



2023-2024 SEPA Case Study Template

Your Name: Brandy McFadden

Your School: Edward Little High School & (AVEC Schools include Oak Hill High School, Leavitt Area High School and Lisbon High School)

Grade Level(s): Mixed: 10th, 11th, & 12th.

Course(s) Taught: Environmental Science; and AVEC Gifted and Talented Math & Science Course

Number of Students Involved (Total): 40

Date: April 24, 2024

Name of your scientist partner and their institution, and any other partners: Juyoung Shim, University of Maine of Augusta. AVEC Math/Science has advisors: Jamie Boucher, Kayleigh Getty, & Sara Brown.

Teacher Profile: A brief biography of yourself. How long have you been teaching? What did you study in school? What are you passionate about inside and outside the classroom? Why are you interested in the All About Arsenic+ project?

I have been teaching high school science for 18 years. As an undergraduate, I studied Marine Science and Environmental Science. During the summers and school breaks, I interned at the New Hampshire Department of Environmental Services in their Limnology Lab. As an intern, I analyzed water samples from our NH lakes and monitored/mapped aquatic vegetation, specifically looking for invasive plant species. This inspired my focus in Graduate School. As a graduate student in Biology, I specifically looked at the local adaptations of invasives species by growing them in both their native and non-native ranges and analyzing the variations in growth. This passion for asking questions, collecting data, drawing conclusions, etc, is something I try to bring to my classroom. I enjoy bringing students into the field to experience this hands-on. In the AVEC Math/Science program, we specifically go on field trips to engage students in STEM activities with Scientists or professionals in the field. The 'All About Arsenic+' project aligns to my goals in engaging students in real-life, hands-on learning.

Abstract: Provide a 500-word summary of your project. Describe the curriculum. How was drinking water sampling, data analysis, and science communication integrated into that curriculum? Provide specifics (number of samples collected, what the samples were analyzed for, how Tuva was used, what opportunities students had to talk about their data through some public outreach, etc...).

Our project revolved around the Municipal Water Supply from Lake Auburn. We had a unit in the Environmental Science class focused on Drinking Water. We have had significant issues with the drinking water supply in regard to high phosphorus content, which has led to dead zones, fish kills and alum treatments. So, students collected water, analyzed their data using Tuva and created a presentation for Parents, Administration and other citizens of Auburn who may not understand the science behind this issue (see below). This unit also included a presentation from my scientist partner, Juyoung Shim, regarding behavior responses of planaria in water samples.

In the AVEC Math/Science gifted and talented program, we had a theme for the year that revolved around drinking water. We visited the Auburn Water District & Lewiston/Auburn Pollution Control facility, toured the facility and looked at water samples; so students saw where their water source started and where it ended. Many of these students in the program come from two rural schools and therefore private wells (Leavitt and Oak Hill), while two schools had municipal water sources: Lisbon has three wells, and Edward Little uses water from Lake Auburn. Students sampled their drinking water and we just received the samples. On Tuesday, April 30th, we will be using Tuva to analyze the samples and they will have a 'water filter challenge'. Students designed a water filter last meeting, all materials were purchased and they will be tasked with building these on Tuesday.

Drinking Water Project

Part 1: Background Information

Describe the water cycle as it applies to drinking water.

- Identify where your drinking water comes from
 - i. Where does the water from Lake Auburn or your Well come from?
 - ii. How does water get to you?
 - iii. What process does it go through before you can consume it?
- Identify some contaminants that can result from runoff.
- Identify some contaminants that can result from just the geology of the area (radon, arsenic, etc)
- How do the contaminants identified above impact drinking water?
 - i. Hypoxic/Dead Zones
 - ii. PFAs

Part 2: Your data:

Analyze the result of your Drinking Water, what does it tell you?

- Ranges of metals, are they all within range? (explain)
- Briefly highlight some contaminants that may be in the water but weren't detected in the testing (PFAs, Fecal Coliforms, etc)

Part 3: Sustainability:

Help your audience understand the steps they can take to promote clean drinking water in Maine.

- What are some positive behaviors that citizens should do to protect their drinking water?
- What are some negative behaviors that citizens should avoid to protect their drinking water?
- Identify areas where the City of Auburn (or surrounding towns) could change to help protect their drinking water and suggest how they could change it.

Part 4: Educational Piece

- Create a media educational piece help your audience understand the cycle of drinking water here in Auburn and the factors that could influence it.

Details

Did you...

	No	Yes	If yes, how many?
<p>Collaborate with any other teachers in your school? - If so, who and what do they teach?</p> <p>I collaborated with teachers from Oak Hill: Jamie Boucher (Science), Lisbon High School: Sara Brown (Math); Leavitt Area High School: Kayleigh Getty (Science).</p>	<input type="radio"/>	√	<u>4</u>
<p>Conduct any experiments? - If so, what kinds of questions did students ask?</p> <p>Yes, we used Planaria and completed behavioral surveys. Some questions were:</p> <ol style="list-style-type: none"> 1. How do PFAS impact planaria? (how do they impact us)? 2. Which chemicals in our water have a bigger impact on behavior of planaria? 	<input type="radio"/>	√	_____
<p>Go on any field trips? - If so, where and why?</p> <p>University of Maine Augusta – met with Juyoung Bates – meeting place for AVEC Math/Science</p> <p>All field trips were to support data collection, understanding of the Data, or to see research labs (UMA)</p>	<input type="radio"/>	√	_____
<p>Have any guests visit your classroom? - If so, who and why? What did the guest do?</p> <p>Scientist Partner – Juyoung Shim Conducted behavioral studies with Planaria</p>	<input type="radio"/>	√	_____
<p>Have a Community Meeting? - If so, where was it, what did the students do, how many people attended, etc...?</p> <p>Students presented Drinking water project to class and were given bonus points if they presented it to parents, or someone else in the community.</p>	<input type="radio"/>	√	_____
<p>Have other Outreach Events? - If so, where were they, what did the students do, how many people attended, etc...?</p>	√	<input type="radio"/>	_____
<p>Use your stipend to purchase anything for your classroom? - If so, what, and how did you use it?</p>	<input type="radio"/>	√	\$ _____

Purchased supplies for sampling.			
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Describe the student, or group of students, whose work most exemplified the All About Arsenic+ project this school year. What were they excited about? How did that facilitate their learning?

This was done with two groups, one a class at Edward Little and another a group of Gifted & Talented students from Androscoggin County. My students were excited to see what was in their drinking water, we talked about the elements sampled and what their limits were (they made 'baseball' cards for each one to describe what the minimum/maximum levels were for Maine and how they impacted our health). We also looked at the relative changes for these minerals (especially Manganese) in Auburn Municipal water (we used TUVA).

Reflect on your students' primary learning outcomes/gains with reference to data literacy, science communication, and using data visualizations in communication. What are they getting out of their involvement in this project?

My Environmental Science class uses project-based learning, so students collected samples, analyzed their results and the impacts it could have on their local community, and presented the data in a variety of ways (Canva presentations, Canva Website development, Posters displayed in the classroom, etc).

How did you use Tuva, for the arsenic data?? Did you use the software for teaching, was it a tool students used to create data visualizations? What about other Tuva data activities? Did you use them in your teaching? Did students build skills using those activities?

We used TUVA to look at the distribution of Manganese since that is what we found high levels of in some of our municipal water sources sampled. I used it mostly as a demonstration for the class, we looked at the graph together.

What challenges did your students have with Tuva, the website, the datasheet, Anecdota, anything related to the project process.

It took me a while to figure out TUVA, so I didn't spend much time having students play with it in class.

How did you enhance *your own* Data Visualization and Science Communication skills?

I still feel like I am in the beginning stages of understanding TUVA, I would need more time to continue to hone in on my own skills before I could role this out for student use in class.

Which aspects of this project will you repeat next year?

'Water Filter' challenge, I did that with the AVEC group and they were super motivated and excited. I made 'dirty' water, bought supplies through my GT budget and had student groups (by school) build water filters. The motivating part for them was a prize at the end AND watching me drink their filtered water (after narrowing it down to the final samples that passed the 'Turbidity Test').

Which aspects of this project will you change next year?

I would like to use TUVAs more, but that all depends on how much time I have to work with it myself.

List and describe the resources that helped your students the most this year.

Canva, All About Arsenic+, Auburn Water District, etc.

Provide a list, and links, if applicable, to specific curricular items such as online worksheets, articles, books, YouTube videos, and labs.

[Municipal Water Cycle YouTube Video](#)

[Planaria Labs](#)

Add addendums such as curriculum, photos, student assessments, testimonials from parents/students, etc.

See the curriculum project above. Image is from our visit to UMA, Students learned what a Spectrophotometer could analyze for data.



What are anticipated needs for the 2024-2025 school year?

More water sample materials, planaria, petri dishes, paint brushes, field trips to Auburn Water District & Lewiston Auburn Pollution Control Authority.

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