Bay Area Scientists in Schools Presentation Plan

Lesson Name: Zombie Apocalypse
Presenter(s): Alicia Taylor (aliciaataylor@gmail.com)

Grade Level: 4th grade

Teaser:
The zombie apocalypse has happened! How will you survive? Where will you find clean water?

Objective: *Students will understand that microorganisms are the cause for making water unsafe to drink. Students will understand how to best filter their own water to eliminate bacteria.*

Standards Connection(s) Life Sciences

CA Science Content Standards: 4th grade

Life Sciences: Living organisms depend on one another and on their environment for survival.

Next Generation Science Standards:

Connections by topic:

Kindergarten: Interdependent relationships in ecosystems
2nd grade: Interdependent relationships in ecosystems
3rd grade: Interdependent relationships in ecosystems
4th grade: Matter and energy in organisms and ecosystems

Scientific and Engineering Practices:

1. Asking questions and defining problems
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts:

1. Patterns
2. Cause and effect: Mechanism and explanation

3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
7. Stability and change

Vocabulary/Definitions:
Bacteria
Aseptic technique
Sterilization
Disinfection
Filtration

Materials: Presenter brings:

1. USB drive with PowerPoint presentation
2. Pipets and tips
3. Parafilm
4. Filters (t-shirt material, 2 types of lab filters, coffee filters, and paper; 5 types of filters in total)
5. Agar plates (LB or TSA plates will work, prepare amount based on number of students)
6. Example Petri plates with microbial growth
7. Water samples (dog bowl water, sink water, filtered fridge water, bird bath water, toilet water, etc.)
8. Cereal bowls and/or paper/plastic cups
9. Paper towels (for any spills)
10. Hypothesis worksheet
11. 5 permanent markers

Classroom Set-up: teacher prepares:

1. Break students into 5-6 groups, with 4-6 students each
2. Students need a pencil and a laboratory notebook, if they have them.
3. Trash can
4. Place to store Petri plates for ~48 hrs for kids to see bacterial growth/ finish filling in hypothesis worksheet (somewhere the Petri plates won't be touched)

Classroom Visit

1. Personal Introduction: **_____5____ Minutes**
Who are you? What do you want to share with students and why?
How will you connect this with students' interests and experiences?

I begin with a quick introduction to myself (name, what I do, where I work, etc.). Then using PowerPoint slides with mostly pictures, I begin with asking students what bacteria are. Many answer "germs". Then explain that 99% of bacteria are not actually germs. Ask students where bacteria live (everywhere). Do they eat microorganisms? (yes, pizza dough, yogurt, etc.). I show pictures of bacteria with PowerPoint slides. How many bacteria live inside us? Etc.

Topic Introduction: **_____10____ Minutes**
What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge…

I ask if they can define sterilization vs disinfection. These are new words so I define, then ask if they were having surgery, would they prefer that the doctor has sterilized or disinfected the surgical tools (sterilized). Would they want to drink sterile or disinfected water? How do you get nearly sterile water? (Filtration)

I begin to frame the activity into a zombie apocalypse idea. Civilization is gone. Some canned food may be collected from the grocery store. But where are you getting your clean water?

2. Learning Experience(s): **___25_____ Minutes**

What will you do, what will kids do? Demonstrations, hands-on activities, images, games, discussion, writing, measuring… Describe in order, including instructions to kids.

Groups of students are supplied with 2 agar Petri plates and a sample of water. Each group also gets a different type of filter material. Students filter their water sample into a cup or bowl. On the Petri plates, they place a "before filtration" and "after filtration" water sample on each plate. The water sample is collected with a pipette. 0.1 mL is transferred to the appropriate plate. The "before" filtration water sample comes from the water sample itself. The "after" filtration sample is collected from the bowl or cup the sample was filtered into.

Presenters help with showing how to filter and how to place water onto the plate (using pipette).

Depending on class size, students can perform twice. Best if each group uses same (but clean) filter with a different water source as a comparison. Have students fill out hypothesis worksheet (which type of filter works best, which water source will have most bacteria). Bring in sample Petri plates that already have bacteria growth so students understand what they are looking for in 48 hrs (explain how to count colonies). Store samples to be returned to in 48 hours, when teacher can walk them through counting the colonies and comparing effectiveness of filter materials and bacteria found in water samples.

3. Wrap-up: Sharing Experiences **____5_____ Minutes**

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

Put this in terms of camping, how would you get clean water if you are out in the wilderness? What if there's a zombie apocalypse? Could you drink water from the toilet? Where can you find water sources in an emergency? What do you think the best method for cleaning water is?

Teacher goes over hypothesis worksheet as a class 2-3 days later. I suggest making a chart on the board and letting students fill in their answers. Then class can see whole comparison of which water sample was dirtiest and which filter worked best.

4. **Connections & Close:** **_____5____ Minutes**

What else might kids relate this to from their real-life experience? How can they learn more? Thanks and good-bye! Clean-up.

I ask teachers to share some online links with the students (see below, let teachers selected based on age appropriate level of understanding). Have students seen family members make coffee or tea? Are those filters? Why would you want to filter coffee? So as not to drink the actual coffee particles.

Total 50 – 60 Minutes

Follow-up – After Presentation

Ask teacher to help students finish hypothesis worksheet after looking at bacteria growth on Petri plates after 48 hrs.

1. http://www.nbc.com/revolution/photos/survival-guide-water/265836 This is really basic and easy for students to read. Not time demanding. I think it's from a tv show (haven't heard of it)
2. http://www.survivalx.com/wilderness-survival/fire-and-water/water-purification/ similar into to #2, also very short
3. http://water.epa.gov/drink/contaminants/basicinformation/pathogens.cfm maybe a little too technical
4. http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/pollutants/coliform-bacteria
5. http://www.biology4kids.com/files/micro_bacteria.html general info on bacteria
6. http://www.microbiologyonline.org.uk/about-microbiology/introducing-microbes/bacteria general info on bacteria
7. http://www.encyclopedia.com/topic/bacteria.aspx bacteria general info