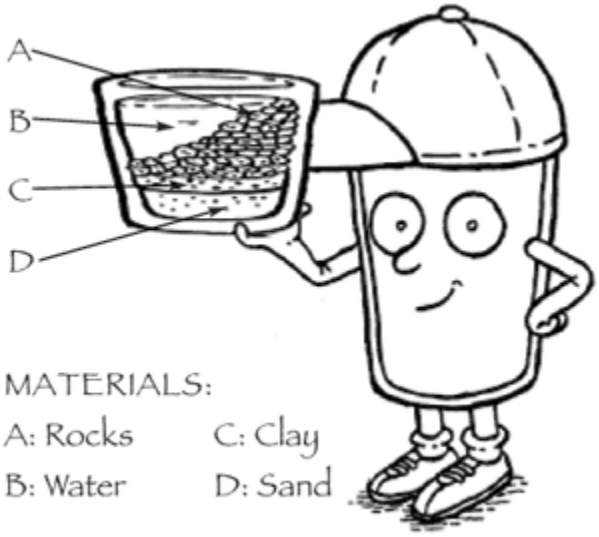
Thirstin Builds an Aquifer in a Cup (Aquifer on the Go)

Adapted from the EPA's Ground Water and Drinking Water webpage, http://epa.gov/safewater/kids/grades_k-3_thirstin_builds_an_aquifer.html

Grade Level: K-3

Background:



Many communities obtain their drinking water from underground sources called **aquifers**. Water suppliers or utility officials often drill wells through soil and rock into aquifers for the ground water contained therein to supply the public with drinking water. Home owners who cannot obtain their drinking water from a public water supply, will have their own private wells drilled on their property. Unfortunately, ground water can become contaminated by harmful chemicals, such as lawn care products and household cleaners that were used or disposed of improperly, and any number of other pollutants, that can enter the soil and rock, polluting the aquifer and eventually the well. Such contamination can pose a significant threat to human health. The measures that must be taken by well owners and water plant operators to either protect or clean up contaminated aquifers are quite often costly.

Note: This demonstration should follow a class discussion on potential sources of pollution to drinking water supplies.

Objectives:

To illustrate how water is stored in an aquifer, how ground water can become contaminated, and how this contamination ends up in a drinking water well. Ultimately, students should get a clear understanding of how careless use and disposal of harmful contaminants above the ground can potentially end up in the drinking water below the ground. This particular experiment can be done by each student at their work station.

Materials needed per student:

1. **1 clear plastic cup** that is 2 3/4" deep x 3 1/4" wide for each student

2. **1 piece of modeling clay or floral clay** that will allow a 2" flat pancake to be made by each student for their cup
3. **White play sand** that will measure 1/4" in bottom of each student's cup
4. **Aquarium gravel** (natural color if possible) or small pebbles (approximately 1/2 cup per student)
   (HINT: As many small rocks may have a powdery residue on them, you may wish to rinse and dry them on a clean towel prior to use. It is best if they do not add cloudiness to water.)
5. **Red food coloring**
6. **1 bucket of clean water** and **small cup** to dip water from bucket

Procedure:

1. Pour 1/4" of white sand in the bottom of each cup completely covering the bottom of the container. Pour water into the sand, wetting it completely (there should be no standing water on top of sand). Let students see how the water is absorbed in the sand, but remains around the sand particles as it is stored in the ground and ultimately forming part of the aquifer.
2. Have each student flatten the modeling clay (like a pancake) and cover 1/2 of the sand with the clay (have each student press the clay to one side of the container to seal off that side). The clay represents a "confining layer" that keeps water from passing through it. Pour a small amount of water onto the clay. Let the students see how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.
3. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of the cup, have students slope the rocks, forming a high hill and a valley (see Thirstin's illustration). Explain to students that these layers represent some of the many layers contained in the earth's surface. Now pour water into your aquifer until the water in the valley is even with your hill. Students will see the water stored around the rocks. Explain that these rocks are porous, allowing storage of water within the pours and openings between them. They will also notice a "surface" supply of water (a small lake) has formed. This will give them a view of both the ground and surface water supplies which can be used for drinking water purposes.
4. Use the food coloring and put a few drops on top of the rock hill as close to the inside wall of the cup as possible. As an example, explain to students that often old wells are used to dispose of farm chemicals, trash, and used motor oil. This practice can show up in the ground water and their drinking water. They will see that the color spreads not only through the rocks, but also to the surface water and into the white sand at the bottom of their cup. This is one way pollution can spread throughout the aquifer over time.

Follow up:

Discuss with students other activities that could pollute their aquifer. Assign students the task of locating activities around the school or their own homes that could pollute their

drinking water sources if not properly maintained. Allow students to drain off the water in their cups and carry home their container to refill with water and show their parents surface and ground water and how the food coloring illustrates pollution activity above their aquifer can affect all water. Students should discuss with parents what steps they can take as a household to prevent water pollution.

Michigan Content Standards:

Kindergarten

Science GLCS:

S.IP.00.12 Generate questions based on observations.

S.IP.00.13 Plan and conduct simple investigations.

S.IA.00.12 Share ideas about science through purposeful conversation.

S.IA.00.13 Communicate and present findings of observations.

S.RS.00.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

P.FM.00.11 Compare the position of an object (for example: above, below, in front of, behind, on) in relation to other objects around it.

Social Studies GLCS:

K – G5.0.1 Describe ways people use the environment to meet human needs and wants (e.g., food, shelter, clothing).

K – P4.2.1 Develop and implement an action plan to address or inform others about a public issue.

English Language Arts:

S S.DS.00.01 engage in substantive conversations, remaining focused on subject matter, with interchanges beginning to build on prior responses in literature discussions, paired conversations, or other interactions.

S.DS.00.04 plan and deliver presentations using a descriptive informational organizational pattern providing several facts and details to make their point clearly and audibly.

L.CN.00.01 understand and follow one- and two-step directions.

L.CN.00.02 ask appropriate questions during a presentation or report.

L.CN.00.03 listen to or view knowledgeably while demonstrating appropriate social skills of audience behaviors (e.g., eye contact, attentive, supportive) in small and large group settings; listen to each other, interact, and respond appropriately.

L.CN.00.04 begin to evaluate messages they experience, learning to differentiate between sender and receiver.

Mathematics:

First Grade

Science GLCS:

S.IP.01.12 Generate questions based on observations.

S.IP.01.13 Plan and conduct simple investigations.

S.IA.01.12 Share ideas about science through purposeful conversation.

S.IA.01.13 Communicate and present findings of observations.

S.RS.01.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

P.PM.01.22 Demonstrate that water as a liquid takes on the shape of various containers.

Social Studies GLCS:

1 – P4.2.1 Develop and implement an action plan to address or inform others about a public issue.

English Language Arts:

S.CN.01.03 speak effectively maintaining appropriate posture, eye contact, and position using props such as photographs or illustrations in narrative and informational presentations.

S S.DS.01.01 engage in substantive conversations, remaining focused on subject matter, with interchanges beginning to build on prior responses in literature discussions, paired conversations, or other interactions.

L.CN.01.01 understand, restate and follow two-step directions.

L.CN.01.02 ask appropriate questions for clarification and understanding during a presentation or report.

L.CN.01.03 listen to or view knowledgeably while demonstrating appropriate social skills of audience behaviors (e.g., eye contact, attentive, supportive) in small and large group settings; listen to the comments of a peer and respond on topic adding a connected idea.

L.CN.01.04 begin to evaluate messages they experience, learning to differentiate between sender, receiver and message.

Mathematics:

Second Grade

Science GLCS:

S.IP.02.11 Make purposeful observation of the natural world using the appropriate senses.

S.IP.02.12 Generate questions based on observations.

S.IP.02.13 Plan and conduct simple investigations.

S.IA.02.12 Share ideas about science through purposeful conversation.

S.IA.02.13 Communicate and present findings of observations.

S.RS.02.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

P.PM.02.14 Measure the volume of liquids using common measuring tools (measuring cups, measuring spoons).

E.FE.02.11 Identify water sources (wells, springs, lakes, rivers, oceans).

E.FE.02.12 Identify household uses of water (drinking, cleaning, food preparation).

E.FE.02.21 Describe how rain collects on the surface of the Earth and flows downhill into bodies of water (streams, rivers, lakes, oceans) or into the ground.

E.FE.02.22 Describe the major bodies of water on the Earth's surface (lakes, ponds, oceans, rivers, streams).

Social Studies GLCS:

2 – G5.0.1 Suggest ways people can responsibly interact with the environment in the local community.

2 – G5.0.2 Describe positive and negative consequences of changing the physical environment of the local community.

2 – P3.1.1 Identify public issues in the local community that influence the daily lives of its citizens.

2 – P4.2.1 Develop and implement an action plan to address or inform others about a public issue.

English Language Arts:

R.CM.02.04 apply significant knowledge from grade-level science, social studies, and mathematics texts.

S S.DS.02.01 engage in substantive conversations, remaining focused on subject matter, with interchanges building on prior responses in book discussions, peer conferencing, or other interactions.

S.DS.02.04 plan and deliver presentations using an informational organizational pattern (e.g., descriptive, cause/effect, compare/contrast) providing supportive facts and details to make their point, reflecting the source of information, while maintaining appropriate intonation and tone of voice using a prop.

L.CN.02.01 understand, restate and follow three- and four-step directions.

L.CN.02.02 ask appropriate questions for clarification and understanding during a presentation or report.

L.CN.02.03 listen to or view knowledgeably while demonstrating appropriate social skills of audience behaviors (e.g., eye contact, attentive, supportive) in small and large group settings; listen to the comments of a peer and respond on topic adding a connected idea.

Mathematics:

Third Grade

Science GLCS:

S.IP.03.11 Make purposeful observation of the natural world using the appropriate senses.

S.IP.03.12 Generate questions based on observations.

S.IP.03.13 Plan and conduct simple and fair investigations.

S.IA.03.12 Share ideas about science through purposeful conversation in collaborative groups.

S.IA.03.13 Communicate and present findings of observations and investigations.

S.RS.03.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

E.ES.03.41 Identify natural resources (metals, fuels, fresh water, farmland, and forests).

E.ES.03.42 Classify renewable (fresh water, farmland, forests) and non-renewable (fuels, metals) resources.

E.ES.03.51 Describe ways humans are dependent on the natural environment (forests, water, clean air, earth materials) and constructed environments (homes, neighborhoods, shopping malls, factories, and industry).

E.ES.03.52 Describe helpful or harmful effects of humans on the environment (garbage, habitat destruction, land management, renewable and non-renewable resources).

E.SE.03.13 Recognize and describe different types of earth materials (mineral, rock, clay, boulder, gravel, sand, soil).

Social Studies GLCS:

3 – G5.0.1 Locate natural resources in Michigan and explain the consequences of their use.

3 – G5.0.2 Describe how people adapt to, use, and modify the natural resources of Michigan. (H)

3 – P3.1.1 Identify public issues in Michigan that influence the daily lives of its citizens.

English Language Arts:

R.CM.03.04 apply significant knowledge from grade-level science, social studies, and mathematics texts.

S S.DS.03.01 engage in interactive, extended discourse to socially construct meaning in book clubs, literature circles, partnerships, or other conversation protocols.

S.DS.03.04 plan and deliver presentations using an effective informational organizational pattern (e.g., descriptive, problem/solution, cause/effect) supportive facts and details reflecting a variety of sources; and varying the pace for effect.

L.CN.03.02 listen to or view knowledgeably while demonstrating appropriate social skills of audience behaviors (e.g., eye contact, attentive, supportive) in small and large group settings.