Lesson Plans

MOSS

McCALL OUTDOOR SCIENCE SCHOOL

University of Idaho

College of Natural Resources

Title: Virtual Rafting Adventure
Grade Level: 5th -8th grade

Topic:	**Stream velocity and discharge**
Background:	Stream velocity measures the speed of the flow of water usually in feet per second, while stream discharge measures volume per unit of time, usually cubic feet per second. Seasonal patterns affecting runoff and snow melt can influence both measurements as can the physical dimensions of the body of water.
Next Generation Standards:	Dimension 1 (Practices 1, 2, 3, 4, 5, 8) Dimension 2 (Concepts 1, 2, 3, 4, 5, 6, 7) PS2.A, PS3.A, PS3.B, PS4.A, LS2.C, & ESS2.C
Goals:	Students will have the opportunity to study stream dynamics by making a model stream and raft.
Objectives:	• Students gain an understanding of the units describing quantitative stream characteristics • Students design experiments to measure stream flow • Students recognize that volume of water in a stream can vary and observe the effects of this variation in a system • Students relate stream flow to weather conditions and the water cycle
Materials:	• Wide aquarium tubing • Mini marshmallows or other small buoyant objects • Water source • Volumetric measurements for water (recycled drink containers or measuring cups) • Rulers • Dry erase markers • Stopwatch
Set up:	• Cut aquarium tubing to desired lengths for model • Find suitable outdoor space with garden

	hose access to fill water containers
Classroom Time:	2 hours
Introduction (Engage):	Conduct a guided imagery with the students. Ask students to close their eyes and sit quietly as instructor reads the following story: Imagine yourself in a floating raft with your friends. You are going rafting on the Lochsa River (adapt to local watershed river if desired), one of the wildest rivers in the west! Breathe in deep and smell the sweet scent of the pine trees and listen to the cold river water rushing around you. We are in the month of May and the sun has started to melt much of the snow. The water level is rising as the snow melts. You notice how quickly the water is moving downstream and begin paddling, as the guide directs, "Forward strokes!" Twisting, turning, shouting, getting sprayed and splashed with water (optional walk around room with squirt bottle and spray students lightly) you surge down the swelling river. After many rapids you go under Lowell bridge and the guide points out a water level gauge. "Look to your left, see how high the river is right now?" "It's at seven feet!" Jimmy (insert name of student from your classroom) yells out. "The river is flowing at 2,500 cfs (cubic feet per second) and will continue to change as the snow melts!" exclaims your guide. Upon your return from your rafting trip, you become curious about the water science behind the success of your trip. What do the units expressed in the river measurements mean (feet measures height and cfs measures a rate or speed)? Why do you think the river was at a high water level? What factors could contribute to the amount and speed of the river flow?
Activity (Explore):	Use wide aquarium tubing as a model river to illustrate how velocity and discharge change with higher or lower volumes of water added to the tube. Use a mini marshmallow or other small buoyant object to represent a raft. Provide students with different volumes of water using recycled materials such as empty soda bottles and milk jugs. Have students experiment with the different volumes of

	water, different angles by holding the aquarium tubing at a slant, and different shapes of the tube by bending the path of the model river. For example, students could use half their container of water to pour down the tube and then double the water while matining the height of the tube for both trials. How do these factors influence velocity (speed) and discharge (the speed of the water and the volume of water that passes through a certain point)? Encourage students to use stopwatches and known volumes of water to design a method of measuring velocity and discharge. Use a dry erase marker on the tube to mark the water level at various points in the tube as water is added. Measure the height from the bottom surface of the tube to the mark to represent the stream water level gauge. Students can race their boats (marshmallows) while each using different amounts of water and angles of the tube. Have students hypothesize ahead of time which boat will be the fastest. This can be very student lead, or broken down with instructions from the teacher such as: 1. Fill your soda bottle to the half way mark on the bottle. 2. While holding the tube at 0.5 meters, time how long it takes the marshmallow to reach the end of the tube (float marshmallow in the soda bottle to be poured out into the tube). 3. Now double the amount of water and keep everything else the same. 4. Now go back to half the soda bottle water but double the height of the tube, 1.0 meters high.
Explanation	Based on what you know about watersheds and the ecosystem, what are the sources of the water in the river (snow melt, snow pack, precipitation)? What part of the water cycle does this represent (runoff)? Share observations about experiments conducted. What seasonal variations did the different volumes of water added to the river represent? How can the amount of snowfall and compaction of snow be affected by weather patterns?
Elaboration:	A month later you decide to go rafting on the Lochsa

	again. In June the river is at 5 feet and 1500 cubic feet per second. Draw or write about how this rafting experience might be different from the first trip in May. In your first model river, you controlled the amount of water added to the system. Repeat the experiment using the garden hose to make a continuous flow of water in the aquarium tube. Can you think of a method using the tools at hand to calculate the stream velocity and discharge?
Evaluation:	What do you know about changes in stream velocity and discharge and what can cause these changes? What seasonal factors contribute to the increase or decrease of water in the river? What would you expect on a rafting trip in the middle of summer (July)? What would be the best months to go rafting and why (weather conditions)? Try to graph or illustrate your reasoning based on the water level of the river.

Additional resources:
For more watershed basics, see Chapter 3 of:
http://cwam.ucdavis.edu/

For daily stream flow conditions in your area:
http://waterdata.usgs.gov/nwis/rt