

EDCI 786 Topics: Science Research in the Classroom Instructional Unit Outline

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Project Title The Hidden Flow

Instructional Overview

This lesson was created with the assistance of Dr. David Steward of the Civil Engineering Department at Kansas State University. It is designed to foster the understanding of groundwater and the movement of water through materials of different permeability. Groundwater is the largest non-frozen fresh water resource on Earth and it is critical that society understands groundwater flow and transport and how to manage the use of water resources. Dr. Steward has included a video of a lecture/demonstration of a groundwater model he uses with students at Kansas State. This video contains background information that will provide teachers a greater understanding of groundwater flow prior to completing this activity with students. In this activity groups of students will create a groundwater model, predict and investigate the movement of water in groundwater systems and relate this movement to the materials that make up the Earth's crust.

Timeline

Day 1 Develop the concept of groundwater, where it comes from and how it moves

- Review the water cycle from previous science courses
- Have students list everywhere they find water, then pair share and place all answers on the board (teacher listens to see if groundwater is ever mentioned)
- Discussion of groundwater and key vocabulary words—students copy and define the following eleven vocabulary words:

groundwater	aquifer	confined	unconfined
porous	permeable	impermeable	saturated
water table	recharge	discharge	

Day 2 Vocabulary work and review

- Students review each other on vocabulary words, while teacher checks for completion
- Discussion of how to visualize and apply each term
- Group demonstrations of saturated, permeable, impermeable, aquifer, unconfined aquifer, confined aquifer, water table, recharge, discharge
- Homework: Groundwater Terms Word Search

Day 3 Illustrations of groundwater models and group planning

- Check homework—discuss problems
- Show and discuss transparency, book or internet illustration of groundwater model
- View clips and discuss Dr. Steward's video
- Groups begin planning their groundwater model

Day 4 Groundwater Model work day

- Groups create of groundwater model and pump water through it calculating the flow rate
- White board results and work on write up of activity

Day 5 Groups present model to class

- Each group gives a 10 minute presentation to class demonstrating flow rate
- Groups complete compare/contrast activity and clean up
- If time allows: Discussion of pollutants and how it would travel in system, have one group demonstrate this movement in their model
- Homework assignment to explain how and why groundwater moves

Purpose

The purpose of this activity is to allow students to create a groundwater model. This model will be used to determine the permeability of the earth materials that are used to make the model. Students will calculate a flow rate (discharge) through their model and compare and contrast it with other student built models.

Grade Level 9th (English Language Learners ,ELL)

Student Learning Outcomes (Instructional Objectives)

Students will be able to:

1. Create a groundwater model illustrating the key vocabulary words
2. Predict the flow of water through the groundwater model
3. Measure the rate of flow through the ground water model
4. Compare and contrast student made groundwater models
5. Explain how and why groundwater moves

Pertinent Sections of Science Standards (8-12)

This unit of instruction addresses many additional high school science standards. The standards listed are the ones that have a direct link to the instruction.

Standard 1: Science as Inquiry, Benchmark 1, Indicators 1-5

The student actively engages in:

1. asking and evaluating research questions
2. investigations, including developing questions, gathering and analyzing data, and designing and conducting research
3. using technological tools and mathematics in their own scientific investigations
4. conducting an inquiry, formulating and revising the scientific explanations and models using logic and evidence and recognizing that potential alternative explanations and models should be considered
5. communicating and defending the design, results and conclusions of the investigation.

Standard 4: Earth and Space Science, Benchmark 1, Indicator 4

The student will understand the processes of water cycling through surface water (oceans, lakes, streams, and glaciers), groundwater (aquifers), and the atmosphere (hydrological cycle).

Standard 6: Science in Personal and Environmental Perspectives, Benchmark 4, Indicator 2

The student understands there is a need to assess potential risk and danger from natural and human-induced hazards.

Plan for Implementation

This activity will be implemented in the first quarter of the fall semester. During this quarter the students will have a large unit of study on water which will include water characteristics, water sheds, water quality testing and issues, regulations and sources. Prior to the activity the students will be familiar with the terms related to groundwater. This activity will give them to opportunity to apply these terms and visualize how groundwater moves. An extension will have the students injecting or packaging a pollutant into the model and tracing the movement of the contaminant.

Unit Assessment

Rubric will be established for the model and group work.

A percentage grade will be figured for all the other assignments

Resources (Print and Websites)

<http://www.groundwater.org>

<http://water.usgs.gov/education>

<http://www.ctic.purdue.edu/KTW/Brochures/GroundSurface>

<http://cfpub.epa.gov/surf/locate/index.cfm>

http://www.mines.edu/outreach/cont_ed/esrc.shtml source for an \$11 groundwater model kit

Video clip—ce654

Chapters 2 and 3 of Prentiss Hall Physical Science dealing with Chemistry and States of Matter

Chapter 16 of Holt Earth Science on Groundwater