Cool, Clear Water

Grade Level:
3-8

Subject Areas:
Science, Language Arts

Setting:
Classroom or Lake

Skills:
Communication, Observation, Deduction, Critical Thinking

Prior Preparation:
Review the "Watersheds: Where We Live" poster included in the trunks. Discuss with the class what watersheds are and how lakes are a part of the "bigger picture." Introduce water vocabulary from the back of the poster and from this activity.

Vocabulary:
Algae, Eutrophication, Monitoring, Nutrients, Sediment, Surface Water, Turbidity

South Dakota Education Standards for 4th grade:
Science
Indicator2: 4.L.2.1
Language Arts
Indicator 2: 4.L.2.2

Objective: By completing this activity the students should be able to identify on technique involved in lake and river monitoring; understand why algae and other aquatic plants grow in water, determine levels of turbidity, and understand the effects of sediments on a water body.

Materials:

½ teaspoon of instant iced tea mix
½ teaspoon of sediment
Water
Cool, Clear Water activity map
Plastic spoons
EPA's "Citizen Lake Monitoring Program" video
3 - 60cm turbidity tubes
Pitcher

Background:

A lake is much more than place for groundwater, surface water, or precipitation to collect. A lake can also control flooding, provide habitat for fish and wildlife, and give us a place to swim, boat, and fish. In addition, many people value lakes for their aesthetic appeal.

Each lake is unique in appearance, chemistry, biology, and physical characteristics. Even within a lake, these attributes can vary. For instance, water at the surface of a deep lake may be chemically and biologically different than water near its bottom. In a shallow lake, the difference between the top and the bottom waters is very small.

Moderately deep lakes undergo a natural aging process known as eutrophication. This mean, over time, they gradually fill in, becoming ponds, marshes, wetlands, and eventually, forests. Lakes are identified based on how biologically productive they are – also known as their trophic state. Clear, nutrient-poor lakes with little life are known as oligotrophic. Murky, nutrient-rich lakes that are full of life are eutrophic. Those lakes that are somewhere in between are mesotrophic. How a lake functions and ages is determined in part by its size and volume, how much sunlight it receives, the length of its shoreline, and the health of its watershed.

We all want lakes to be healthy, with clean water, plenty of fish and wildlife, and no pesky insects or weeds. However, our everyday actions can greatly affect these fragile aquatic ecosystems, degrading the very qualities that attracted us to them in the first place. For example, nutrients in fertilizers, detergents, failing septic systems, eroding soils, and animal waste can cause algae to bloom and aquatic plants to grow and multiply rapidly. Algal blooms can greatly reduce water quality. Too many aquatic plants can clog lakes, interfering with swimming, boating, and other recreational uses. There are many other ways we can affect lakes. By removing dirt and native plants from a shoreline, we can unintentionally encourage erosion or allow non-native plants to take over.

Realistically, few lakes can satisfy all our individual desires. At best, we can strive for a balance - to keep each lake healthy and serve our needs too. There are many ways that people can help lakes that include joining a local lake association, protecting the lake by controlling runoff (minimizing the use of fertilizers, using environmentally friendly garden products and using native plants as buffers around shorelines), becoming a "healthy lake" advocate, and becoming a volunteer lake monitor (people or groups who are custodians of the lake by water sampling, planting native plants and monitoring turbidity periodically).

Turbidity is the measure of water clarity or how much light can pass through water. When there is too much material in the water, such as soil particles, algae, plankton, microbes and other substances, water clarity is reduced and turbidity increases. Excessive turbidity over a period of time can negatively affect fish and other aquatic life by raising the temperature of the water, reducing photosynthesis of aquatic plants, which in turn reduces the amount of oxygen available for fish and clogging fish gills.

Lakes and streams all have a level of turbidity that should be monitored to determine the health of the water body. Turbidity can be measured by lowering a Secchi disk into the water body and immersing it until it is no longer visible. You can then measure the depth at which it disappeared. This will determine the amount of turbidity of the water body. This information can help determine the health of the lake or stream. The greater amount of turbidity, the less likely it is that the lake/stream and its inhabitants are healthy.

Procedure:

- Referring to the map, ask the class to identify the lakes and streams. Briefly discuss why lakes are important to the state. Lead a discussion about how water is replenished in lakes (by streams, rain and groundwater).
- Show the video. Have a follow-up discussion about what type of citizen involvement was shown, how they, as a class, could participate in this type of program and what they learned about lake clarity as in indication of water quality in lake.
- Divide the class into 3 groups. Assign a group to each column. Make sure the drain tubes are closed by squeezing the crimp. Have each group pour water into their column from the faucet, filling the tubes around 3/4 full.
- Column 1 is clean water. Have group one view the Secchi disk located at the bottom of the tube. It should be visible all the way to the bottom. Ask for comments about the health of such a lake (possibly nutrient-poor water - lake may not be in very good shape!). Explain the circumstances to the class of the lake with clear water. Responses to all the questions and discussions will vary.
- Column 2 is water with the soil (sediment). Add ½ teaspoon (or a little less) to the tube after it has been filled with water. Place your hand over the opening at the top and gently stir the water/sediment mixture. Talk briefly about how sediment can enter a lake (through runoff and by other means). Have a few students measure the clarity of the water looking into the tube and slowly draining the tube, using the hose crimp to slowly allow water to drain out of the drain tube (when students can read the Secchi disk, stop draining the water. Have the group take a measurement). Water clarity will not be as good a Column 1, but visibility should be fairly good. Discuss with the class what happens to the lake by additional water entering it, recreational use (boats, jet skis, and others), wildlife, etc. Allow the sediment to settle back to the bottom. After sediment has settled, place your hand over the opening and again gently agitate the sediment in the column. Have the students re-measure the water clarity now. What is the difference in their measurements? Ask for comments about the health of such a lake.

- Column 3 is water with iced tea mix. This column is a representation of algae or other biological material that can grow in lakes that receive too many nutrients (an example to use is lake land owners over-fertilizing their lawns thus causing fertilizer to runoff and enter the lake). Add ½ teaspoon of tea mix to the column. The tea mix should be dark enough so that the disk is no longer visible at the bottom of the column. Follow the same procedure as with Column 2, draining water until the Secchi disk is visible. After measuring, point out how the material in Column 3 does not "settle out" in the lake as it does in Column 2.
- Ask the students to identify the ways the water could have ended up as it is in each column (if it were a real lake). Lead a discussion with the class on options of getting involved with a local lake monitoring program.
- **Note**: this activity can be conducted at a lake. In that case, additives may not be necessary. A suggestion would be to have each group of students take a water sample at different locations on the lake and then compare water quality from each site.

Vocabulary Glossary:

Algae	aquatic plants (usually microscopic in size) that can grow as single cells or long strands of cells
Eutrophication	the natural physical, chemical, and biological changes that take place as nutrients, organic matter, and sediment are added to a lake. When accelerated by human-caused influences, this process is called cultural eutrophication.
Monitoring	to watch, observe and check especially for a special purpose
Nutrients	something that nourishes or promotes growth and repairs the natural wastage of organic life
Sediment	materials or matter that settles to the bottom
Surface water	water that is on top of the ground
Turbidity	the measure of water clarity or how much light can pass through water

Extensions:

- Introduce the phrase, "Think globally, act locally." Apply the concept to a discussion of tributaries and lakes. Discuss possible local streams or lakes that your class could adopt. Explore possibilities of involving local agencies, groups and/or organizations such as a local lake/citizens monitoring group (who can be identified and contacted through the Lakes and Streams Association in South Dakota).

- Set up a classroom aquarium with organisms and water collected from a local lake. Have students keep a journal or how the organisms were collected. Lead class discussions on how each organism is dependent on other organisms. Have students categorize the types of organisms collected and produced in your aquarium environment. Upon completion of your aquarium habitat unit, return creatures to the lake from which they came.

- Create aluminum foil watersheds that include streams, lakes, and rivers. Sprinkle pepper and drop some red, blue and green food coloring on different parts of the water shed. Use a spray bottle to make it rain, and collect the runoff. What does it look like? Where did the pollution come from? What can be done to clean it up? What could have been done before it rained? How does this affect the turbidity of the lake in the model?