Project Title: Arsenic and You!

School: Mount Desert Island High School

Grade Level: 10-12

Teacher: Hannah Podurgiel

Project Partners: Sarah Hall (College of the Atlantic), Anna Farrell (MDIBL), Jane Disney (MDIBL)

Teacher Profile:
This was my fourth year at MDI High school, and I taught for two years prior to coming to Maine. In school, I studied Spanish, Italian, and Geosciences, and then went on to get my Master's in Curriculum and Instruction (for science education). I currently teach Chemistry and Science of the Outdoors. I am passionate about really engaging with the world around us through hands-on, place-based education! The All About Arsenic project fits well with this, as I believe it brings a greater awareness to students and others about a very real issue in a very tangible way.

Summary:
I started by first introducing the All About Arsenic project to my Science of the Outdoors class using a slideshow. In the slideshow, I showed them maps of arsenic levels in soil in the United States and where there is higher probability of having arsenic. We watched two videos, "In Small Doses: Arsenic" as well as "King of Poisons: The Social History of Arsenic," in order to get some background on the topic. I also discussed the problem with high arsenic levels in food and water, and gave them a tour of the "Arsenic and You" Dartmouth website. From there, we discussed how we might approach our project, and decided that we would take water samples ourselves, and also get as many samples as possible from 9th graders by going into the 9th grade Biology classes to give a presentation. My students, in groups, put together the water sampling kits and an informational slideshow to show the 9th graders. They gave presentations to the Biology classes and showed them how to collect samples. When we got the samples back, my students put the samples into our sample spreadsheet, and we sent them off to be tested. When we got the data back, my students did some spreadsheet comparison/analysis of just our class data (to see how our class contaminant levels matched up with local geology), and we then used Tuva to do some additional data exploration and analysis. We tried to answer these questions: Does having a filtration system help arsenic levels? What is the most common type of well around here? What is the highest arsenic concentration within the dataset? Is there a correlation between arsenic and any other element? Overall, we submitted 56 samples!

Project Details:
- There were 12 students involved in this project in my Science of the Outdoors class.
- Links that were helpful to us:
  - https://www.dartmouth.edu/~arsenicandyou/index.html
  - https://www.youtube.com/watch?time_continue=1&v=6HVNpoFvRdk&feature=emb_logo
  - https://www.youtube.com/watch?v=pAiSlLtf07s&feature=emb_logo
  - https://www.youtube.com/watch?v=NEVRgFImgNA&feature=emb_logo
  - http://www.allaboutarsenic.org/
- We:
  - Collaborated with the 9th grade biology teacher to have as many 9th graders as possible participate in gathering water samples.

    - Went on a number of field trips for the course, including to locations where we could see the Ellsworth Schist (which seems to be associated with higher arsenic levels).
    - Looked at our data as a class and how our water contaminant levels may or may not have aligned with the geology of the island.
    - Invited Sarah Hall from the College of the Atlantic to come and speak to us about geology and arsenic.
- Before ever looking at arsenic data, we used Tuva to explore a Weather Balloon dataset (since we were studying meteorology). This allowed us to become comfortable manipulating variables and looking at data in Tuva. Then, when we got our arsenic data back, we used Tuva to answer these questions: Does having a filtration system help arsenic levels? What is the most common type of well around here? What is the highest arsenic concentration within the dataset? Is there a correlation between arsenic and any other element?

Discussion:

- We learned that not all water filters are the same! Some types seem to help much more than others, and based on the data, having a filter does not necessarily mean lower arsenic levels (especially if home filters are not cleaned!). Most of our wells around here are drilled wells, and while we did not have any samples within our own class from a well drilled into Ellsworth Schist, we did notice that students living geographically close to each other (with similar bedrock geology) did seem to have some similar contaminant levels for things other than arsenic. We learned that getting lots of people to participate in a study can be quite difficult! We had to continually encourage our 9th graders to bring their samples back to school. However, we also learned that being well organized ahead of time was a huge help.
- I learned that my students were lacking in some data literacy skills, but were very quick to pick them up with some direct instruction and individual exploration using tools such as Tuva.
- In the future, I might try to use more of a Question, Claim, Evidence model for student data analysis. I would create a Google Slideshow with a number of research questions, and after assigning questions to students (or having them make their own), I wold have them come up with their own Claim for each question, and then provide Evidence for their claim (the student would paste a graph that shows the data that supports their claim). This would make sure they are getting practice with graphing the data, and allow us all to see the data in one place in a way that tangibly answers our questions.

Conclusion:

I am so glad that we got to participate in this project, and am excited to try out some new things the next time around! Thank you to all of the people who partnered with us and provided so much support along the way!

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