FINAL CASE STUDY 2023

Project Title: All About Arsenic

School: Bow High School

Grade Level: 9-12

Teacher: Brenda Mitchell

Project Partners:Priyanka Roy; Keene State College, the Bow Committee on Drinking Water Quality and Whitewater Water and Wastewater Solutions.

Teacher Profile: I have been teaching middle and high school science since 1985. I studied Microbiology and Immunology (at the time it was becoming Biochemistry) at the Univ of CA at Berkeley. I then attended San Franscisco State Univ to get a teaching credential and later received a MA in administration and supervision in education.

I am passionate about the environment and sustainability. I bring that to the Chemistry classroom by linking chemistry to the environment. My entire course is centered around looking at water and water contaminants. This made the All About Arsenic project a natural fit! The 23-24 school year will be my final year in teaching as I plan to retire next June.

Summary: During the 22-23 school year, about 90 students were involved in the water collection. Collection was done beginning in December of 22 and besides the students, other samples were solicited from district employees and community members through email and newsletter.

The project is set up to integrate with topics in the Chemistry curriculum throughout the school year. Data literacy begins in September and is a continuous strand in the curriculum. Work began last summer by the science department at BHS to weave data literacy into all science classes in a meaningful and scaffolded manner.

The Chemistry curriculum is based around water. Water contaminants and the removal of such is integral to the course.

Project Details:

Fall: : Introduction tohttps://docs.google.com/document/d/1imYrU8fcIFU3NC1whKU-WpS_g99lznADP4ejgtP0E8A/edit: looking at TUVA files and having students use graphs to answer questions and also to generate questions. Thinking about water and Penny Data (student response)The data literacy pretest was taken. Review of central tendency, variability and types of graphs. Based on the feedback from the data literacy pretest, variability was emphasized and students were required to produce frequency graphs with lab data to help with analysis.   Particle Diagrams were introduced to assess student understanding of concepts.

Students conduct a lab that generates many (conflicting) data points. They design their own questions and procedures and then graph the data (using Sheets). Generates discussion of noise vs what can be controlled. Lab: Chem Is Try
The introductory phenomena is Love that Diry Water, a slides presentation. Students are introduced to the properties of water: polarity, electromagnetic forces, ionic bonds, solubility Labs: solubility races, paper chromatography, micro column chromotography, water filtration lab . Particle Diagrams are revisited and are

refined.   Water collection is done. <u>Arsenic</u> (and other contaminants) are introduced as soluble. Dangers of Arsenic and other contaminants that are common in Bow are taught. <u>Data</u> from past years is briefly examined as a class and in groups.

<u>**Winter 2022-23:**</u>: Students do a <u>career exploration</u> project. As part of the project, some Priyanka Roy's students have made videos introducing their lab and projects. <u>Video from past</u> <u>interviews.</u>
Students look at results from the <u>water collection</u> (<u>anecdata</u>) and generate questions to ask as well as graphs to support their answers to the questions.
Solubility is looked at through the <u>reactions lab</u>. <u>Particle diagrams</u> are further refined; students must now predict the solubility of the particles and divide the soluble ones into ions and show their interactions with water. The reactions lab itself is now based on compounds that are water contaminants or can be models for water contaminants and students examine this yearś water data as part of their analysis. <u>Student example lab</u>.

–<u>**Spring of 2023**</u>: Honors students conduct a bioassay using contaminants chosen from results of the water collection or that model Arsenic as a contaminant. (Honors students are self selected and the number ranges from 4 to 20. Honors students meet as a group in our FLEX period once a month.) We used the booklet <u>Toxic Risk</u> to help plan the projects. Project assignment.   <u>Incomplete student presentation.</u>
 Students presented their projects at the Keene State Academic Excellence <u>Conference</u>. This was done live so students were able to watch other presentations on campus.

The stipend during 2022-23 was used for

Throughout the year, I write brief articles for the school newsletter regarding the project.

<u>Newsletter Files</u>   <u>Final Article</u>

The Bow Clean Drinking Water Committee has continued to use our data and to support our work with water in Bow. Students from Bow are now helping the committee edit a video on how to make and install a DIY heavy metal under sink (point of service) device. We have worked with the Health Committee (along with the Water C) to explain that the water in the middle school is safe but foul tasting and smelling and offered methods to alleviate the odor/taste issues. WhiteWater Water testing is presenting on May 10 at the BHS School Fair. This is a consulting company that is working with the Water Committee on the well water offered to a small number of businesses and homes. They have invited students to work with them on their current research regarding phosphates and phosphate abatement.

<u>Link to the committee web page</u>

Discussion:
        As in previous years, students were able to personalize their Chemistry learning by applying the information to their wells at their homes and their own health. The value of this cannot be overstated. Learning how to fix the problem was also of great learning!
        I did not get any emails from parents this year.
        I am impressed every year with how attentive students are to issues that directly impact them. In addition, several honors students have elected to use the basis of their bioassay project to do an independent project in their life science class. It has been interesting to collaborate with those teachers for the first time on projects that cross the subject lines of our classes.

Based on the data discussions as part of this project, when the science department met last summer we created a continuous thread for every science class that will be data literacy. We delineated what topics will be taught in which classes and spent some time searching through TUVA for data sets to use in every class. I copied the data literacy pretest analysis for every math and science teacher and we met to discuss the findings. Based on that we have begun to reshape the teaching for the next years.

Conclusion: All About Arsenic has enhanced the curriculum and the engagement of students in Chemistry classes at Bow High School. By using well water and specifically arsenic contamination in well water as a central theme for the class, students have made real life connections.