

**Element 1: Classroom Context**

- Content Area - Science, Mixtures & Physical Properties Unit
- Grade Level - 7
- Class Size - 32 students - 20 females, 12 males; 3 Black/African American, 2 Hispanic/Latino, 1 Asian, 26 White/Caucasian
- Student Population - 990 total students enrolled
- General Description of School Environment - Each grade level (~330 students each) has 90 laptops to share amongst 12 teachers. Desktop computers are located in the media center for teachers to sign up to use as well as in a computer lab. Each science teacher has a class set of textbooks (textbooks may also be checked out from the library for 24 hours) and all students have access to the online textbook. The school itself is a high-performing middle school in the city with 30% on free or reduced lunch.

**Element 2: Lesson Planning with Rationales for Your Decisions.**

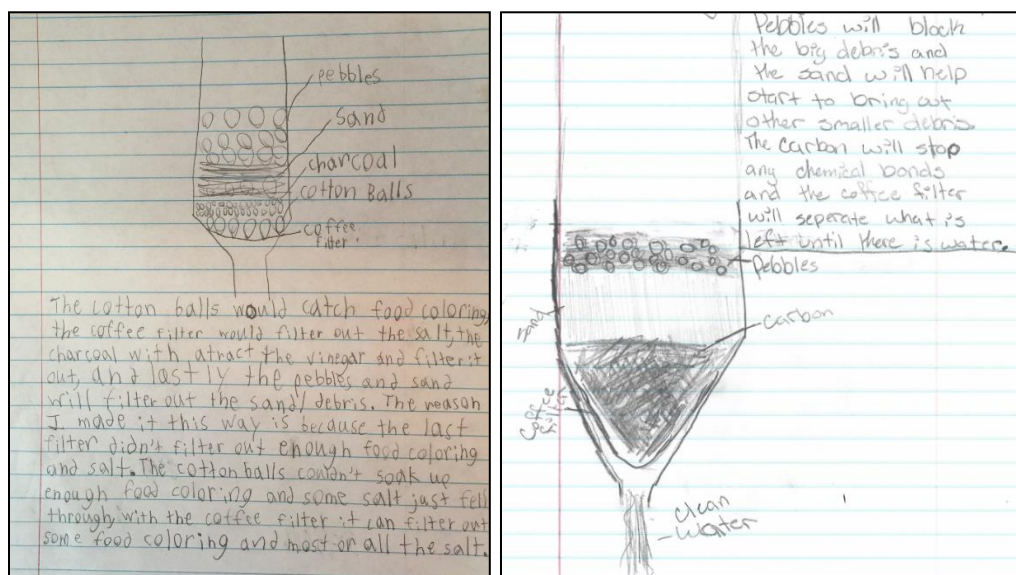
\*Students have already learned about physical properties, types of mixtures, and parts of a solution. They have read non-fiction articles on water filtration and how different cities clean their water.

Time-frame	Lesson Elements	Metacognitive Reflection
Day 1	<p>Reviewing with students about mixtures, the class will now focus on mixtures within Colorado Springs' water.</p> <ol style="list-style-type: none"> <li>1. Students brainstorm what sorts of things can be mixed in with the water.</li> <li>2. Students view the PowerPoint exposing them to the scenario -- a natural disaster poisons the local waters and students are left to drink from one of three water sources: toilet, swimming pool, or nearby stream.</li> <li>3. After some discussion/share-out of justifications, students design a water filter using limited (4) supplies (sand, rice, macaroni, pebbles, cotton, activated carbon, water bottle, cheese cloth, paper cup, &amp; coffee filter) to clean a sample of water.</li> </ol>	<ol style="list-style-type: none"> <li>1. Access prior knowledge (hiking/camping experiences, observations from home, etc.); also create relevancy for the upcoming lesson.</li> <li>2. Recent water availability issues has made this something students can see as a possible outcome, also adding to relevancy.</li> <li>3. In the design, students must exercise their analysis skills, justifying why each part is there as opposed to blindly guessing. We're trying to reinforce the need for critical, logical, reasonable, and justifiable thinking.</li> </ol>
Day 2	<ol style="list-style-type: none"> <li>1. After explaining the lab set-up and expectations, students build and test their water filters.</li> <li>2. After viewing their results, students ask questions (of each other &amp; of each other) and research common filtering techniques.</li> <li>3. Students then re-design their water filter and</li> </ol>	<ol style="list-style-type: none"> <li>1. Hands-on creation and testing of their ideas to make the results more concrete (as well as create better questions)</li> <li>2. Emphasize communication &amp; collaboration</li> <li>3. Applying new knowledge &amp; new</li> </ol>

	offer justifications for their new filter	thinking
Day 3	1. Students create an advertisement (with justifications) for their water filter, offering "customers" reasons why their water filter works and explaining how it removes particulates from the water sample.	1. This gives students an opportunity to use academic language and synthesize it into common language.

### Element 3: Description of Lesson Implementation

(Day 1 - bring your parents to school day) Students engaged in a brief discussion about things that may be found in water other than water and watched a PowerPoint about what would happen if an earthquake contaminated the water supply. There was a short discussion about what water source (pool, toilet, or stream) would be preferred and why - parents also participated in this discussion. Students were assigned to groups of 4. After seeing the options of items, groups drew and described the water filter they would create to purify the water from their water source (pages 26-27 in their notebooks).



(Day 2) The lab set-up was explained by the teacher - bags of materials were set up in the lab area along with samples of water that required filtering (vinegar, salt, food coloring, & sand were added to the water samples). Lab safety rules were reviewed and groups began building their water filter. As they built their filters, the teacher walked from group to group asking for an explanation of their filter - why they designed it the way they did, what they expect to happen, and after the testing, why did the results come out the way they did?

After the clean-up, students discussed their results and then began to redesign their water filter based on their results.

(Day 3) In their small groups, students created posters of their water filters and wrote/presented an advertisement about why their water filter works and how it works. Students were assessed on the justifications of their redesign.

#### **Element 4: Reflection**

##### *Teacher Reflection*

For the most part, things worked well, albeit with definite room for improvement. The most effective moments were when students were allowed to verbally process their understanding both with each other and with me. I found that the groups that I asked fewer probing questions tended to have weaker justifications/reasoning than the ones who had to explain their ideas aloud more. This would align with the strategy of giving students more processing time. Given our curriculum map and general timing of the week, the whole lesson felt rushed and frantic at times (to me). I would have preferred to have allowed some of our discussions and research moments (some students used their phones during the plan and redesign parts) to be extended.

Likewise, there were some budgetary concerns about the materials, specifically the cost of supplying the activated carbon. Several students complained about just redesigning another water filter and not rebuilding it. I would agree with their complaints. They really needed to concretely test their understanding of separating mixtures and water purification techniques to provide better reasoning later on.

##### *Student Reflections Excerpts (13 student samples)*

- *"I really enjoyed the water filtration assignment and I thought that it was very interesting. I learned about Colorado water quality and how you can clean water. I thought that learning about water was important. I don't think anything should be improved."*
- *"My opinion on the water filtration unit is that it was fun and something I, myself, would want to do again. I learned that making a water filter is harder than I thought. I think learning about water was important because it's one of those things you don't think about until its gone or undrinkable. One thing I think could have improved the unit would be like [the teacher] explaining how each of the materials for the filter would work and clean the water."*
- *"My opinion on what I learned in the water filtration unit is that activated carbon separates the chemicals from a solution."*
- *"I learned about our water and how our city deals with water. I did find learning about water important because I now know how much work it takes to make clean water which made me appreciate it more. I think it was fun. I just wish I knew about pH."*
- *"I found learning about water was really important because it made me think how to conserve water. We could have finished or made improvements to our water filters."*
- *"I enjoyed the discussions, but in the future, it might be interesting to debate the science topic. I learned a lot about our local utilities and water. Learning about water is important since there is*

*only so much of it on Earth and it is such a necessity. I think the water filtration unit was good, but could be improved if there were options, like seeing what is in water after washing something off like an apple... giving more options."*

- *"...Something that could have been improved is there should have been more talk about what Colorado Springs actually uses to filter their water and what the best materials are to filter our water."*
- *"My opinion was that it was okay. It seemed to remind me of last year's water unit."*
- *"I had a lot of fun making the water filter. However, I would have liked to be able to make a second filter after doing our revisions."*
- *"I personally found the research the best. Finding out new things on our daily water supply was awesome. I learned all about the way they clean our water. I would change the water filtration lab to watching a video of the process of cleaning water."*
- *"...My favorite part was the discussion because we got to openly speak our opinions. The hardest part of this was planning and making the actual filter."*
- *"...I think that you should have given us a little more time on the poster. That's it, though."*
- *"...If I am drinking water and putting it in my body, I need to know about it and what's in it. I would have liked to have gotten more information on it and how it's cleaned."*