

Project Title: All About Arsenic

School: Presque Isle High School

Grade Level: 11-12

Teacher: Erika Bernard

Project Partners: Who did you work with for this project? Name your mentor and their institution and any other partners.

The scientist partner on this project was Judith Roe at the University of Maine at Presque Isle.

Teacher Profile: I am currently in my 9th year of teaching science. Throughout these years I have taught everything from Earth Science to anatomy and am currently teaching various levels of chemistry. I began my college career as a physical therapy student which allowed me to take various science classes but I always loved education as well. I decided to meld the two and switched majors for get my B.S. in Secondary Education – Biology. The extra credits from my years in physical therapy also allow me to teach the physical sciences. I am currently getting my Master's in Stem Education to be a more well-rounded teacher in the classroom. While I have always been drawn to the life sciences, teaching chemistry has really gotten me interested in the environmental side of science. Last summer I had the opportunity to take an environmental chemistry course for my master's which has lent itself well to this project.

Inside the classroom, I try to make things as fun as possible for the students. I find that my background in a variety of sciences allows me to draw on other courses for background and grow the curriculum from there. Outside of the classroom I try to be outside with my 4-year-old daughter and husband as much as possible. We are currently getting into gardening so we will see where that takes us.

My draw to this project is that it based on our own backyard so to speak. We have a lot of farmland around us in Maine and to study that is exciting. The real-life data experience that my students would gain in the process can't be beat. Plus, I never do enough data analysis in my classroom. I tend to fall into the rut of lecture/assignments/exams. My students were really engaged in this throughout the year and were constantly asking when we would be able to work on it. While I didn't do a great job at blending it into my curriculum, next year I will know what works and what doesn't.

Summary:

We started the All About Arsenic project in my College Prep Chemistry in the Fall of 2021. We first talked about the elements on the periodic table and ran through the Arsenic PowerPoint that was shared in Google Drive. From there, I had created an Arsenic Webquest for the students to gain more background information on the topic. The Webquest contained news articles and video from the Arsenic poisoning that occurred years ago at a church in New Sweden. The students were very excited to get started after this.

A lot of my students are on city water but I was able to collect many samples including students and teachers in the building. From there we sent them out to be analyzed. While we waited for the results, I continued to use Arsenic as an example for various activities in the classroom. We also practiced using TUVA Labs. There are some great chemistry related activities such as Periodic Trends and other Elemental assignments that correlated with my lessons. This allowed the students to learn how to use the website and be ready for when the results arrived.

With these results, we ran a bioassay with Judith Roe from UMPI using annelid worms. Judy will have much more on this. We used the one well water sample that we found was high in arsenic during the process.

After the results of the bioassay the students did a lot of research to see what was the case for this. They also created brochures utilizing our bioassay information and graphs from TUVA using the arsenic data. The premade questions from the TUVA folder in google drive also helped steer the students in certain directions. It definitely helped them start their graphs and from there they were able to ask their own questions and find answers.

While we were not able to present at a community meeting this year, the word of our project spread quickly and the students were excited to tell family and friends. We were also able to push out some information on our school's social media pages. We are hoping that the brochures created this year can be handed out with sample kits at next year's open house.

Project Details:

- How many students were in the class that was involved in this project?
 - There were roughly 12 students involved with this project the most, although I had many more students collect well water samples for this. Next year I hope to have more classes involved. I think what I will be teaching next year will make this more possible.
- Detail specific curricular items such as questions, articles, books, YouTube videos, and labs. It's helpful if you provide links.
 - I first relied on the shared resources in Google Drive such as the All About Arsenic PowerPoint and the TUVA resources.
 - I created a Webquest for the students to learn more about arsenic. https://www.bookwidgets.com/play/D9QPD9?teacher_id=5653584380166144
 - We utilized TUVA Labs throughout the year whenever I could find a lesson to match what we were currently doing in class. The students took to this website pretty quickly and were able to complete quite a bit on their own. Next year, I hope to have more time to input data from our bioassay.
 - For our bioassay, I used the book "Assessing Toxic Risk" by the NSTA Press. We talked about toxicology and utilized the worksheets provided by the book prior to and after working with Judy Roe. <https://www.amazon.com/Assessing-Students-Cornell-Scientific-Inquiry/dp/0873552229>
 - Our bioassay led us to water quality and conservation. I used a simple water quality kit to help explain this along with some YouTube videos. I had modified a lab from TeachEngineering.org to help with this as well.
 - Teach Engineering: <https://www.teachengineering.org/activities/view/uok-2216-wastewater-treatment-plant-model-water-quality>
 - Our water quality kit is a little old and used by our other classes. I couldn't find it on amazon anymore, but linked a similar one. https://www.amazon.com/Earth-Force-Low-Cost-Quality-Monitoring/dp/B0080GR71G/ref=sr_1_1?dchild=1&keywords=low+cost+water+monitoring+kit+lamotte&qid=1623682222&sr=8-1
 - We also watched the "In Small Doses" Youtube video and a TED Talk on water conservation: <https://www.youtube.com/watch?v=6HVNpoFvRdk&t=145s>
<https://www.youtube.com/watch?v=nLB8A--QdHc>
- Did you:

- Collaborate with any other teachers in your school?
 - The only collaboration was through the collection of well water. A few teachers were excited to have their wells tested!

- Go on any field trips? Why and where?
 - Not this year. We are hoping to go to the water treatment facility next year. We are also hoping to head up to UMPI and complete some bioassays there. We were able to go on a couple of field trips with the help of Randy Martin for the Orchards, Gardens and Fields program.

- Conduct any experiments? What kinds of questions did students ask?
 - We conducted a bioassay utilizing the book “Assessing Toxic Risk”. This helped students understand toxicology and what questions to ask before starting the project. We also completed a water quality lab and bioassay with Annelid worms.

- Use your stipend to purchase anything for your classroom? If so, what, and how did you use it?
 - I did not use the stipend this year. Luckily, I work with a lot of teachers who collect everything and never throw it away (we’re a bunch of hoarders). I was able to find everything I needed this year in our storage closets. Next year, I will need to order new items such as falcon tubes for collection.

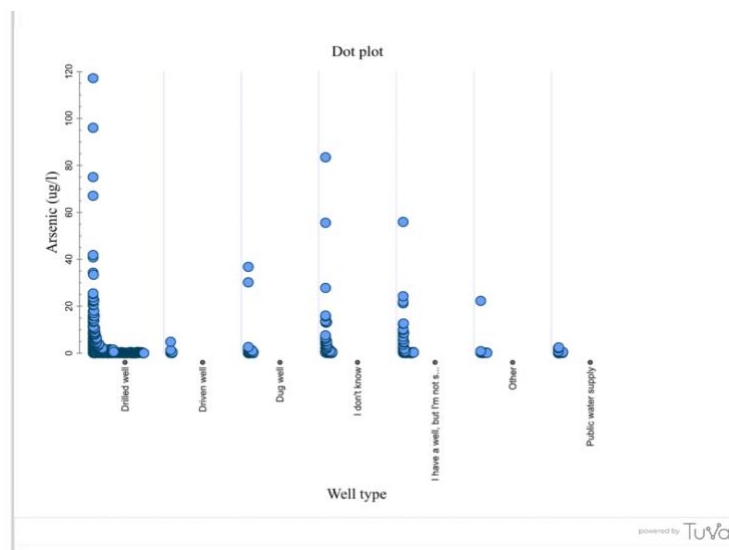
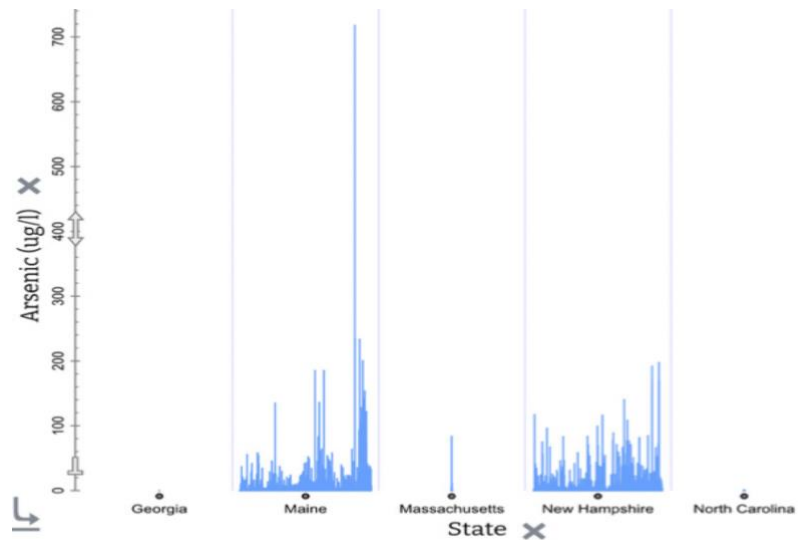
- Invite any guests to visit your classroom?
 - Yes, Randy Martin from the Central Aroostook Soil and Water Conservation District presented to the class on heavy metals in soils.
 - Judy Roe from UMPI also joined our classroom for a few days to help with the Annelid Worm Bioassay

- How did you use Tuva, both for the arsenic data and for other datasets?
 - This year, we used TUVA throughout the year. A good number of lessons in TUVA matched up with my chemistry curriculum and they were great additions to the classwork. We also used to during our bioassay and final activity (brochure) for the arsenic project.
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- How did you plan your community meeting?
 - Sadly, we did not get to this. Instead, we pushed out information on our School’s social media pages. Next year, we hope to meet with the city council. While our water quality results were not terrible, our soil samples were very surprising.

- Include any data analyses your students did.
 - Bioassays:
 - Annelid Worms: Data collected by students was entered into the spreadsheet
 - <https://docs.google.com/spreadsheets/d/1-TFdJyZtmJdue72AlghatfuSSH-YR76INYPYmr8pcl/edit#gid=0>

 - Examples of graphs made with TUVA to complete our Arsenic Brochures.



Discussion:

- What did students learn? It's great to include quotes if you have them.
 - The main takeaway from the project, in my opinion, was how little students even knew about arsenic and other contaminants in our water supply. After learning the foundation of the element, it was also amazing to see students ask questions about our area specifically. They wanted to learn about the agriculture, the use of pesticides and our water supply in general. They asked questions and tried to solve problems on conservation. More specifically near the end of the project, the students were interested in toxicology as a whole. We were able to branch out using the "Assessing Toxic Risk" text into other toxins that are naturally occurring. Asking all of these questions and finding answers will hopefully stay with the students throughout life. The students really liked being able to use TUVa to answer questions with actual data. The fact that this project wasn't just a made-up scenario was huge for them.

- What did you learn?
 - Teaching data literacy was the biggest thing I learned this year. What I thought I had been doing right in years past, I realized wasn't transferring over enough as a whole. For example, completing labs and creating graphs in class was great, but students weren't ever seeing the big picture. Through this project, I realized that it isn't just about teaching students the measurements and units, it's really about how they can apply it and ask more questions. As a science teacher, this project changed how I viewed data literacy. It was hard at first, but letting

the students take over for the bioassay was amazing to watch. They were able to create the whole task on their own using questions and ideas that I hadn't even thought of. I also learned a lot more about arsenic and water quality.

- What would you do differently?
 - I believe that getting to complete this project again next year will be so beneficial for myself and my students. I was not as organized as I wanted to be this year. The year as a whole wasn't as structured as I thought it would be coming back after a pandemic. I think I have some good ideas and takeaways for next year.
 - While I was able to collect samples extremely quickly and the results were back quickly, I didn't get the ball rolling soon enough in the spring semester. I had a hard time fitting in the project with my everyday curriculum. Now that I have seen what the students can do and what they are interested in, I think I will have a much better idea for next year. I understand the flow of the project better and what I can fit in with each unit. Making this part of our "normal" curriculum is obviously the main goal. I also see the value in taking more time with it as well as students develop more curiosities towards the work being done.
 - I also feel more prepared for community outreach next year. I know what the well water looks like in my area and the students and I have even preplanned areas we really want to test in the fall. Even though I won't see my current students again next year, they are invested in the process and ready to still bring me samples. Working more with the UMPI this year was also huge for my students and I think it was really great for them to meet with a scientist and see real research.

Conclusion: I feel really lucky to be able to participate in projects such as this for my students. They learned so much this year and I feel like we barely touched the surface. Through sampling water, analyzing results and trying to teach others, our job is not nearly finished. Next year as we plan for a "normal" school year, I have a lot of plans.

References:

*The All About Arsenic website and the shared google drive folder were my main starting points.

Webquest:

https://www.bookwidgets.com/play/D9QPD9?teacher_id=5653584380166144

TUVA:

<https://arsenicdata.tuvalabs.com/>

"Assessing Toxic Risk" by the NSTA Press:

<https://www.amazon.com/Assessing-Students-Cornell-Scientific-Inquiry/dp/0873552229>

Teach Engineering Activity:

<https://www.teachengineering.org/activities/view/uok-2216-wastewater-treatment-plant-model-water-quality>

Simple Water Quality Kit:

https://www.amazon.com/Earth-Force-Low-Cost-Quality-Monitoring/dp/B0080GR71G/ref=sr_1_1?dchild=1&keywords=low+cost+water+monitoring+kit+lamotte&qid=1623682222&sr=8-1

"In Small Doses" Youtube video:

<https://www.youtube.com/watch?v=6HVNpoFvRdk&t=145s>

TED Talk on water conservation:

<https://www.youtube.com/watch?v=nLB8A--QdHc>

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