Lesson Plan for Water People

Aim
For all classes to investigate, through discussion and experimentation, the various people involved in providing the water we use in everyday life and what they do to get it to our taps.

Time requirements
Approximately 120 minutes (for 1 water quality technician experiment and 1 hydrologist experiment)

Resources
- Interactive water resource and a whiteboard or projector

Activity 1
- Water samples (dishwater, well water, rain water, pond water, etc.)
- Test tubes, graduated cylinder, test tube rack, methylene blue in a dropper bottle, data table

Activity 2 - Water samples, dissecting microscope, hand lenses, graduated cylinder, petri dishes, data table
Activity 3 - Clear jar and a ruler
Activity 4 - String (needs to be thicker than thread), rocks / stones, measuring cup, large pan or sink

Learning objectives
To learn about the people involved in providing our water and to observe, discuss and investigate water; where it comes from, its movement and its quality.

Curriculum Strands
Biology
Senior Cycle – Unit 1: Biology – The Study of Life (1.4.9 Human Impact on an Ecosystem)
Junior Cycle – Section 1C: Animals, Plants and Micro-organisms (1C2 the Microscope, 1C7 Ecology)
Geography
Senior Cycle - Elective Unit 4: Patterns and Processes in Economic Activities (4.5 Environmental Impact)
Junior Cycle – Section C: Patterns in Economic Activity (Unit C1. Primary Economic Activities: the earth as a resource)

Skills
Questioning, observing, predicting, recording, discussing, cooperating, investigating, counting, analysing, interpreting and presenting data

Links to Green-Schools
Step 3 Action Plan – Experiments to help understand what a water person does
Step 6 Informing and Involving – Whole school community learns about the people involved in getting water to our taps

Vocabulary
Methylene blue, dissolved oxygen, sweep and kick tests, invertebrates, cohesion, adhesion, gravity, molecule

Running the activity
- Review the water cycle from Section 1 and ask the students to name people that may be involved in the various sections. Go through the examples in Section 4.
  Laboratory and Water Science
- Do some experiments as part of a **microbiologist and water quality technician's job**.
- Gather some samples of water e.g. tap water, bottled water, rainwater, distilled water and if possible samples from a surrounding water source and test the quality of the water chemically and biologically.
- Label the various jars with water source and if it's from a natural source add the location e.g. upstream or downstream from town/village, date and time.

1) **To test the quality of water chemically,** apply methylene blue to water samples to look at the dissolved oxygen (DO) content. To do this put 5 ml of each water sample into a test tube (label) and add approx 20

drops of methylene blue. Ask the students to develop an hypothesis based on the experiment they are about to carry out, then place the samples in a test tube rack and observe them at intervals for approximately 1 hour, recording observations in a data table. The rate of clearing of the blue stain is an indication of the amount of oxygen in the water as methylene blue acts as an indicator of respiratory activity. While there remains free oxygen in the water, the methylene blue dye in the water remains blue. As soon as all of the oxygen has been consumed by bacterial (respiratory) activity, the methylene blue shifts from its observable form to a colourless form as the bacteria act on the dye. A high level of oxygen is a good indication of water quality.

- Does the data collected support their hypothesis? Why or why not?
- In which test tube did the blue colour disappear first?
- Which water sample contains the most organic matter? Which contains the least organic matter?
- Which water sample contains the most oxygen? Which water sample contains the least oxygen?
- What can you conclude about the DO levels and the amount of bacteria found in a water sample?

Write a brief report to explain the experiment. Include the answers to the above questions and an explanation of any sources of error which may have interfered with the data collection and the final results and present.

2) **To test water quality using biological methods**, firstly, you can examine water samples under low power on the microscope or with a hand lens to check for organisms, providing a detailed description of the sample e.g. the types of organisms, if any were found and if they were living. This links in with the amount of organic matter in the samples and DO content. Conclusions can be drawn based on observations.

- Secondly, go to a nearby freshwater source and collect water samples with the students (if possible), via a figure of 8 sweep test and/or kick tests, observing safety protocol during field work. The first method involves collecting invertebrates using a dipping net in a figure of 8 motion (on the surface, below the surface and on the bottom of the water course) and the second involves disturbing the creatures in the water with a gentle kick upstream from a dip net that you will use to collect invertebrates. Bring the samples back to the class to study or check the samples in the field (remember to put them back where you found them). Transfer the creatures into a white tray with some water and using an invertebrate identification key that tests water quality, identify the types of creatures, their numbers and note the level of pollution they indicate in a table. Write a brief report and present to the class.
  Note: You can get a simple ID key from the Field Studies Council
  http://www.field-studies-council.org/publications/pubs/freshwater-name-trail.aspx
- All results could be put together on an informational poster and put on your Green-Schools notice board.
- Do some rainfall and/or flow experiments as part of a **hydrologist's job**.

3) **Rain Gauge** – measure the amount of rain that falls from the sky:

- Put a jar outside in an open area before it starts raining.
- After it stops raining, measure how many inches of rain are in the jar with your ruler.
- Why did it rain and how much water fell?

4) **Water Flow experiment** – investigate the direction water flows and its properties:

- First, soak your string in water for a minute or two.
- Tie one end of the string onto the weight (a rock) and tie the other end to the handle of the measuring cup.
- Put the rock at the far end of a pan, stretching the string out as far as it will go and then slowly start pouring. The water will follow the string (some may spill).
- Play around; see how wide you can make the stream of water, how steep you can make the angle and if a heavier string will hold and attract more water.
- What direction did the water flow in? Did the water stick to the string? How did it do this?
  This experiment could be carried out during a water awareness day or week.

Explanation

Water defies gravity in this experiment as it has some special properties, making it a very unique substance. It has both strong "cohesive" (sticks to itself) and "adhesive" (sticks to other things) properties.

See Section 2 and Section 4 of the Water Resource

Questions

- What challenges will the water people face in the future and how can these be resolved?
- For further questions see running the activity.

Go further

- You could visit an outdoor education centre to carry out geography field studies.
- Students could do individual or group projects on a water person