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ABSTRACT

The Water in Africa Project was realized over a 2-year period by a team of Peace Corps volunteers. As part of an expanded, detailed design, resources were collected from over 90 volunteers serving in African countries, photos and stories were prepared, and standards-based learning units were created for K-12 students. This unit, "Water Pressure," helps students look at water usage in the United States and Africa to gain a clearer understanding of the problems facing both areas as population increases and natural resources are stressed. Intended for use with high school students, the unit can be used in geography, language arts, mathematics, and world history classes. Six 50-minute class periods are suggested. The unit lists materials needed, outlines applicable standards, provides essential questions, and gives student objectives. It details day-by-day procedures, assessment activities, and follow-up/enrichment activities. (Lists 10 additional resources and contains handouts.) (BT)

Water Pressure

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Funded through a grant from the Department of Education, the Water in Africa project was realized over a two year period by a team of Peace Corps Volunteers, World Wise Schools' (WWS) classroom teachers, and WWS staff members. Inspired by an idea of one creative WWS teacher, the project eventually expanded into a detailed design. The development and implementation of the design included the collection of resources from over 90 Volunteers serving in African countries, the preparation of those photos and stories, and the creation of standards-based learning units for K-12 students.

Water Pressure

Description:

Of all the water on earth, 97.5% is salt water, and of the remaining 2.5% fresh water, some 70% is frozen in the polar ice caps. The other 30% is mostly present as soil moisture or lies in underground aquifers. In the end, less than 1% of the world's fresh water (or about 0.007% of all water on earth) is readily accessible for direct human use. As human population grows, the pressure that is put upon this available water intensifies. The purpose of this lesson is to look at water usage in the United States and Africa and to gain a clearer understanding of the problems facing both areas of the world as population increases and natural resources are stressed.

Timeframe: Six 50-minute class periods

Curricular Areas: Geography, Language Arts, Math, World History

Grade Level: Grades 9-12

Materials

- World Water Use Fact Sheet
- Graph paper
- Colored pencils
- Art supplies, poster board
- Internet access for students
- Evaluation Rubric

Standards

Geography Standard 1- Understands the characteristics and uses of maps, globes, and other geographic tools and technologies

Benchmark-- Transforms primary data into maps, graphs and charts

Geography Standard 16- Understands the changes that occur in the meaning, use, distribution, and importance of resources

Benchmark-- Understands programs and positions related to the use of resources on a local to global scale

Geography Standard 17- Understands global development and environmental issues

Benchmark: Understands why policies should be designed to guide the use and management of Earth's resources to reflect multiple points of view

Language Arts Standard 4- Gathers and uses information for research purposes

Benchmark-- Uses a variety of primary sources to gather information for research topics

Benchmark-- Determines the validity and reliability of primary and secondary source information and uses information accordingly in reporting on a research topic

Benchmark-- Synthesizes information from multiple research studies to draw conclusions tht go beyond those found in any of the individual studies

Language Arts Standard 8- Demonstrates competence in speaking and listening as tools for learning

Benchmark-- Makes formal presentations to the class

Benchmark-- Responds to questions and feedback about own presentations

Math Standard 5- Understands and applies basic and advanced concepts of statistics and data analysis

Benchmark: Selects and uses the best method of representing and describing a set of data

World History Standard 44- Understands the search for community, stability, and peace in an interdependent world

Benchmark: Understands major reasons for the great disparities between industrialized and developing nations

Essential Questions

Why is there a disparity of resources between developing and industrialized nations?

Why do nations need to work together to solve resource problems?

Objectives

Students will:

- Participate in discussions about their own water resources, the resources of Namibia, and global water resources
- Transform primary data on world water usage into a graphic representation of it (using either an electronic spreadsheet or pencil and paper
- Gather information using a variety of primary sources, and synthesize them to form their own conclusions
- Create a poster that illustrates their solution to a problem

- Make a formal presentation to the class using their posters to illustrate their conclusions and solutions

Procedure

Procedure Day One

1. Begin by discussing the following facts about water. Grab student attention by asking "What do you do that takes three hours?" The following facts are from WaterPartners International: (www.water.org.)

    - **Every day over one billion people will make a three-hour journey on foot just to collect water.** How do you think your life would be different if you had to walk three hours every day just to get water? (Less time for other things, might appreciate water more, would not bathe as often, would not drink as much, etc.)

    - **There is enough water on earth to cover the United States with a blanket 93 miles thick**. If there is so much water on earth, why is there a problem with water use and supply? Why do people have to walk so far to get some? (Not all water is potable, some is salty, or polluted. Some water is not accessible, or is located in underground aquifers. Also, water is not evenly distribute. Deserts get less rainfall than do rainforests.)

    - **1.5 billion people lack access to safe water supplies. That is a quarter of the world's population.** Imagine if every fourth person in the room didn't have clean, safe water. What would happen to the friendships in the room (e.g., people would be resentful, maybe fights would break out, some people would try to share, others would horde water)?

    - **The average Honduran spends 25% of their income on drinking water. The average American spends .5% of their income on drinking water.** What would change in your life if you had to spend a quarter of your income on drinking water?

    - **Over 25,000 people die every day from water-related diseases. Worldwide that is over 80,000,000 people in the last 8 years.** What is a water-related disease? (Examples can be diseases that come from drinking parasitically contaminated water such as giardia, dysentery, or "Montezuma's revenge." Other water-related diseases come from a lack of water, (dehydration), from parasites that use water to breed (malaria), and diseases that thrive where refugees share too little water for hygiene (typhus, cholera). Do you know anyone who has had a water-related disease? Did you ever know anyone that died of a water-related disease?

    - **In the last 8 years, 130 people in the United States have died of water-related disease**. If so many people die every day, why doesn't it seem to happen here?

(Clean water, easily accessible, good government system, enough water, etc.)

2. For homework, ask the students to write a reflection about what they learned about water supplies. Ask students to write about the question "What are your feelings about the disparity of water resources that we learned about today?" The intent is to keep students thinking about water issues. Students should be given points simply for completing the assignment; as it is a reflection it does not need to be assessed using an evaluation rubric.

Procedure Day Two

1. Spend a few moments at the beginning of class to go over the homework assignment in small groups. Students should share their reflections with their small group before turning in the assignment for credit.

2. Pass out World Water Use fact sheet.

3. Give the class an overview of the facts on the sheet. Point out the various countries on the map. Domestic water use consists of water for drinking, bathing, etc. Discuss the differences you see on the raw data sheet.

4. Give each student two different colored pencils and graph paper. Instruct students to make a bar graph of the information on the sheet, with gallons on one axis and countries on the other. Color the Africa section in one color and the North America section with the other. (See Follow-up/Enrichment Activities below for instruction to make this a computer-based activity using Excel.)

5. Discuss the differences you see on the chart. The more industrialized nations use a great deal more water than the others. Why is that? (For example, cheap, easy access to water; greater natural supply of water; flush toilets versus squat toilets.)

6. At the end of class, have students add more thoughts to their reflection on what they have learned about water usage.

Procedure Day Three

1. Introduce the Water in Africa Web site to your students. Have students work in pairs reading the stories and looking at the pictures of Namibia. Students should direct their research to the essential questions," Why is there a disparity of resources between developing and industrialized nations? Why do nations need to work together to solve resource problems?" Suggest that they read the Conservation, Daily Usage, and The Source of Your Water sections first, and then look at other stories and pictures afterwards. It works well if the students take turns reading the stories out loud to one another.

2. At the end of class, make a web on the board of the main ideas that the students came up with about water usage in Africa. Themes might include the following: Namibia is a

desert country; people use much less water; people and animals sometimes share water; and water is recycled. Leave the work on the board, overhead, or paper chart to help students with their projects for the next two days.

Procedure Day Four and Five (Can take longer if teacher wishes)

1. Divide class into small groups. Tell the students that they are going to work together to create a plan for Namibia to access and share water with its neighbors. Remind the students of the essential questions, "Why is there a disparity of resources between developing and industrialized nations? Why do nations need to work together to solve resource problems?"

2. Start by reading the case study about water availability in Namibia at Population Action at: www.populationaction.org/why_pop/water/water-case1.htm

3. Discuss difficult concept vocabulary :(desalinization, aquifers, delta, hydrologists, etc.) Summarize the problems in Namibia (Rain water evaporates quickly without replenishing aquifers, no rivers, population is changing from being nomadic to stationary, desalinization plants create excessive pollution, etc.) What is Namibia's solution? (Divert water that now flows to Botswana.) What is wrong with this solution? (Will hurt delicate ecosystem, takes water from people who live along the delta, will cause political problems with Botswana.)

4. Have students brainstorm in their groups to come up with what they would like to have more information about. Remind them of what they learned on the Water in Africa site. For example one group may want to focus on researching desalination plants to find out if there are less-polluting models. Another group might want to research the Okavango River area of Botswana to understand the issue of the delicate biome there. Another group might want to research rainwater collection systems. Let each group decide what area of the problem they want to focus on.

5. Instruct the groups that they have the next two days to research and come up with a solution to Namibia's problem. On the fifth day, students will present their solution to their classmates, in the form of an oral presentation and poster illustrating their solution. Emphasize that this is a short time, so their presentations don't have to be perfect, nations spend years coming up with good solutions to problems. All solutions should be based on research and their impressions from the Water in Africa Web site.

6. Allow students the rest of the class period and the next day to work on researching their problems. Students may need help finding what they are looking for on the Internet. A list of helpful water Web sites are included. Provide the evaluation rubric to students prior to assigning homework so that the requirements for the plan are clear as they are building it.

Assessment

The students present their plans to the class as a whole. At the end of the presentations, the class can vote on which plan is the most feasible, the most creative, etc. Final projects should be assessed using the evaluation rubric: (Passed out at the beginning of the assignment.)

Follow-up/Enrichment Activities

Have students research water-use issues in the United States, for example there is a great debate over the Colorado River and California's consumption of water. A great resource is PBS's miniseries "Cadillac Desert." (A book and website are also available: www.kteh.org/cadillacdesert/home.html)

Bring in gallon jugs to represent the amount of water used in various countries to give students a visual representation of the amount of water used every day in countries around the world.

Investigate the biomes of the countries involved to see if the landscape of the country affects its water resources and usage. Instead of a paper and pencil graph in day two, students can experiment with Microsoft Excel to make graphs on the computer. See an example here.

Get more information about water systems, the comparative cost of water, and lots of good definitions about water usage in the Water Handbook at http://www.unicef.org/programme/wes/pubs/glines/water.htm

Additional Resources

Material World : A Global Family Portrait. Peter Menzel. Sierra Club Books. 1994 A great book of photographs of families all over the world surrounded by their belongings. Contains a great page of pictures of toilets of the world.

Water Science for Schools http://ga.water.usgs.gov/edu

Water Partners International http://www.water.org

World Water Day www.unesco.org/science/waterday2000

Water Aid Educational Activities www.wateraid.org.uk

Exploris www.exploris.org

World Health Organization at http://www.who.int/inf-fs/en/fact112.html

Drinking water issues in the US at the following web sites:

- The Environmental Protection Agency at www.epa.gov
- The U.S. Geological Survey at http://water.usgs.gov/
- The National Water Resources Association at http://www.nwra.org

About the Author

Carly Sporer Garrett is a teacher at Palomar High, a continuation school in Chula Vista California. She served in the Peace Corps in Mongolia in 1995-96. After she piloted this unit with her class, she reflected: I began the unit by talking about some water-related facts. The kids got into that discussion, it was really fun. That night they reflected on what they learned. The next day we looked at water usage facts and made bar graphs to show the disparity in usage between Americans and other countries in the world. That was a nice way to integrate math, and it made them shocked even more. We are lucky to have so many students who were born in Mexico, so they had a greater understanding of water usage, telling stories from personal experience. (Hauling water, not bathing so much, getting sick, etc.) We posted the graphs and moved into the rest of the unit. The students ended up with a lot more knowledge of water usage, and the week has been pretty enjoyable for them. They are not the best web-researchers around so it is kind of frazzling for me to run back and forth helping everyone find appropriate materials. Hopefully this unit improved that skill a little also.

World Water Use Fact Sheet

Country	*Domestic Water Use (Gallons/Person/Day)*
Africa	**10**
Egypt	40
Ghana	9
Kenya	13
Morocco	16
Mozambique	3
South Africa	44
Zimbabwe	14

Country	*Domestic Water Use (Gallons/Person/Day)*
North & Central America	**95**
Canada	209
Costa Rica	23
El Salvador	12
Guatemala	9
Honduras	9
United States	176

From WaterPartners International
http://www.water.org/howhelp/oneday/fact_sheet.htm

Evaluation of Water Proposal for Namibia

Student Names_____

Area	Points	Descriptors
Content Accuracy	/5	The group: • Proposed a feasible research-based solution to Namibia's water problems • Demonstrated an understanding of the available resources and infrastructure in Namibia
Content Depth	/5	The group: • Showed multiple points of view, i.e. the needs of neighboring countries as well as Namibia • Demonstrated why nations should work together to solve problems of resources
Process	/5	The group: • Used a variety of primary sources to gather information • Synthesized information and drew conclusions about Namibia's water problems • Modeled the cooperative nature of their solution for Namibia through behavior in their group, e.g., shared duties, contributed to the work of the group, compromised when necessary
Presentation and Neatness	/5	The group: • Demonstrated competence in speaking through the formal presentation, e.g., included definitions for clarity, supported main ideas using examples, statistics, and analogies when appropriate • Had a neat and appealing visual component • Responded to questions and feedback about own presentations, e.g., defended the idea, expanded on the topic or used logical arguments
Creativity	/5	The group: • Was creative and innovative in using local resources to solve the problem •
Total	/25	Beginning Level of Proficiency 0-5 Limited Level of Proficiency 6-10 Adequate Level of Proficiency 11-15 Proficient Level of Proficiency 16-20 Advanced Level of Proficiency 21-25

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