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| **Water Dawgs Lesson Plan**  **Topic: Drinking Water and Human Health**  **Learning Module #11** | | | |
| **Lesson Objectives(s):** | | * SWBAT analyze primary source documents to identify the cause and effects of the Flint Water Crisis. * SWBAT describe the causes, symptoms, method of transmission, and water treatment for water borne illnesses. * SWBAT explain how drinking water is related to human health. * SWBAT create an action plan to address potential problems in local water quality. | |
| **Associated NGSS Standard(s):** | | N/A | |
| **Associated A.P. Environmental Science Standard(s):** | | * EIN-3-C-Identify sources of human health issues that are linked to pollution * EIN-3-D-Explain human pathogens and their cycling through the environment | |
| **Materials:** | | * PowerPoint * Printed materials:   + Lesson worksheets (WS) – 1 copy per student   + “Handout 2 – Lead Poisoning and Health” (Handout 2 [H2]) – 1 copy per student   + “Handout 3 – Why didn’t Flint treat its water?” (Handout 3 [H3]) – 1 copy per student   + Fact sheets for “Disease-causing microbes” activity –Each student will need ONE fact sheet… divide number of students by 6 to determine how many copies of each fact sheet you will need     - Campylobacter (H4)     - Cryptosporidium (H5)     - E. coli (H6)     - Giardia (H7)     - Hepatitis A (H8)     - Shigella (H9)   + *NOTE-> There is no H1 for this learning module* * Poster paper * Sharpies/colored pencils/makers | |
| **Instructor to do before lesson:** | | * Print: * Printed materials:   + Lesson worksheets (WS) – 1 copy per student   + “Handout 2 – Lead Poisoning and Health” (Handout 2 [H2]) – 1 copy per student   + “Handout 3 – Why didn’t Flint treat its water?” (Handout 3 [H3]) – 1 copy per student   + Fact sheets for “Disease-causing microbes” activity –Each student will need ONE fact sheet… divide number of students by 6 to determine how many copies of each fact sheet you will need     - Campylobacter (H4)     - Cryptosporidium (H5)     - E. coli (H6)     - Giardia (H7)     - Hepatitis A (H8)     - Shigella (H9)   + *NOTE-> There is no H1 for this learning module* * Look over PPT/Lesson plan   + NOTE-> The EXPLORE activity (Investigating the Flint Water Crisis) has multiple parts and thus is more complicated than usual. Make sure to look over the part and following the timing suggestions. * Check to make sure videos work on projector * **NOTE: The introductory song (“Fresh Water for Flint” by Jon Connor) has STRONG language (i.e., multiple F bombs). Go over this with the course supervisor before class to determine if this is OK to play. You may need to obtain parental permission to listen to the song during class, or look for a clean version.** * The engage and explore parts of this lesson are sourced from the website teachrock.org. We encourage you explore this website and sign up for an account if you are using these materials! | |
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| **Part of Lesson** | **Time** | **Duration** | **Lesson** |
| **ENGAGE** | 9:00 | 25 | “Fresh Water for Flint” by Jon Connor – Song Analysis  \*\*Play Jon Connor’s song[**“Fresh Water for Flint”**](https://www.youtube.com/watch?v=EsmoxpWfi80)  **(N*ote: The song contains strong language, teacher discretion advised. The link will open to the official song on YouTube, we suggest loading the video before class to avoid showing advertising during class.*)**  ^^Allow 5 min  \*\*Pass out the lesson worksheets (WS)  \*\*Then, have students answer the following questions silently on their lesson worksheets (WS):   1. What event is being referred to in the sample at the beginning of the song? 2. Based on any prior knowledge, what do you know about the Flint water crisis? 3. What do you feel is the mood of this song? What emotion do you think Connor is conveying? What aspects of the song lead you to this conclusion? (*Students might consider the prevalent use of powerful drums, the strong lyrics, the angry tone in Connor’s voice, etc.*) 4. Why might Connor be conveying this emotion in the song? 5. Why might Connor feel so strongly about the situation in Flint? (*Connor is from Flint, Michigan.*)   ^^Allow 10 min  \*\*Discuss the song, questions, and student answers.  ^^Allow 10 min |
| **EXPLORE** | 9:25 | 1 hour, 10 min | Investigating the Flint Water Crisis  **PART 1**  \*\*Tell students that in this lesson they will be examining the science and politics behind the ongoing Flint water crisis, which relates to the water treatment. To warm up, discuss each of the following questions as a class:   1. What is water treatment? (*Water treatment is the process by which water is cleaned and disinfected for healthy consumption*.*)* 2. Why is water treatment important? What might result from ineffective water treatment?   ^^Discuss questions, Allow 5 min.  **PART 2**  \*\*Show the Water Treatment Diagram**.** Go over with the class each step of water treatment.  ^^Allow 5 min.  **PART 3**  \*\*Tell students they will now be watching an interview with Dr. Mona Hanna-Attisha, a pediatrician who was the first to discover high levels of lead in Flint’s drinking water. Play Video 1: [**“Dr. Mona Hanna-Attisha on Discovering Lead in Flint.”**](http://www.c-span.org/video/?c4802313/mona-hanna-attisha-discovering-lead-flint)  After the video has played, discuss each of the following questions with the class:   1. According to Hanna-Attisha, what types of products or processes expose people to lead? 2. Why does Hanna-Attisha describe lead exposure as a form of “environmental injustice”? What kinds of people are most affected by lead exposure? 3. Why did Hanna-Attisha “freak out” when discovering there was lead in Flint’s water supply?   ^^Allow 10 min  **PART 4**  \*\*Pass out [Handout 2 – “Lead Poisoning and Health”](https://3o9d0y1wloj7e90sc37nviar-wpengine.netdna-ssl.com/wp-content/uploads/Handout-2-%E2%80%9CLead-Poisoning-and-Health%E2%80%9D.pdf) from the World Health Organization (H2).  \*\*Let students may decide whether they want to read the article silently or aloud as a class.  \*\*Then, have students discuss the following 5 questions with a partner:   1. What is lead? Where is it found? 2. How does lead enter the body? 3. What systems of the body does lead affect? 4. What are some of the symptoms of lead poisoning? 5. What kinds of people are particularly vulnerable to lead poisoning? Why?   \*\*Then, discuss answers as a class.  ^^Allow 20 min  **PART 5**  \*\*Play Video 2:  [**“Dr. Mona Hanna-Attisha on the Cause of the Flint water crisis.**](https://www.c-span.org/video/?c4802321/mona-hanna-attisha-reason-flint-water-crisis)**”**Then show  Map of Michigan.  \*\*After the video has played, discuss each of the following questions with the class:   1. According to Hanna-Attisha, why did the city officials of Flint decide to switch water sources? What new source of water was chosen? 2. Based on the map of Michigan, did the city of Flint lack any nearby sources of fresh water? 3. What caused lead to get into the water? Was lead present in the Flint river, or did get into the water in another way?   \*\*Show theWater Treatment Diagramonce again.  Then, discuss each of the following questions with the class:   1. What component of the water treatment process is Hanna-Attisha referring to? 2. What might have caused the city of Flint to not include this component in the treatment of the Flint river water?   ^^Allow 10 min  **PART 6**  \*\*Pass out Handout 3 – “Why didn’t Flint treat its water? An answer, at last” (H3)  \*\*Let students may decide whether they want to read the article silently or aloud as a class.  \*\*Then, have students discuss the following 5 questions with a partner   * 1. According to the article, was Flint obliged to provide corrosion treatment for their water supply?   2. How much would it have cost the city to add this treatment?   3. When did the city start adding corrosion control to the water treatment facility? Why didn’t they make this decision sooner?   4. What excuse did the state of Michigan make for not including corrosion control in Flint’s water treatment? Did they admit it was a cost-cutting measure?   5. According to the article, how long were Flint residents exposed to lead in the drinking water before action was taken? Do you think this is an acceptable amount of time to address such a concern?   \*\*Then, discuss answers as a class.  ^^Allow 20 min |
| BREAK | 10:35 | 10 min | BREAK |
| **EXPLAIN** | 10:45 | 15 min | Drinking Water and Human Health  \*\*Use PowerPoint to go over key facts about drinking water and human health. Note that additional information about topics is in notes section of Slide 3 and 4, and within notes.  \*\*During this presentation, encourage students to interact and ask questions! There are no guided notes, but they can take notes on their own if they so choose  **Slide 1**  The average American consumes 1 to 2 liters of drinking water per day. Virtually all drinking water in the United States comes from fresh surface waters and groundwater aquifers.  **Slide 2**  Surface waters and aquifers can be contaminated by various chemicals, microbes, and radionuclides.  Disinfection of drinking water has dramatically reduced the prevalence of waterborne diseases (such as typhoid, cholera, and hepatitis) in the United States.  Other processes may also be used to treat drinking water depending on the characteristics of and contaminants in the source water.  **Slide 3**  *🡪NOTE: make sure to explain each cause of contamination*  Common sources of drinking water contaminants include:   * Industry and agriculture**.** Organic solvents, petroleum products, and heavy metals from disposal sites or storage facilities can migrate into aquifers. Pesticides and fertilizers can be carried into lakes and streams by rainfall runoff or snowmelt, or can percolate into aquifers. * Human and animal waste**.** Human wastes from sewage and septic systems can carry harmful microbes into drinking water sources, as can wastes from animal feedlots and wildlife. Major contaminants include Giardia, Cryptosporidium, and E. coli. * Treatment and distribution. While treatment can remove many contaminants, it can also leave behind byproducts (such as trihalomethanes) that may themselves be harmful. Water can also become contaminated after it enters the distribution system, from a breach in the piping system or from corrosion of plumbing materials made from lead or copper. * Natural sources. Some ground water is unsuitable for drinking because the local underground conditions include high levels of certain contaminants. For example, as ground water travels through rock and soil, it can pick up naturally occurring arsenic, other heavy metals, or radionuclides.   **Slide 4:**  If drinking water contains unsafe levels of contaminants, it can cause health effects, such as gastrointestinal illnesses, nervous system or reproductive effects, and chronic diseases such as cancer. Factors that can influence whether a contaminant will lead to health effects include the type of contaminant, its concentration in the water, individual susceptibility, the amount of water consumed, and the duration of exposure.   * **Health effects of chemical exposure.** Chemical exposure through drinking water can lead to a variety of short- and long-term health effects. Exposure to high doses of chemicals can lead to skin discoloration or more severe problems such as nervous system or organ damage and developmental or reproductive effects. Exposure to lower doses over long periods of time can lead to chronic, longer-term conditions such as cancer. The effects of some drinking water contaminants are not yet well understood. * **Health effects of consuming water with disease-causing microbes.** Most life-threatening waterborne diseases caused by microbes (such as typhoid fever or cholera) are rare in the United States today. The more common illnesses caused by viruses, bacteria, and parasites can result in stomach pain, vomiting, diarrhea, headache, fever, and kidney failure. Infectious diseases such as hepatitis can also occur. Hepatitis may be severe in people with weakened immune systems (e.g., infants and the elderly) and sometimes fatal in people with severely compromised immune systems (e.g., cancer and AIDS patients)   ^^Allow 15 min for presentations. |
| **ELABORATE** | 11:00 | 1 hour, 10 min | Disease-causing Microbes in Drinking Water  \*\*Tell students that in this activity, they will become an expert on a particular disease-causing microbe that can be found in drinking water. Students will read an overview about the microbe, and then create a poster to share key fact about your microbe with the rest of the class.  \*\*Go over what the poster should include  What your poster should include:   * Name of the disease * Name of the bacteria or virus that causes the disease (sometimes this is the same as the name of the disease) * Picture or diagram of the disease organism * Symptoms of the disease/how long the disease lasts * Method of transmission * Prevalence in the world/recent outbreaks * How it can be removed from the water supply * Any other facts you want to include! Be creative!   \*\*Divide students into 6 groups. (There are 6 different microbes and diseases to choose from; so, if there are less than or equal to 6 students, students will work independently.) Allow students to choose their disease/microbe. Give each student the appropriate handout based on their choices (H4, H5, H6, H7, H8, H9)  \*\*Pass out poster creation materials (markers, sharpies, colored pencils, poster paper)  ^^Allow students 40 minutes to read over their fact sheets and create their poster.  \*\*Students will then present their poster.  \*For each presentation (other than your own), students will write down two facts about the disease/microbe on their fact sheet within their lesson worksheets.  ^^Allow ~4 min per presentation. |
| **EVALUATE** |  | 20 min | Closing Activity  \*\*Students will answer the questions from the scenario on their lesson worksheet:  **Scenario**: One day, you begin to notice a foul taste and strange odor coming from your tap water at home. After speaking to some friends and neighbors, you learn they notice similar issues with their water.  What would you do to ensure the tap water is safe for your community? Answer these questions:  1. What is one way (or more than one way) you could accurately test the quality of your tap water?  2. What agency would you consider reaching out to in your community that is responsible for environmental protection and water treatment?  3. What strategies would you use to bring awareness of water quality issues to your community members?    ^^Allow 15 min for writing their answers.  \*\*If time remains, you may discuss answers with the class. Then, collect responses to review. |