Selected Topics in Education
Reading the Licking River
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Dirty Water versus Clean Water

Grade 4 Science

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Lesson Context

Time Frame	Objective	Procedure
Day 1	Students will compare methods for making a wet spot on the chalkboard disappear.	Students will be placed into 5 teams. Each team will select a method to make a wet spot on the chalkboard become completely dry. All the students will then compare to see which of the 5 methods worked most quickly.
Day 2	Students will be able to write the definition of a molecule.	Class will read pages B5- B9 of the Science textbook together, and copy the definition on page B6.
	Students will be able to draw and label a description of the water cycle.	Pages B8- B9 of the Science textbook contain a diagram and a description of the water cycle. Activity 2 on page B9 instructs the students to describe the water cycle, and include a picture.
Day 3	Students will label 10 different ingredients as able to mix evenly, or not mix evenly in water.	Students will be placed in groups of 5. Each group will be given 10 small cups of water, and 10 different ingredients to mix into the cups. They will then label each ingredient as able to mix evenly, or not mix evenly.
Day 4	Students will identify various qualities of water.	Pages B12-B17 of the Science textbook will be read together by the class. These pages contain water's ability to cling, solubility, and buoyancy.

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Day 4		Solubility will be connected to the activity of ingredients that mixed evenly or not.
Day 5	Students will determine pH, DO, conductivity, and temperature using Lamotte kits to test the water in the creek in Boone Woods Park. Students will check for coliforms using Coliscan Easygel.	Students will be placed in groups . We will walk to Boone Woods Park together, since it is connected to the school. Each group will take 2 samples of the water. One sample will be tested on site, and the other will be saved for day 6 activities.
Day 6	Students will construct a water filter following the directions on page B18. Students will determine pH, DO, conductivity, temperature and coliform levels of the water sample saved from the previous day after it has been put through the filter they have made.	Students will be placed in the same groups as day 5. They will follow the directions on B18-B19 of the Science textbook to construct a water filter. They will put the water sample that was saved from the previous day into the water filter. They will run the same tests as the previous day, and then see if the readings have changed. Students will write a lab report about the activities.
Day 7	Students will identify the amount of fresh water available on the Earth, and discuss ways of protecting it from pollution.	Students will read pages B20-B25 of the Science textbook together and discuss it. We will connect this discussion to the activities on days 5 & 6.
Day 8	Students will complete the chapter review on pages B26-B27 of the Science textbook in their notebooks.	Students will be given time in class to work on the chapter review. Anything not completed during class time will be completed for homework.

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Day 9	Students will correct the chapter review that was completed the previous day. students will complete the study guide to help prepare for the test.	Teacher will go over the chapter review and give the correct answers. Students will make any necessary corrections in their notebooks. Students will use the remaining time to complete the study guide.
Day 10	Students will make any necessary corrections to the study guide.	Teacher will give the correct answers to all questions on the study guide. The rest of the class time will be spent answering any questions the students still have about the test.
Day 11	Students will take the test on chapter 1 of the Science module on water.	Students will take a written test covering all the material In days 1-10.
Day 12	Students will observe the workings of a water treatment plant.	Students will take a field trip to a water treatment plant to observe use of water filters and other methods to clean and test water on a larger scale.

Objectives

1. Students will demonstrate the use of Lamotte pH kits, and record the results.

2. Students will demonstrate the use of Lamotte DO kits, and record the results.

3. Students will demonstrate the use of conductivity meters, and record the results.

4. Students will demonstrate the use of thermometers in the creek, and record the results.

5. Students will demonstrate the use of Coliscan Easygels, and record the results after 48 hours.

6. Students will use the instructions and materials provided to construct and demonstrate the use of a water filter.

7.Students will make predictions about how they think the water will change after it is filtered.

8. Students will compare the results of the 2 sets of water samples,(before using the water filter, and after using the water filter.)

9.Students will write a lab report about the testing and filtering activities. It will include predictions, procedures, data collected, and conclusions.

10. Students will compare the experience of testing and cleaning he water samples with the methods used by a water treatment plant, after the follow up field trip.

Program of Studies

Scientific Inquiry

- ask simple scientific questions that can be answered through observations combined with scientific information.
- use simple equipment (e.g., plant light), tolls (e.g., rulers, thermometers), skills (e.g., describing), technology (e.g., electronic media), and mathematics in scientific investigations.
- use evidence (e.g., descriptions) from simple scientific investigations and scientific knowledge to develop reasonable explanations.
- communicate (e.g., graph, write) designs, procedures, and results of scientific investigations.
- review and ask questions about scientific investigations and explanations of other students.

Conceptual Understandings

- Properties of Earth's Materials: Earth's materials are solids (e.g., rocks, soils), water (e.g., oceans), and gases (e.g., oxygen).
- Properties of Earth's Materials: Earth's materials have different physical (e.g., capacity to retain water) and chemical (e.g., ability to support plants) properties and provide resources that humans use.

Applications/Connections

- Describe the role of science and technology in dealing with local issues (e.g., landfill locations).
- Examine the role science plays in everyday life.

Core Content

Physical Science

- SC-E-1.1.1 Objects have many observable properties such as size, mass, shape, color, temperature, magnetism, and the ability to react with other substances. Some properties can be measured using tools such as metric rulers, balances, and thermometers.

Earth and Space Science

- SC-E-2.1.2 Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials (e.g., stone, clay, marble), as sources of fuel (e.g., petroleum, natural gas), or growing the plants we use as food.

Life Science

- SC-E-3.1.2 Organisms have basic needs. For example, animals need air, water , and food; plants need air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met.
- SC-E-3.3.2 The world has many different environments. Distinct environments support the lives of different types of organisms. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.
- SC-E-3.3.3 All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms; other changes are beneficial (e.g., dams built by beavers benefit some aquatic organisms but are detrimental to others.

Materials

1. Discover the Wonder science text for grade 4.
2. Lamotte DO kits.(one for each group)
3. Lamotte pH kits.(one for each group)
4. Conductivity meters.(one for each group)
5. Thermometers (one for each group)
6. Coliscan Easy gels (two for each group)
7. Pipettes(two for each group)
8. Petri dishes(two for each group)
9. Wax pencils or permanent markers for labeling the petri dishes.
10. Notebooks and pencils to record observations.
11. 2-liter bottles (1 for each group)
12. Clear plastic cups (several for each group)
13. Strainers (one for each group)
14. Alum (20 grams for each group)
15. Spoons (several for each group)
16. Pieces of window screen, about 7 cm square (one for each group)
17. Rubber bands (one for each group)
18. Cotton balls (5-6 for each group)
19. Small pieces of charcoal (like for aquarium filters), to measure 3 cm for each group
20. Small pebbles (like aquarium gravel), to measure 5 cm for each group
21. Coarse, clean sand, to measure 3 cm for each group
22. Scissors (one pair for each group)
23. Distilled water and a squirt bottle for each group.
24. Antibacterial hand cleaner
25. Measuring cups marked by milliliters
26. Centimeter rulers (one for each group)
27. Handouts with charts of water testing and filtering, 1 for each student.

Procedures

Day 5

Teacher will separate the class into groups. The number of groups depends on the number of testing supplies that are available. Each group will receive a Lamotte DO kit, a Lamotte pH kit, a conductivity meter, a thermometer, a Coliscan Easygel, a pipette, a petri dish, a bottle of distilled water for rinsing the equipment, and a sample bottle to bring water back to the classroom for the next day's activities. Students will be asked to write down their predictions for these tests before we begin. It would be great to have some parents who are willing to come along and help.

My school is right next to Boone Woods Park in Boone County. We always have parents sign waivers to allow us to take the students to the park for various educational activities throughout the year. There is a creek that runs through the park. We will walk to the creek to take the water samples.

First the teacher will demonstrate how to take the temperature of the water, then she will guide each student group in taking temperatures. Students will be directed to write the data in their notebooks. Next the teacher will demonstrate using the conductivity meter and then guide the students in using theirs and recording the data.. This procedure will continue until all of the tests have been run. Finally, the teacher will guide each of the groups in collecting samples of water to be brought back to the classroom for the next days activities. At the conclusion of testing and taking samples, all students will use the antibacterial hand cleaner before returning to school.

Upon returning to school, students will be instructed where to put the water samples for the next day, and where to store the Coliscan Easygel samples. Teacher will lead a discussion about the days activities.

Day 6

Students will be instructed to get into the same groups they were in the previous day for testing and sampling. They will need to get the water samples that were saved from yesterday. The teacher will explain that the class is going to make water filters, similar to the ones used at water treatment plants, in order to try to clean the water samples that were collected the previous day. The teacher will demonstrate each step that the students must take in the process, and then help the students through that step. Before we begin, the students are to make predictions about what they think will happen to the water during the filtering process.

Step 1 is to pour the water sample into one of the clear plastic cups, and record what the water looks like. It is then supposed to stand for 5 minutes so that it can settle. While the water is settling, instruct the students how to make an alum solution. The students should mix 20 grams of alum with .25 l of tap water, and stir until it is completely dissolved. By the time they finish this, 5 minutes will be up and it will be time to record what the water looks like after it settles. This one sample of alum solution should be enough for the entire class to use.

Next, demonstrate how to skim any debris off the top of the water sample, and guide the students in this activity. Then, pour the water into a second clear plastic cup, being careful to leave any sediment behind in the first cup. Have the students observe this 2nd cup and record their observations. At this point, 3 spoonfuls of the alum solution are added to the 2nd cup, and stir. The water must stand to settle for 5 minutes again.

While the water is settling, guide the students in cutting off the top of the 2 liter bottle.

The cut should be made about 2/3 of the way down the bottle from the top. Then guide the students in attaching the square of window screen to the neck of the bottle with the rubber band. By this time, the 5 minutes of settling should be complete. Observe the water and record the observations. The water is then to stand for 5 more minutes.

While it is settling again, guide the students in the next step of constructing the filter. Each group should place their cotton balls in the neck of the bottle. At this point the part of the bottle with the neck should always remain upsidedown. Place a 3 cm layer of the aquarium charcoal on top of the cotton balls. Add a 5 cm layer of aquarium gravel, and then a 3 cm layer of sand. Your water filter is now ready for water. The instructions tell you to first run tap water through the filter to get it thoroughly wet and to rinse through any of the dust from the charcoal, sand, and gravel. Run the tap water through the filter until it runs clear. Once the water is running clear, let it sit to drain for a minute. At this point it is ready for the students to run their water sample through the filter and collect it into a clean, clear plastic cup. Record observations of the filtered water.

Now the students will be guided through running the same tests that were done at the creek the previous day. They should make predictions about the test results. Will they be the same as before the filtering? If not. What will be different? Demonstrate each one, and guide the students through it, just as on the previous day. Discuss the fact that even though the water looks clean, there could still be germs and bacteria present, and that is what the Coliscan Easygel will help to show them. Also discuss that the water treatment plant runs similar tests to help them decide what else needs to be done before the water can be sent to people's homes to be used for drinking water. Let the students know that they will be visiting a water treatment plant to see these same processes on a much larger scale. People from the Sanitation District will be visiting the school to explain what happens to our water after it goes down the drain.

Finally, instruct the students on how the report for all these activities must be done. It should include predictions of what they thought they would find in the water, both before and after it was filtered. All the procedures that were used at the creek and in the classroom should be detailed. The data should be recorded in some form, such as a set of charts. There should be a conclusion that answers the questions in the assessment, and shows what the students have learned from this activity.

Definitions/Explanations of Concepts and Skills

The water that comes through the pipes in our school and our homes, comes form natural water sources, like the creek in Boone Woods Park, near our school. Water from the creek leads to larger creeks and streams which lead into the Ohio River. The Ohio River is the main water source for the area in which we live. The water must be cleaned and tested for safety before it can be piped into schools, homes, and businesses.

There is a limited supply of fresh water that can be used for living organisms on the Earth. We must learn how to protect our water supply, and must also learn how to clean the parts that are polluted, so that it is safe to use.

There are lots of other living organisms that need clean water, besides humans. Fish and other aquatic life need adequate amounts of DO in the water in order to survive. The pH level

can also affect aquatic life. Water treatment plants make the water safe for people to drink, but it does not help the fish. We need to be careful about what goes into the water that can affect the aquatic life.

It is important that the water we use, and goes down the drain, also gets cleaned before it is released back into the environment. Some of the same cleaning, filtering and testing procedures are used before the water goes back into the river.

Assessment

1. There will be informal assessment of the interaction and cooperation of students during the group activities.

2. The most formal assessment will be the lab report. A.) It must contain predictions of what the students thought they would find out about the water, both before and after it was filtered. Ther should also be predictions about what was happening to the water during the filtering process. B.) It must contain the procedures that were followed, both at the creek, and in the classroom. C.) The data charts about testing and filtering should be included. D.) The students should answer the conclusion questions in complete sentences. The questions are as follows:

I. What did you learn about the water from the tests we took at the creek?

II. What did you learn about the water from the filtering process?

a.) What happened to the water after you added the alum?

b.) What happened to the water as it passed through the filter?

III. What did you learn about the water after the filtering process, and you ran the water tests again?

IV. Were your predictions correct? If not, why do you think that happened?

V. Why do you think this process is important before water is piped into our homes and schools?

VI. Why do you think this process is important after the water leaves our homes and schools, and goes down the drain?

The rubric for this assessment is posted.

References

Discover the Wonder, Teacher's Edition, grade 4, Scott Foresman, 1996, B 4-27

Discover the Wonder Explorer's Activity Guide, grade 4, Scott Foresman, 1996, 35-36

Discover the Wonder, Teacher's Assessment Package, grade 4, Scott Foresman, 1996, 48