

SUMMARY OF STEM INTEGRATION EXPERIENCE: FLINT WATER FILTERS

Introduction

This document provides a brief description of a 6.5-hour professional development experience for middle school science and math teachers focused on STEM integration. The goal is to engage the teachers as learners in a STEM integration project. Afterwards, teachers are encouraged to reflect on their experience through the lens of an educator, unpacking some of the pedagogical decisions and implementation practices involved in the experience in order to begin thinking about how to develop and implement these types of activities for their own students. This experience is an adaptation of the Water Filters unit from the Engineering is Elementary curriculum.

Session One: Contextualization (1.5 hours)

- Teachers were split into 3-person teams, with each team associated with a Flint zip code
- The history of the Flint Water Crisis was reviewed
- Teachers were given a detailed problem statement outlining the challenge and the parameters/constraints of the activity (e.g. working collaboratively not competitively; details about design parameters, etc.)
- Citizen Science data from the actual Flint Water Study were explored and analyzed (typically by using a spreadsheet/Excel) by the teachers in order to answer a specific question they asked of the data (e.g., where is the water the most contaminated? How is the level of contamination tied to average household income for a zipcode?)
- If time allowed, teams were encouraged to create a visual representation (graph/chart) of their data exploration
- At the end of this first session, activities for the next two sessions were outlined.

Session Two: Collaborative calibration table generation (3 hours)

- The water filter models were introduced – upside down 2-liter bottles, filtering materials, “contaminated” water
- Each team was given a set of filter material combinations to try; a lengthy conversation about what makes a good, fair, and consistent “test” of filter materials ensued
- “test” results consisted of flow rate and water quality estimates
- Teams ran their trials and fed data into a google spreadsheet that populated in real time
- Once teams completed data collection and sharing, data for each filter material was organized and plotted with a large box and whisker plot (which was introduced at this point of the project). These were displayed around the room for all teachers to see.

Session Three: Informed design and iteration (2 hours)

- Using the box and whisker plots generated from the previous session, teams made informed decisions about what to include in their filter prototypes.
- Teams built their filters and tested them, again accounting for water quality and flow rate. These two measurements had to fall within a certain range in order for teams to be successful (and to advance their idea to the next round with the other groups).
- Data was recorded, discussed as a whole group, and then everyone worked on another iteration of their design.
- Each team then made a final recommendation to the City of Flint based on their work of the day.

(Problem statement given to teachers)

You and your team are one of the engineering firms that have been invited to a rapid prototyping session aimed at **collaboratively** developing a proof of concept model for a whole house filter that homeowners can install on their water main line within their houses. Although the teams in the room represent different engineering firms, you are all working together under a cooperative agreement to explore different potential designs, since the ultimate goal is to find effective and viable solutions for the residents of Flint as quickly as possible.

Overall, the filter should seek to optimize water purity and flow rate while maintaining a low cost in order to the City of Flint to be able to purchase and distribute the most filters possible to its residents. The residents and city officials of Flint are eager to hear about your design ideas in the next few days.

