ENGINEERING EDUCATION
FOUNDATION OF AMERICA

EEFA STEM Taskforce Activity:
Water Filtration

Activity Overview:

Participants will create a water filtration device using two water bottles and their choice of filtration materials. In our scenario, the dirty water will be simulated storm runoff from the gutter. This water needs to be filtered before it enters the Mississippi River. (If you'd like to make up a different scenario, that's good too!)

Material List (provided):

- Two plastic water bottles per device, cut in half
- Cotton Balls
- Uncooked Macaroni
- Aquarium Gravel
- Play Sand
- Coffee Filters
- Cheesecloth
- Vinegar
- Scissors
- Rubber Bands
- Paper/Plastic Cups (to hold filter material)
- Simulated wastewater (For 1 gallon: combine 2 cups distilled vinegar, several drops yellow food coloring, dust swept from the floor, a half-cup topsoil or sand, a handful of pet or human hair, and enough water to fill the gallon. Shake well.)
- pH test strips
- Paper Towels
- Waste Bucket

Instructions:

1. Find two empty water bottles. Cut the bottom off both bottles.
2. Discard the cap from one bottle. Cut a square of cheese cloth and secure it over the opening with a rubber band. Make sure the other bottle has a cap and it is tightened.
3. Turn both bottles upside down and nest the bottles together. The capped bottle should be on the bottom. The device is ready for filtration media.

4. Measure the pH of the simulated stormwater or use the pool testing strips before it is filtered.
5. Discuss with the participant(s) what materials they are going to use and why. Ask them about the order of the materials they are placing in the filtration device.
6. Have the participant pour the stormwater through their filtration device using a measuring cup. Have them observe the speed of the water through the different materials. If they are working alongside another participant, have them compare their procedures and results.
7. Measure the pH of the filtered water or use the pool testing strips and compare to the initial measurement. Compare the color of the filtered water to the original wastewater.
8. Discuss with the participant which filtration media they think worked the best and what they might do differently if they did the experiment again.
9. Once the participant is done, the used filtration material can be placed in a waste bucket. The water bottles can be reused with new cheese cloth for the next participant. Filtered water is not drinkable. The filtered water can be reused as simulated stormwater by adding additional dirt, newspaper, and vinegar.

Things to Keep in Mind:

- HAVE FUN AND ENGAGE WITH PARTICIPANTS!!! 😊
- Know your audience – Use vocabulary based on participant age and ask questions that the participant will understand. Tailor the activity to the participant as needed. Participants can work alone or in groups.
- Explain the background of the experiment – Stormwater has pollutants in it from the road, farm fields, etc., and it needs to be filtered before entering a river or lake so we can keep our rivers and lakes clean. Ask them why that might be important (safe for animals and plants, safe for humans/recreation…).
- Note the order and amount of filtration materials.
    - Example: Coffee filter on top of the materials will make the water filter very slowly. In real life this could cause a back up of runoff and lead to flooding. How could this be modified to reduce the chance of flooding? Are there pros and cons to the solution?
    - Engage with the participant and ask questions about the materials they chose, the order they placed them in, and the thickness of each layer. In the real world, filtration media first filters out larger debris and then filters out smaller debris. How do the layers of filtration media need to be placed to accomplish this?