going outside to a playground or park is not an option Develop an indoor or outdoor lab activity using concepts from the University of Northern Iowa's Ramps and Pathways program a. https://regentsctr.uni.edu/ramps-pathways b. https://regentsctr.uni.edu/ramps-pathways/media-center/ramps-and-pathways-beginning Physics and engineering are the basis for the Ramps and Pathways work, but these activities may also be used to observe and characterize the Earth's natural/geologic processes and products (Rivers, energy, erosion and sedimentation). **Modeling** The next class or opportunity continues to help the students model their observations from the previous activities. The playground was used to model general landforms/shapes: E.g. slides to model rivers and/or hills/topography, Depressions to merry-go-rounds to model smaller ponds or larger lakes. The next step has the students use a 'medium' that they are comfortable with to create models that simulate the Earth's landforms. Ideally students could use new observations from a local stream, a different area of their playground, their yard. Modeling activities could include the construction of diorama/map using: a. Paper and color pencils (two-dimensional) b. Legos (three-dimensional) c. Playdough (three-dimensional) d. Minecraft (three-dimensional) Help the students to visualize shapes and patterns in nature by having a discussion of how their newly created models compare to the and the three activity maps and their journal observations of the playground or Ramps and Pathways models. *e.g. topography (Up/down = hills/valleys ; linear/circular = rivers/lakes)
Explanation	Students will explain how their model mimics the natural world. Specifically how certain shapes and patterns can help others learn about the Earth's surface and distributions of land and water. Thought process and student lead in questions = "*Students can talk about how their models accurately represent the natural world and about the limits of their models (it's smaller, I ran out of blue legos, I used blue legos for the river but the river is actually brown...why do we do that? etc.*)

Evaluation	- Student models will be evaluated by teachers and teacher assistants to confirm knowledge progression of natural shapes and patterns. - Mapping/drawing on subsequent discussions or testing could confirm knowledge retention - Playground games and/or discussions could also confirm knowledge retention
Enrichment/ Elaboration/ Extension	- Could address movement and erosion standards too, - Could calculate and graph the amount of time it takes for students, balls, blocks (sediment) to go down a straight vs curved slide then compare to our streams - Should take developing knowledge to a local stream for discussion

Rubric

'Criteria'	**Almost never**	**Rarely**	**Occasionally**	**Frequently**	**Almost Always**

	1	2	3	4	5
Water distribution/shape	Student does not associate land shape with water type/shape		Student recognizes some, not all water body shapes		Distinguishes landscape position impacts water type and shape
Relationship between energy and shape	Student is not able to relate changes in landscape position to changes in energy and shape		Student understands changes in energy, but has difficulty linking changes in energy to changes in shape		Recognizes changes in landscape position slope between two or more locations influences water's energy and shape
Mapping/Modeling	Student is not able to visualize, characterize, or draw, different water bodies, circular to linear, on land.		Student recreates some water bodies on paper or models, but the work is lacking detail or some interpretations are incorrect.		Distinguishes and is able to recreate or 'predict' a landscape's water bodies as a product of landscape position and energy.
Application	Student is not able to apply landscape position and energy knowledge to nature or paper		Is able to begin using knowledge to predict how objects move through water bodies, some fast some slow		Creatively applies developing knowledge of water shape from position and energy to nature and/or paper