Project Title: All About Arsenic

School: Bow High School

Grade Level: 10-12

Teacher: Brenda Mitchell

Project Partners: Priyanka Roy Chowdhury, Keene State

Teacher Profile: I studied Microbiology and Immunology at UC Berkeley. After graduating, I attended San Francisco State University to get a CA teaching credential, subsequently teaching in San Francisco at a middle school for eight years. During that time, I taught London Breed who is now the mayor of San Francisco!
I came home to NH and to my alma mater, Pembroke Academy, to teach math, chemistry, physical science and biology. After five years in this very traditional environment, I wanted to stretch my wings a bit more, so I moved to teaching at Bow High School where I have now been for 21 years. At Bow, I have taught integrated science, anatomy, Chemistry, AP Chemistry and have designed and taught a half year forensic science class.
I have created a Chemistry course that is rigorous and based around environmental concerns. Each unit has ties to real life problems and the entire course centers around water and water issues. The parent of a former student contacted me to tell me of this grant opportunity because she felt it was such a perfect fit. It is. Arsenic in well water is a huge issue in Bow.

Summary: This was the second year of my participation in the arsenic project. This year, we started with teaching data literacy on the second day of school! We created a series of explorations based on datasets in Tuva to lead students through the basics on data analysis. This was very successful. Students were able to use these methods to look at data throughout the year and it sparked great conversation about the differences between large and small sets of data. I was also able to compile data obtained over the years through Tuva for an experiment so that students had a large set of data in an experiment they did.

The arsenic monitoring, like last year, was part of the water issues unit(s). It was integrated as part of discussions of heavy metals, solubility of ions and precipitates, water well issues and water pollution. This year we did not do the Element of the Week project but rather integrated the information into the daily activities in class.

Students collected the water samples after we did a series of activities in class about cleaning up foul water. Students did a water filtration lab and a distillation of water lab in which they utilized computer probes to test for turbidity, electrical conductivity and pH. The probes, along with a spectrometer, were purchased over the last two years with grant money.

Priyanka Chowdhury brought several of her undergraduate research students to Bow High school to present quick synopses. Since I teach chemistry and she is a biologist we felt that focusing on the data collection and analysis aspects was most beneficial to all. Students from Chemistry, AP Chemistry, AP Biology and Environmental Science classes attended. The Keene State students did a magnificent job presenting and had the rapt attention of the BHS students. Good questions were asked and most of the students stayed to do the optional hands-on activities the students had brought with them. The other teachers involved were very impressed not only with the research and presentations but with the class discussions that occurred organically afterwards. All of us decided that having this happen every 1-2 years would be wonderful.

Four chemistry classes, about sixty students in total, participated in the project. Forty-eight students and five staff members collected samples that we sent out for testing. Results from the testing were made available after we started distance learning.

Distance learning at Bow HS was demanding for both students and teachers. Classes met for 45 minute periods four days a week and used the fifth day for working with students needing tutoring, make up work or special ed modifications. It was very challenging to find simulations to replace labs and to monitor student progress. Unfortunately, the analysis of our collective data was one of the things that fell by the wayside. I had to make some tough decisions about which parts of the curriculum to omit while doing enough of everything that students were still prepared for college and AP Chemistry. Given that we had already done so much data analysis in the first semester, this became a logical cut.

No community meeting was held this year. We had planned to have students write articles for the Falcon Times and to display projects about arsenic and water purification at the Baker Free Library. I am quite sad that this did not occur. I do plan to do this next year with the three years of data we will have collected by then.

Besides the formal partnership with Keene State, we also partnered with the Bow Drinking Water Committee. They have been very supportive and would like to see us continue the project past the end of the grant. One of their goals is to get all the private wells in Bow tested for Arsenic, Lead and Uranium (the big three issues in Bow water). This project has allowed them to make real progress towards this goal: more testing has been done through the project in one year than in ten years of community outreach. I have forwarded them the data from last year and will from this year for them to use on their web site, printed documents and community presentations.

Next year I would like to begin again with the data aspect first. That was very successful. I have started using a resource/method called POGIL and the data analysis with Tuva will fit perfectly. I would also like to have the Keene State students visit, perhaps to a smaller group of BHS students. I certainly plan on MUCH more community outreach at the end of the project.

Conclusion: All About Arsenic has been a wonderful addition to the BHS Chemistry curriculum. We have deepened our data analysis with Tuva and have been able to inform many families about the importance of drinking water quality.

References:
Build Your Own Water Filter
https://docs.google.com/document/d/1M_uf_YkDwMyeCoNCcgKgLVHVvjP5ITeBzPTjXFC3_YU/edit
Distillation https://docs.google.com/document/d/1lnU6ZB2_lEgsR_2d-7uZrr8--7lw1Mqm0Us30RKHOMg/edit
Water Pollution Testing
https://docs.google.com/document/d/1PHWocsr7rdNhd3pctui0XNyc1R6FBhYcnoB4eAWl7do/edit
Presentation on the All About Arsenic Project
https://docs.google.com/presentation/d/1mj6aIqK7NZHJYZ6qOV0QcCN2aFNnoOBvq-Fw0ECYlXE/edit#slide=id.p
Intro to Water Data Thinking https://docs.google.com/document/d/1U20LBfxV2fsgYVglYmnbG-L5VpS464BYgUMut4CjSPk/edit
Love that Dirty Water (to engage students and elicit questions)
https://docs.google.com/presentation/d/154dgrg1OvwAnDHXAEIhiYRr6yYSBVup5PFkScau9VoA/edit

Five Dropper Simulation (prep for formal lab)
https://docs.google.com/document/d/1Ht6HrSNYIQxkrmGytVB52v3IAKVYDRAqU3e97p4MRvA/edit
Formal Lab that integrates solubility, types of reactions and water pollution
https://docs.google.com/document/d/140a56v54sSgudFzWWKUI-HJ4W15E61SIolPDvk0OHLk/edit
Rubric for the formal lab https://docs.google.com/document/d/1D0rYElZN9HN9D9SSi0XqqK9u-xSZnDiBHdYZb-aoMvo/edit
Data Literacy activity using data from past years
https://docs.google.com/document/d/1tHtkxqTVaPqn2ZoM54YjRCKKB8QOouUgdbGSEfgsWUI/edit