**Saturday Science Lesson Plan**

**February 20, 2010**

**A) Learning Objectives**

* Students will pour their assigned pollutant into a clean water source in front of the class as part of a group story.
* Students will talk about ways to clean all of the visible pollutants out of the water in front of the class.
* In groups of four, students will pour polluted water through three different sieves to remove all of the visible pollutants from the water.
* Students will draw three pictures of a water sample after it is cleaned in different sized sieves in their journals.
* Students will write their observations their journals to provide evidence for their inference of whether water is “safe” or “unsafe.”
* Students will describe and write the similarities and differences between their model waterworks and a real life waterworks in a Venn diagram.
* Students will match puzzle pieces of a waterworks in their notebooks and color the worksheet once all pieces fit together.

**B) Standards**

* **National Science Education Standards**
  + K-4 Science as Inquiry: Abilities necessary to do scientific inquiry
  + K-4 Science as Inquiry: Understanding about scientific inquiry
  + K-4 Earth and Space Science: Properties of earth materials
  + K-4 History and Nature of Science: Science as a human endeavor
* **Indiana State Academic Standards**
  + K.1.1 Raise questions and the natural world
  + K.1.2 Begin to demonstrate that everybody can do science
  + 1.1.2 Investigate and make observations to seek answers to questions about the world
  + 2.1.1 Manipulate an object to gain additional information about it
  + 2.1.3 Describe, both in writing and verbally, objects as accurately as possible and compare observations with those of other people
  + 2.1.4 Make new observations when there is a disagreement among initial observations
  + 2.1.5 Demonstrate the ability to work with a team but still reach and communicate one’s own conclusions about findings
  + 2.1.6 Use tools to investigate, observe, measure, designs, and build things
  + K.2.1 Use whole numbers, up to 10, in counting, identifying, sorting, and describing objects and experiences
  + K.2.2 Draw pictures and write words to describe objects and experiences
  + 1.2.6 Describe and compare objects in terms of number, shape, texture, size, weight, color, and motion
  + 1.2.7 Write brief information descriptions of a real object, person, place, or event using information from observations
  + 2.2.1 Give estimates of numerical answers to problems before doing them formally
  + 2.2.5 Draw pictures and write brief descriptions that correctly portray key features of an object
  + K.3.1 Describe objects in terms of the materials they are made of
  + 1.5.2 Make and use simple picture graphs to tell about observations
  + 2.5.4 Begin to recognize and explain that people are more likely to believe ideas if good reasons are given for them
  + K.6.1 Describe and object by saying how it is similar to or different from another object
  + 1.6.1 Observe and describe that models, such as toys, are like the real things in some ways but different in others

**C) Content Knowledge**

* As populations rise, the availability of safe drinking water increases. Pollutants, such as bacteria, petroleum additives, fecal matter, and trash contaminate human water supply.; while the Water Cycle naturally ‘cleans out’ some of these impurities, some dangerous additives can still reside in untreated water.
* Most of the pollutants found in drinking water are caused by humans. From an oil company employee’s oversight in monitoring a leaky pipeline to a schoolchild dropping their water bottle on the ground, man-made pollutants end up in rivers, lakes, streams, and oceans. Negligence for safe litter disposal has consequences of unsafe water and costly water treatment facilities.
* Water that is pumped out of rivers and lakes is sent to a water treatment plant to become safe for human consumption; before the water reaches the plant, large items, such as wood, rocks, or dead animals, are screened out and sent to a landfill. Next, the water is pumped to the treatment facility and is aerated to release dissolved gases from the water, keep organic material suspended, and force grit to settle out. After this step, the water enters sedimentation tanks, where organic sludge is settled out and processed in digester tanks. The lighter scum, composed of oils, plastics, and soap, that remains after the sludge is removed, thickened, and sent to the digesters. Next, the water is filtered through sand or gravel to get rid of most bacteria, reduce turbidity and color, and remove any remaining solids. Finally, the water is sterilized when chlorine and other necessary chemicals are added to kill bacteria. The remaining sludge and scum in the digester is kept for about 1 month and then used as fertilizers or sent to a landfill.1

**D) Materials**

* 20 coffee filters
* 26 mechanical pencils
* 8 glue bottles
* 6 crayon boxes
* sand (about a bucket full)
* 14 beakers
* 10 rubber bands
* 6 sieves/strainers with large holes
* 6 sieves/strainers with small holes
* 16 baby food jars (or other small containers with lids)
* 1 fishbowl
* 1/4 cup soil
* dry leaves
* vegetable oil
* 1 styrofoam cup
* nylon fishing line
* baking powder
* molasses
* vinegar
* baking soda
* yellow food coloring
* blue food coloring
* red food coloring
* labels for baby food jars
* picture cards
* large chart paper

**E) Lesson Description**

1. 9:35-9:40 Recap last week’s material with hanging chart (see below)
2. 9:40-9:45 Discuss with students how water gets dirty, write brainstorm on board
3. 9:45-10:05 Pollution story (model how activity works first)
4. 10:05-10:20 Discuss story & whether water is safe or not, brainstorm ideas on how this water could be cleaned & why the water needs to be cleaned, write ideas on board
5. 10:20-10:40 Snack and bathroom break
6. 10:40-10:50 Introduce materials for cleaning water, use ideas from before snack to plan how to clean water, model how to clean water and how to write observations & inferences
7. 10:50-11:10 Clean water activity
8. 11:10-11:25 Discuss what happened in the activity and students’ observations. Introduce vocab words on word bank: pollution, observation, inference, waterworks
9. 11:25-11:35 Story time with waterworks book
10. 11:35-11:40 Discuss how our activity and a real waterworks were similar and different using a Venn Diagram on the large paper
11. 11:40-12:00 Puzzle/color activity
12. 5-E Learning Cycle
    * **Engage** Instructors will ask the students “What do you remember about last week’s lesson?” to gauge cognition of the water cycle. The Water Safety chart will be used (see below for schematic design) and we will begin to discuss how our actions affect the water cycle and water’s safety. Instructors will ask attention-focusing questions such as “How do you think water gets dirty?,” “Who makes water dirty?,” and “How do you know when water is dirty?” Instructors will write down student’s ideas on the board in a brainstorming chart. Next, instructors will introduce the “Who Polluted the Jordan River” story by explaining that the class will participate in telling a story about who makes our water dirty. Each pair of students will get a baby food jar with a picture on it, and each table will receive a list of “characters” in the story. Instructors will explain that when the student’s character is called in the story, he/she should come up and add the material inside their baby food jar to the water bowl; instructors will model this in front of the class to demonstrate the importance of cooperation and attention to detail. During this story, students will likely generate questions about “Why did that pollutant/gross stuff get into the water?” and “How can these things not go into the water?” After the activity, we will discuss the story and brainstorm ideas about why this water needs to be cleaned. Instructors will show available materials and students will generate ideas on how this water could be cleaned with these supplies; their ideas will be listed on the board. Instructors will introduce the terms ‘observation’ and ‘inference’ when discussing why the water needs to be cleaned; these words will be added to the word bank.

**Is Our Water Safe?**

* + **Explore** Students will explore a Waterworks by constructing two sieves and a slime mat. In groups of 4, students will gather their materials (a sieve with large holes, a sieve with small holes, coffee filters, 1 beaker full of water, and 1 empty beaker), and construct their experimental set-up. \*\*Instructors and volunteers will be available at the stations to help answer student questions and to help in set-up.\*\* Students will put samples of the previously-dirtied water (from the “Who polluted the Jordan River” activity) through a series of sieves and write/draw what the water looks like after each trial in their journals; the journal component is further explained in the “Evaluate” section below. During this activity, student-generated questions are expected to include “Why won’t the water’s color/odor change?” and “What can I do to clean my water?”
  + **Explain** The class will discuss what happened in the water cleaning activity. Instructors will ask several action questions about the student’s experiments, such as “What happened when you poured the dirty water into the large sieve/small sieve/coffee filter?”, “How do you think these things were removed from the water?,” and “Do you think this this water safe to drink now?” Instructors will explain the rationales behind students’ observations about the cleanliness of the water. Next, the vocabulary words of ‘pollution’ and ‘waterworks’ will be listed and drawn on the Word Bank and students will define what these words mean in connection to their previous activity.
  + **Elaborate** Students will listen to a story about a Waterworks; this story will provide students opportunity to elaborate on the methods of cleaning water. After the story, the class will discuss the similarities and differences between the “Waterworks” that they created and a real-life Waterworks that they learned about in the story. Instructors will make a Venn diagram on large paper and students will fill in the diagram with their ideas of what was similar and different.
  + **Evaluate** As students complete at least three trials of water cleaning with different size sieves (as described in the Explore section), they will individually write down their data in their journals. Data will be recorded on a pre-printed chart in their notebooks and will include pictures of the water at each cleaning stage and words (if possible) to describe the smell and color of the water and how much sand, rocks, and litter that remains in the water after it is sieved. Later in the session (after the reading of the Waterworks book), students will be given a paper puzzle of a Waterworks. Students will paste together the puzzle pieces into their notebook and, after they are correctly together, color the puzzle. Instructors will use these two formative assessments to evaluate student understanding of the steps to cleaning water in a Waterworks.

**F) References**

1 <http://ga.water.usgs.gov/edu/wwvisit.html>