Author: Kevin Jacoves

Unit Title: “Water,water everywhere, nor any drop to drink.” Samuel Taylor Coleridge

Course/Grade Level: General Science, Eighth Grade

Time Requirements for this plan: In a block schedule in which students meet every other day for an 80 minute block two to three weeks will be required to complete this unit. Please note that activity three requires that plants be grown prior to the actual activity taking place. If Chia seeds are used in the lab setup then they should be started 7-14 days prior to the start of the actual activity.

Overview of Unit Plan: Clean drinking water is in both short supply globally, and critical for the health and well being of both people and the animals that people depend on for food and comfort. Although Americans may take the availability of plentiful, clean water for granted; events such as Hurricanes Katrina in the Gulf coast, and Sandy in the Northeast have shown that clean water supplies can be disrupted with disastrous effects on the local populations.

This unit plan has students first look at the role of impure water in the transmission of disease. The unit plan then has students inquire into how filters work to remove impurities from water, then has students build and test their own filtration systems. Students then look at how agricultural practices impact water quality and then review three articles on water rights between the US and Mexico, Glacier retreat and the socio-economic effects in Africa, and a National Geographic article on access to fresh water.

Students will then research different methods used to create fresh water, choose a region of the world with poor access to clean water and create an action plan designed to increase the supply of clean water for the region.

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| **Stage 1 Desired Results** |
| ESTABLISHED GOALS G1 NJCCS 5.1.8.A.1 Demonstrate understanding and use interrelationships among central scientific concepts to revise explanations and to consider alternative explanations.G2 NJCCS 5.1.8.B.1 Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.G3 NJCCS 5.1.8.1.B.2 Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.G4 NJCCS 5.1.8.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others’ ideas, observations, and experiences.G5 NJCCS 5.1.8.D.2 Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model-building.G6 NJCCS 8.1.8.A.1 Create professional documents (e.g., newsletter, personalized learning plan, business letter or flyer) using advanced features of a word processing program.G7 NJCCS 8.1.8.A.3 Create a multimedia presentation including sound and images.G8 NJCCS 8.1.8.A.4 Generate a spreadsheet to calculate, graph and present information.G9 NJCCS 8.1.8.A.5 Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. | ***Transfer*** |
| *Students will be able to independently use their learning to…* T1—SWBAT view a problem from multiple viewpoints and discuss the relative benefits and trade offs of those viewpoints. T2—SWBAT design and conduct an investigation to determine the advantages and disadvantages of different processes with a common end product.T3—SWBAT respect and value the role they can have on impacting the sustainable worldT4 –When given data showing costs and benefits of multiple options SWBAT rank the options in terms of feasibility and be able to recommend options tailored to specific situations. |
| ***Meaning*** |
| UNDERSTANDINGS *Students will understand that…*U1-Clean water is essential for the health and well being of both human and animal populations.U2-Access to clean drinking water is not always available to local populations.U3-a solution that may be the chosen one for a region may not be applicable to another region. | ESSENTIAL QUESTIONS E.1 can clean drinking water be created?E.2 What are the effects of drinking impure water?E.3 How can societies without access to clean water bring clean water to their populationsE.4 How does the access to clean drinking water change or modify the perceptions and actions of local populations.E.5 How does global warming impact the availability of water? |
| ***Acquisition*** |
| *Students will know…* K1 Water can be made drinkable by multiple means such as chemical treatment, ultraviolet treatment, physical filtering, desalination and Reverse-Osmosis filtration.K2 These methods have different costs and steps associated with them.K3 Some methods may be more suited to certain locations due to cost and the impurities found in the local water supplies.K4 Access to water has historically been important in multiple locations around the world.K5 Global warming is impacting many communities access to water and will have political, sociological and economic effects on a global scale. | *Students will be skilled at…* S1 Designing, building and testing simple filters in order to rank their ability to filter water.S2 Researching regions of the world and pinpointing local factors and conditions that influence decision-making on important life-affecting issues.S3 Ranking the different options available and making the best overall choice for a given location/situation. |
| **Stage 2 - Evidence** |
| **Evaluative Criteria** | **Assessment Evidence (performance Tasks** |
| 1. Students to craft an informational brochure/create a PSA that informs the audience of the importance of clean water for health.
2. Review lab books against the lab report rubric, Use the micro-organism trivia questions as formative assessment.
3. Review lab reports using lab report rubric. Utilize student recommendations as an additional level of formative assessment.
4. Research will be utilized in the culminating activity.
5. Students will create a chart or decision matrix that provides the pros and cons of each method of water treatment. This can be incorporated into an informational brochure or PSA and will be used as part of the decision making process when creating their action plan (see step below).

6. Culminating activity: Students to synthesize knowledge gained into a recommendation or ‘action plan’ for a specific region of the world or for a natural disaster occurring in a populated area. Recommendation will be assessed via rubric.  | TRANSFER TASK(S): 1. Students play Pandemic Two, a game in which they craft a bacterium, virus or parasite, choose vectors of transmission and attempt to infect the world. Game found at <http://www.addictinggames.com/strategy-games/pandemic2.jsp> . Upon completion of the game, students to discuss strategies that increased virulence. Posit to the students that they are workers at the CDC; with their new knowledge discuss issues of water safety and hygiene.
2. Water STEM filtration ideas—students build a ‘candy’ filter and learn about some of the issues with water filtration. Students then use different sized filters to screen out pond water. Activity found at: <http://www.watercampws.uiuc.edu/waterclear/labs/lesson_filt.htm>
3. Students model run-off with plants and without plants to show the effects of ground water pollution. Use <http://soils.usda.gov/education/resources/lessons/experiments/erosion/> to build the structure. Make one structure without plants, and one with grass seed or chia seed grown in it. Students to analyze the results and research the use of cover crops.
4. Students to choose a resource and investigate. Options include:
* The role of glaciers in fresh water in Africa--<http://www.unep.org/pdf/UNEP-GEAS_AUG_2012.pdf>
* Listen to Colorado water rights from PRI <http://www.theworld.org/2010/04/colorado-river-water-rights/>
* National Geographic article on access to fresh water <http://environment.nationalgeographic.com/environment/freshwater/drinking-water-sanitation/>
1. Students to research water purification options:
	* **Boiling water** kills some germs but does not remove all of them or chemicals and dirt.
	* **Chemical treatment (chlorine)** kills bacteria and viruses. It is the most common method to disinfect water.
	* **Flocculation** happens when a chemical is added that makes small particles collect together to form larger clumps that are heavier than water.
	* **Sedimentation** happens when particles settle out of the water.
	* **Filtration** moves water through layers of trapping material (such as sand) or passes water through a membrane that has pores to exclude contaminants such as microorganisms, dirt and chemicals.
	* **Water treatment plants** remove or kill microorganisms before sending water through a closed network of piping and into our homes, schools and businesses. With the exception of boiling the water, they may use all of these methods mentioned above to make our water safe to drink.
2. Students to choose a region of the world that has a need for pure water, research the specific needs of the region and then craft a recommendation designed to best answer the need. The recommendation must use an aspect of Web 2.0 technology.
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| Group interactions will be assessed on an on-going basis utilizing short conferences during each activity.  | OTHER EVIDENCE: Groups will share ‘publish’ their findings after each activity. |
| **Stage 3 – Learning Plan** |
| *Summary of Key Learning Events and Instruction** **Lesson One—Kick-Off Activity: The role of water in the spreading of infectious diseases.**

Working in small groups students play the disease game in which some students are given a list of symptoms and other students play the role of physicians and attempt to determine the affliction, the method of transmission and the cure. Following the game students will then go online and play the game Pandemic Two in which there goal is to craft a virus, bacteria or parasite and attempt to infect the world. Upon completion of both games students will debrief the session using inside/outside circles. Students will be asked to highlight the different methods of infection and then brainstorm ideas to minimize the risk of future disease outbreaks. Questions will be structured to highlight the importance of clean water for drinking and bathing. G1,G3,T1, U1,E2, * **Lesson Two—the effects of plantings on storm run-off.**

Students will create models of planted and unplanted plots of land and then monitor the quality of water that runs off of the land. Students will monitor water quality quantitatively by means of Secchi disk analysis and qualitatively with photographs. Students will prepare a lab report detailing their analysis and will use the water collected during this activity when they build their filters in Lesson Three. G1, G2, G3, G4, G5, T2, U2, E1, E3, * **Lesson Three—Candy Filter STEM activity.**

Students will model the effects of filtration by using different sizes and shapes of candies. Upon completion of the model activity students will build filters using found materials and then attempt to filter the water created in lesson two. G1, G2, G3, G4, G5, E1, E3, K1, S1 * **Lesson Four—Research on different water purification methods.**

Students will break into small groups and research an aspect of water purification. Each student group will put together an informational website or brochure listing the benefits and costs associated with their chosen method. G3, G4, G6, G7, G8, G9, T1, T2, T4, U3, E1, E3, * **Lesson Five—Access to fresh water.**

Students will review three informational sources about fresh water access. G3, T1, T3, U2, U3, E3, E4, E5, K3, K4, K5* **Lesson Six—Culminating activity: Bringing fresh water to a region of your choice!**

Students will research a world location and/or situation and then create a proposal to bring fresh water to the region. Students will synthesize information gained in previous lessons and provide a plan of attack documented electronically. G3, G4, G5, G6, G7, G9, T1,T3, T4, U1, U2, U3, E1,E2, E3, E4, E5, K1, K2, K3, K4, K5, S2, S3,  |
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