



Rivers on the Web

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River Work - River Play

By Joe Riederer

In this activity, students recreate the flow rate of a river-the hard way!

One way for students to appreciate the work of a river is to play with water. I know what you're thinking-the word "play" is not found in the State Academic Standards and will not look good in your lesson plans. Just substitute "kinesthetic inquiry" for the word "play" and you're home free. If you can find a way to use "metacognition" or "paradigm shift," it would make it sound even more impressive. The truth is that kids will be playing with water and learning about rivers.

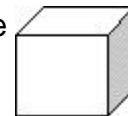
Finding Flow Rate

The flow rate of a river is the amount of water that passes a given point in a given amount of time. Imagine looking at a cross section of a river. This slice has an area that can be measured in square feet (Depth o Width). Multiply this area by the speed of the water.

Area of cross section x Speed of flowing water = Flow Rate

This is not perfect. A river's cross section is not square, so the area calculation is only an estimate. That's not important. Students will be able to experience the work rivers do, even if the numbers are off by a bit.

Build a model to help your students visualize the unit they will be working with. Tape 12 foot-long rulers, or 12 meter sticks, into a cube. Keep this where students can see it throughout this activity-maybe hanging from the ceiling. For this activity, I use cubic feet per sec (ft³/sec), only because most readily available maps use feet as their unit of measure. Change your measurements to meters and the results will be in cubic meters per sec (m³/sec).



You will see that there are three levels of directions. Use the level that is

appropriate for your classroom. If the math calculations are beyond your students' abilities, that's okay. Keep in mind that the goal is to have students experience the work that rivers do. Just modify the activity to fit your situation. If the activity doesn't work the way you like, call a "do over" and try again.

Step 1 -- Find the flow rate of a local river.

- Older students - ask students to devise a way to find flow rate. Use maps to determine width, estimate depth from on-site observations, and time a floating stick to find the speed. This would be a great time to introduce students to spreadsheets.
- Younger students - provide students with an estimated width, depth, and speed.
- Even younger students - provide students with the flow rate.

Step 2 -- Convert the flow rate to gallons/minutes.

- 1 cubic foot per minute = 7.481 gallons per minute
- Older students - ask students to make the conversion.
- Younger students - guide student through the conversion.
- Even younger students - provide students with the converted number.

Step 3 - Fill 100 plastic 1-gallon milk jugs with water.

- Yes, that really does say 100 jugs!
- Seal the jugs tightly.
- Collecting and storing a large number of milk jugs presents a challenge, but it is worth the effort.

Step 4 -- Find an appropriate location

- School yard
- Non-carpeted classroom
- Principal's spacious and palatial office suite

Step 5 - Recreate the flow rate of the river

- Place the jugs on the ground in an area free of any obstacles.
- Draw a box around them with sidewalk chalk (or use a thin rope on the classroom floor).
- Draw a similar size box 10 feet away.
- Tell the class they have one minute to move as many gallon jugs as they can, one student at a time, to the second box.

- If they move all the jugs and still have time left, have them move jugs in the other direction. The total number of gallon jugs moved in a minute is their flow rate.
- Think safety. Remind students to lift with their knees. Student unable to participate in physical activity can serve as timers and counters. Younger students can do the same activity with less water in each jug.

Step 6 -- Wrap up

- Work = Force x Distance.
- In our example the force is the weight of the jug (1 gallon of water = 8.33 lbs.)
- The resulting unit is foot-pounds.
- 1 foot-pound = 1.356 joules.
- Older students - ask students to calculate the amount of work they did.
- Younger students - guide students through the work calculations.
- Even younger students - ask students to write in a journal how hard a river works.

Extensions

1. How many students would it take to match the flow of the Mississippi River?
2. Try the same activity using ice cream pails to form a bucket brigade. Have students pour the water from student to student. This would best be done outside or in the previously mentioned palatial office suite if the weather is not favorable.
3. Let the river "flow" for a longer time-maybe 5 minutes. Will this change the flow rate?
4. Let individual students be a "river" for a minute.
5. Work with the PE department to build a River activity unit
6. Have students decorate the jugs with the names and pictures of river plants and animals. This will remind students that rivers are more than just water.
7. Ask students to calculate the work done by the Mississippi River.
8. Rivers meander. Have the students follow a meandering river, drawn

with chalk, as they move the jugs of water.

9. Help your students explore plans to remove many of the small dams across the country.

10. Find the flow rate of showers and faucets.

11. Empty the milk jugs by watering the flowerbed in front of school.

12. Recycle the milk jugs.

[A Little More about Flow Rates](#)

Flow rates fluctuate throughout the year. Spring floods and summer droughts drastically change how much water a river carries. We put dams on rivers to control the flow rate, which influences the interaction between the rivers and the organisms that live around them. Dams prevent the seasonal floods that scour the silt from the riverbed. Dams also tend to lower the water temperature by releasing cooler water from the bottom of the reservoirs they create.

The USGS maintains a fabulous site for finding river flow information. They post data on most rivers in the country and it is updated daily. Check out Real-Time Water Data at <http://water.usgs.gov/realtime.html>

[Learn more about Joe, and his novel, "Restoration in the Barrens."](#)



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