

Rose-Hulman Institute of Technology

Water without Worry

A demonstration to inspire 4th and 5th grade students to pursue STEM studies.

Team Hydra
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Table of Contents

Part 1: Information	2
Context.....	2
Visuals and Graphs.....	3
Materials List.....	5
Part 2: Demo	6
Test Set – Up Preparation	6
Demo Procedure	7
Part 3: Discussion	8
Questions to Engage Students	8
Student Activity.....	9
Additional Sources	10

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Water without Worry: Water Filter Demonstration

Part 1: Information

Time: 5-10 min

First go through and explain what STEM (science, technology, engineering, and math) is, how these fields can change the world, and what they have brought to everyday life; such as bridges, buildings, cars, hip replacements, and toothpaste. Next, talk about the Grand Challenges and how they are all problems that STEM fields need to solve in order to improve our world. Last, discuss how one of the grand challenges is the lack of clean water. Discuss facts about how many people lack access to clean water, relate it to them through visuals of kids their age, and discuss a school that may be struggling to get clean water to their students. Some of the ways that clean water is brought to people in developing countries is by wells that are built miles away from them, or by having to pay to use a closer well. An easy way for them to help purify water is by using a water filter.

Context

Over 780 million people across the globe lack the access to clean water. This is more than twice the US population. With this large of a water crisis, it is very clear that something needs to be done to fix it, hence why it is a Grand Challenge. The fact that will most likely shock the children the most is that every 21 seconds, a child somewhere dies from a water related disease. This is a fact that the children can very easily relate to; this is one of the own so to speak. Another good fact the kids can relate to is that a 5 minute shower uses the same amount of water as a person in an underdeveloped country uses in an entire day. Showing how the water crisis is a Grand Challenge is helped not only by these facts, but also by the visuals shown in the next section. Getting the children to make their own filter, to physically see the difference in the water that comes out of it hopefully will show them how important STEM careers are and how they truly can help save so many lives.

Visuals and graphs

1. Hope for Haiti. This picture shows a class of students in Haiti close to the student's age. This picture will connect the students to their mission: to build a water filter for the students in Haiti who lack clean water.

<http://hfnews.blogspot.com/2010/11/gettin-schooled-in-haiti.html>



2. It is difficult to get clean water to kids in these developing countries and even a well like this is hard to travel to and may charge them money.

<http://www.flickr.com/photos/waterdotorg/11227135095/>



3. This visual will show the students what many developing countries' water sources look like.

<http://www.nyabushozi.org/2010/06/nyabushozi-photos/attachment/19/>



4. This picture compares the drinking water in Haiti with the drinking water the students may have at home. This shows them how bad the situation is there and how they could help these kids. <http://thesproutingseed.com/give-clean-water-christmas/>



5. This picture gives the students a basic idea of how the water filter can be built and a depiction of the setup.

<http://www.hometrainingtools.com/water-filtration-science-project/a/1803/>



Materials List

<u>Materials</u>	<u>Estimated Cost</u>
1 – 2L bottle	\$2.00
8 Regular Water Bottles (24 ct.)	\$5.00
Gravel (14 L/0.5 cu. Ft.)	\$3.00
Sand (1.5 lb. bottle)	\$2.50 (x2)
Coffee Filters (100 ct. box)	\$3.00
Cooking Oil (48 oz. bottle)	\$3.00
Paper Towels (1 roll)	\$2.00
Styrofoam (2 - 4" spheres)	\$5.00
Beads (1 lb.)	\$3.00
Rubber Bands (80 ct. bag)	\$2.00
Sugar (5 lb. bag)	\$3.00
TOTAL EST. COST	\$36.00 + tax

These numbers were calculated for a class size of 24 students, split into eight groups of three. Below are links to some of the less common items.

Beads (Walmart):

<http://www.walmart.com/ip/Kids-Craft-Plastic-Bead-Value-Pack/19515700>

Gravel (Lowe's):

http://www.lowes.com/pd_92130-76450-GP05RC_0_?productId=3471471&Ntt=gravel&pl=1¤tURL=%3FNtt%3Dgravel&facetInfo=

Sand (Hobby Lobby):

<http://shop.hobbylobby.com/products/white-bottled-sand-550780/>

Part II: The Demo

Test Set-Up Information (prepared before class):

1. Obtain necessary materials, including premade dirty water.
2. Dirty water is comprised of water, oil, food coloring, Styrofoam, and shredded paper towels. Use appropriate judgment on amount of each substance in water.
3. Put gravel, sand, cotton balls, and beads into separate 5oz Dixie cups. Make enough for each group to have one cup of each material.
4. Remove the lids to 1L water bottles and cut the bottles in half. Enough so that each group of 2-3 can have a bottle.
5. Attach the coffee filter to the outside mouth of the bottle using a rubber band.
6. Invert the top half of the bottle and nest it inside of the bottom half.
7. Create teacher's filter by repeating steps 4-6 using a single 2L bottle.

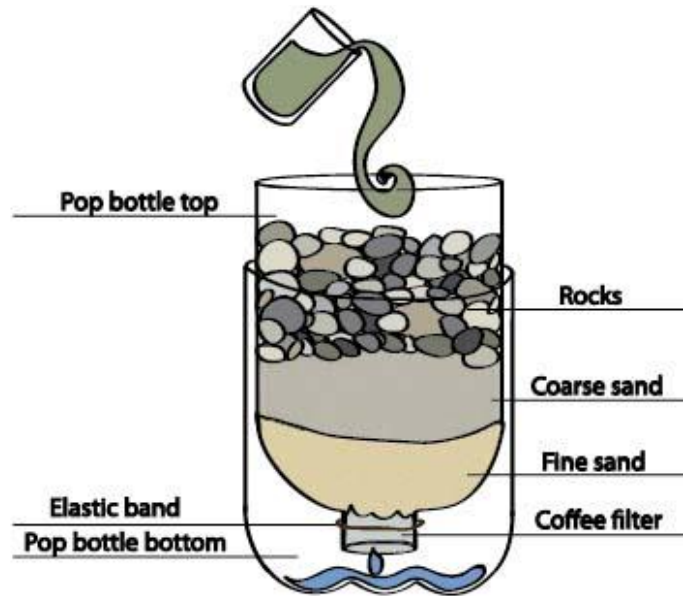


Figure 1. Cartoon example of what the water filter set-up should look like.

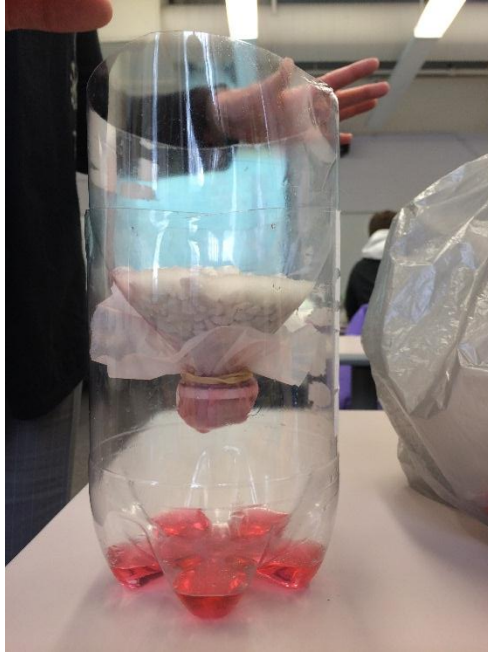


Figure 2. Example of 2L water filter after the experiment was run with Gatorade.

Demo Procedure

Time: 20-25 min

1. Break class into groups of 2 or 3 depending on class size.
2. Give each group 5 minutes to discuss what materials they wish to use to build their filter.
3. Have one representative from each group collect their chosen two or three materials to use in their filter along with their precut and correctly inverted water bottle with the coffee filter attached.
4. Have them add their chosen first layer to the top portion of the bottle.
5. Have them then add their chosen second layer on top of the first layer.
6. If you decide to have them choose a third material, have them add this next.
7. Have each group draw their filter on their hand out.
8. Collect all filters and display them in the front of the class.
9. Pour $\frac{3}{4}$ cup of the premade dirty water slowly through the filter.

Note: Depending on the size of the layers and materials used, the water may take a few minutes to pass through the filter.

Part 3: Discussion**Time: 10-15min**

Have the kids look at and observe what materials are working well for each filter and what materials aren't working well. Have them look for what each material is taking out of the water. Record their observations on the hand out. Go through each question on the hand out in order for each student to have a better grasp on the how water filters work and help others.

Questions to Engage Students

What does each material do?

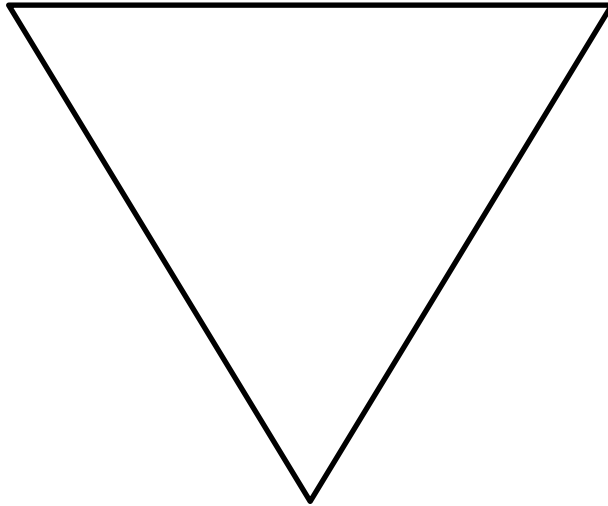
Does the order of the materials in the filter matter?

What other materials could they use?

Why are STEM fields important for the Grand Challenges?

Student Activity

Draw your filter in the triangle below.



1. Observations about the filters:

2. How did each material effect the water?

3. What would changing the material and the order do to your filter?

4. What is the importance of STEM in the Grand Challenges?

Additional Sources

Video on the Grand Challenges, which includes information on each challenge:

<http://www.engineeringchallenges.org/cms/challenges.aspx>

Collection of online resources for Indiana educators in STEM fields:

<http://www.rose-prism.org/moodle/>

Information on STEM careers, including experiments to increase interest:

http://www.sciencebuddies.org/science-fair-projects/science_careers.shtml

Water Treatment Process Video:

<http://www.youtube.com/watch?v=9z14I51ISwg>

How It's Made: Drinking Water

<http://www.youtube.com/watch?v=eIoSt0-K7wI>

Interactive Water Filtration Lesson for Students:

http://www.epa.gov/safewater/kids/flash/flash_filtration.html