PROJECT WET Water Education for Teachers

California Project WET Gazette

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COMMON WATERS & STANDARDS

I'm writing this article on World Water Day – March 22nd – but spent a portion of the morning in a webinar on applying the national common core standards. Language arts and math skills are the subjects of the common core, but the standards focus on an interdisciplinary application demonstrating how these skills are relevant in daily life. The presentation was a welcome sea change after years of reports from teachers and Project WET facilitators regarding administrative dismissal of Project WET as too science and not supportive of language arts and math. This has mystified me since many Project WET activities focus on student application of the same skills of calculations, reading comprehension, spelling and ability to analyze, evaluate and synthesize data to the unique language of science – and does it with a focus on current issues or water concepts relevant to current issues plus a bit of history to boot!

A case in point is the Project WET activity *'A Grave Mistake' (p: 315)*, which begins with students listening to – or reading – a scenario for clues regarding a case of arsenic poisoning in their community from contaminated groundwater supplies. Students are apprised of the current EPA standard for arsenic in drinking water (10 parts per billion) and provided with arsenic concentrations from existing wells in the town. Arsenic compounds have been used in products ranging from paints to pesticides, and the plotted data and historical clues quickly focus attention on a wood preservative factory. Students are asked how they should use the evidence of the well data – with several additional factors tossed in to consider. However, the story takes another turn after an independent study proves the factory is not the source of the contaminant and students must re-evaluate the written as well as plotted data to determine where to drill additional monitoring wells to locate the source of the arsenic, which turns out to be the Civil War era graveyard.

'A Grave Mistake' emphasizes the application of basic language arts skills to solve a current science issue with historic roots – with a little math comprehension thrown in with the well data on concentration ratios. However, the math takes center stage in the activity *'Reaching Your Limits' (p: 371),* an activity that helps students define the terminology of concentration ratios used in water quality testing, while introducing them to drinking water quality standards and the effort involved in meeting these standards. The activity concludes with having students apply their understanding to the Consumer Confidence Report (CCR) that your public water supplier is required to publish each year – arsenic is one of the contaminants for which public water suppliers are required to test. An added extension you may consider using with older students is a review of the **U.S. Geological Survey** fact sheet titled ***'Arsenic in Groundwater Resources of the United States.'*** The fact sheet describes how arsenic concentrations are monitored using well data as in *'A Grave Mistake.'* The fact sheet also notes a couple of facts surprising to many Project WET participants: 1) Arsenic is a naturally occurring substance that is commonly found in groundwater aquifers throughout the United States; 2) Water agencies with public wells serving community water system are required to mitigate contaminant concentrations to meet EPA health standards for drinking water quality while private wells are not.

'The Incredible Journey' (p: 155) is probably the most popular Project WET activity and is another example of an activity with strong language arts and math applications. Students are not only writing a story of their journey as a molecule in the water cycle, but are combining the knowledge of sentence structure, use of descriptive terminology and artistic flair learned in language arts with the terminology learned in science to describe the transformative processes water goes through as it moves between the states of solid, liquid and gas. The cubes used in the game are weighted to simulate water movement in the water cycle and the student worksheet provided in California Project WET workshops allows the class to easily record and calculate ratios, percentages and fractions to assess where 'water molecules' in the class spent most of their time (ocean, glacier, etc.).

Though weighted, *'The Incredible Journey'* cubes only provide an approximation of reality, but the activity is a great springboard to *'A Drop in the Bucket' (p: 257)*, where students do calculate the current percentages of Earth's water cycle 'reservoirs,' and *'Blue Planet' (p: 125)*, where students are introduced to probability and the use of random sampling to calculate the percentage of water covering

the surface of the Earth. *'Blue Planet'* and *'The Incredible Journey'* also provide information to investigate residence times – how long water may stay in a given location – which integrates well into standards focused on fostering student understanding of geologic time scales. Both activities have students using figures from U.S. Geological Survey research. The activity *'Water Inspirations' (p: 535)* also provides a wonderful follow-up to *'The Incredible Journey.'* Students discover how water in all its forms has inspired great literature and art, then are invited to produce their own works of art on water through guided writing exercises – with primary students focused on describing the three forms of water.

Looking for something to supplement more hard-core courses on chemical and physical science? The *'Adventures in Density' (p: 3)* lab provides a basic introduction to the concept, but the 'Heavy and Light Reading' portion relating density concepts to excerpts from literature can be used to break even he most sophisticated density course out of the lab. *'What's the Solution?' (p: 37)* has students investigating the dissolving power of water to solve a crime. Students are developing investigations and writing procedures to distinguish the unique properties of water from other clear liquids in *'Is There Water on Zork?' (p: 27)* and I've had high school students demand they get a chance to re-write the directions for *'H2Olympics' (p: 13)* – an activity focused on the adhesive and cohesive properties of water – in order to make the procedures 'more fair.' How often to you have students *begging* you to let them standardize anything?!

How are these examples of Project WET activities not supporting the use of math and language arts skills? And how is it not a benefit to have our youngest citizens learning from an early age how to comprehend universal concepts like the water cycle or properties of water and be able to apply that knowledge to interpret and analyze scientific data relevant to their daily lives? Our education system tends to train students from an early age to store knowledge and skills in mental boxes for each subject area. Activities like those in Project WET are designed to break open those mental boxes using scenarios requiring students to use skills from multiple subject areas.

The examples above are just a few Project WET activities that do this. Other suggested activities from Project WET Guide 2.0 with language arts and math components include: *'Aqua Bodies' (p: 45) /'Aqua Notes' (p: 51), 'Invaders!' (p: 263), 'Nature Rules!' (p: 277), 'Back to the Future' (p: 307), 'High Water History' (p: 321) and 'There Is No Away' (p: 453).* More activities integrating language arts skills include: *'Poison Pump' (p: 107), 'River Talk' (p: 175 'Hitting the Mark' (p: 327), 'Super Bowl Surge' (p: 405), 'Make-a-Mural' (p: 515) and 'Raining Cats and Dogs' (p: 521).* Others integrating math skills include: *'Your Hydrologic Bank Account' (p: 223), 'Color Me a Watershed' (p: 239), 'Money Down the Drain' (p: 351), 'The Price is Right' (p: 357) and 'Water Audit' (p: 469).*

As always, I hope you find some of the information above or elsewhere in the Gazette of use. Those of you curious to learn more information on some of the topics mentioned above may want to check-out the **'WEBSITES OF INTEREST'** section of this newsletter. I hope everyone is off to a wonderful start to Spring!

WEBSITES OF INTEREST

World Water Day 2012

http://www.unwater.org/worldwaterday

Join the World Water Day 2012 campaign "Water and Food Security." There are 7 billion people to feed on the planet today and another 2 billion are expected to join by 2050. Statistics say that each of us drinks from 2 to 4 liters of water every day, however most of the water we 'drink' is embedded in the food we eat: producing 1 kilo of beef for example consumes 15,000 liters of water while 1 kilo of wheat 'drinks up' 1,500 liters. At all steps of the supply chain, from producers to consumers, actions can be taken to save water and ensure food for all. *See the Winter Gazette for information on the Project WET activity 'Virtual Water (p: 289).*

How Much Water is on Your Plate?

http://www.onedrop.org/calcul/en/

Your eating habits have an impact on water resources, since water is needed to produce goods and food. Between 2,000 and 5,000 liters of water are needed to produce the food consumed by one person in one day – and roughly 30% of all food produced ends up in the garbage can. Drag and drop food items onto the plate to create a complete meal choosing at least one food item from each of the three major food groups. The water meter at the bottom left will calculate the water footprint of your meal. Try to make a meal with a low water footprint.

Common Core State Standards

http://www.corestandards.org

The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

Consumer Confidence Reports (CCR)

http://water.epa.gov/lawsregs/rulesregs/sdwa/ccr/

The Consumer Confidence Rule requires public water suppliers that serve the same people year round (community water systems) to provide consumer confidence reports (CCR) to their customers. These reports are also known as annual water quality reports or drinking water quality reports. The remaining public water systems in the U.S. are not required to provide CCRs, because they do not serve the same people on a day-to-day basis throughout the year. The CCR summarizes information regarding sources used (i.e., rivers, lakes, reservoirs, or aquifers) any detected contaminants, compliance and educational information. The reports are due to customers by July 1st of each year. *Check-out the Project WET activity 'Reaching Your Limits' (p: 371).*

Chemistry Explained: Arsenic http://www.chemistryexplained.com/elements/A-C/Arsenic.html
Arsenic compounds have been known since at least the days of Ancient Greece and Rome (thousands of years ago). They were used by physicians and poisoners. The compound most often used for both purposes was arsenic sulfide. Arsenic was first recognized as an element by alchemists. Alchemy was a kind of pre-science that existed from about 500 B.C. to about the end of the 16th century. People who studied alchemy—alchemists—wanted to find a way of changing lead, iron, and other metals into gold. They were also looking for a way to have eternal life.

Old Cemeteries, Arsenic, and Health Safety http://crm.cr.nps.gov/archive/19-10/19-10-6.pdf
Embalming human remains for burial has taken a long road to its pre- sent state as an art that now minimizes health and environmental concerns of burials. Along the way, health and safety were not always considerations. From the Civil War until about 1910, arsenic was the main ingredient in the embalming fluids used widely throughout the country. *Yes, 'A Grave Mistake' (p: 315) was based on actual studies!*

USGS Fact Sheet http://pubs.usgs.gov/fs/2000/fs063-00/pdf/fs063-00.pdf
Arsenic in Groundwater Resources of the United States. The fact sheet describes how arsenic concentrations are monitored using well data as in *'A Grave Mistake' (p: 315)* The fact sheet also notes a couple of facts surprising to many Project WET participants: 1) Arsenic is a naturally occurring substance that is commonly found in groundwater aquifers throughout the United States; 2) Water agencies with public wells serving community water system are required to mitigate contaminant concentrations to meet EPA health standards for drinking water quality while private wells are not.

Arsenic in Drinking Water http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm
Arsenic is a semi-metal element in the periodic table. It is odorless and tasteless. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. EPA has set the arsenic standard for drinking water at .010 parts per million (10 parts per billion) to protect consumers served by public water systems from the effects of long-term, chronic exposure to arsenic. This web site is designed to provide you with information about arsenic in drinking water and provide guidance materials to help the states and water systems comply with the standard. *See the extensions for the activity 'Get the Groundwater Picture' (p: 149-150) for suggestions on including contaminants in the activity.*

USGS Cooperative Water Program http://pubs.usgs.gov/fs/2008/3043/pdf/fs20083043.pdf
USGS RESEARCH HELPS THE COUNTY OF LOS ANGELES ADDRESS NEW ARSENIC STANDARDS!
In January 2006, the U.S. Environmental Protection Agency (USEPA) enacted stringent standards on arsenic in drinking water. The new limits raised concerns about wells in the Antelope Valley of northern Los Angeles County that had high levels of naturally occurring arsenic. To meet the new standard, Los Angeles County Waterworks District No. 40, considered building arsenic-removal facilities at a cost of nearly $34 million. Instead, the District initiated a well-modification project that was based on the findings of a U.S. Geological Survey (USGS) scientific investigation.

Microbial Transformations of Arsenic http://health.usgs.gov/dw_contaminants/Elements.As.pdf
Microbial Transformations of Arsenic in the Environment: From Soda Lakes to Aquifers
Although arsenic is highly toxic to humans, and indeed most other forms of life, some microorganisms have evolved to tolerate relatively high concentrations of the metalloid, while specialist examples even thrive on the element, using it as a source of energy for growth. This surprising array of microbial processes, together with inorganic and physical processes, constitutes the global arsenic cycle.

National Ground Water Association http://www.ngwa.org/Fundamentals/Pages/default.aspx
A nonprofit organization, NGWA is composed of U.S. and international groundwater professionals — contractors, scientists and engineers, equipment manufacturers, and suppliers. Our purpose is to provide guidance to members, government representatives, and the public for sound scientific, economic, and beneficial development, protection, and management of the world's groundwater resources.

World Water Monitoring Challenge http://www.monitorwater.org/

World Water Monitoring Challenge™ is an international education and outreach program that builds public awareness and involvement in protecting water resources around the world by engaging citizens to conduct basic monitoring of their local water bodies. In 2011, approximately 340,000 people in 77 countries monitored their local waterways. We challenge you to test the quality of your waterways, share your findings, and protect our most precious resource! *Try out the Project WET activities by clicking on 'guides and resources' under the resources tab – or search the 'Watershed' column in the Topics cross reference chart in Project WET Guide 2.0 (p: 548-549).*

Creek Watch App

http://itunes.apple.com/us/app/creek-watch/id398420434

Snap a picture - Save a stream! New iPhone app brings the power of crowdsourcing to local waterways The future of the world's water supply just might lie in the palm of your hand--and other hands around the world. Creek Watch, an iPhone application developed by IBM Research, empowers citizens worldwide to monitor their watersheds and report conditions. Every update provides vital data that local water authorities can use to track pollution, manage water resources and plan environmental programs. The free Creek Watch app is easy to use. Simply stop by any waterway and, with the phone's GPS enabled, take a photo and submit three crucial pieces of data based on your observations. For more information, go to: http://www.ibm.com/smarterplanet/us/en/water_management/article/creek_watch.html

USGS: Water Science for Schools

http://ga.water.usgs.gov/edu/sc1.html

What is the water content of things? Water is needed to grow not only everything we eat but also to produce almost all the products we use every day. This water is either supplied by nature as precipitation and/or added by people during the growing/production process. You can't tell by the size of a product or the appearance of a food how much water was actually used to produce the item.

Water Facts & Fun

http://www.water.ca.gov/education/wffcatalog.cfm

Lots of free materials for California educators, including ***'The California Water Works'*** that has a colorful comic book character, Professor Goodwater, leading students through the water cycle, showing them how water is delivered through California's built and natural water systems to the end users. Guidelines for water conservation are provided as well.

DiscoverWater.org

http://www.discoverwater.org

Targeting learners aged eight to 12, DiscoverWater.org shows children how water affects them - and how they can affect water. The website combines kid-friendly illustrations and animation with interactive, science-based activities covering everything from the water cycle and oceans to water conservation and the role of water in the human body. Students can also collect "Take Action" items throughout the site and create their own personalized printable "Take Action Poster" to help them remember how they can conserve and protect water. *This Project WET Foundation website is designed to complement and extend activities in your Project WET Guide!*

Project WET Portal

http://portal.projectwet.org/

The Project WET Portal is a dynamic online destination where Project WET users around the world can meet and collaborate. There are two levels of membership: General and Guide. General Membership is free and open to anyone who is interested in Project WET. General members can participate in discussion groups for the Project WET Curriculum and Activity Guide 2.0 and Discover Water as well as some other areas of the Portal, but won't be able to see or access all parts of the Portal. Guide Membership is one of the "perks" of participating in a Guide 2.0 workshop. Using the code on the back of the new Guide, Guide members can log in, complete a profile and have access to all materials on the Portal!

If you would like more information on Project WET please contact Brian Brown, California Project WET Coordinator at: projectwet@watereducation.org or (916) 444-6240.

Check our website www.watereducation.org **and/or contact us for updates.**