2024-2025 SEPA Case Study Template

Date: 23 March 2025

Your Name: Kaleigh Martins

Your School: Pelham High School

Grade Level(s): 9-12

Course(s) Taught: AP Environmental Science, Biology

Number of Students Involved (Total): 75

Name of your scientist partner and their institution, and any other partners (other partners can include, but are not limited to, collaborations within the school, community groups, non-profit organizations such as the YMCA, or stand out family or friend mentors that helped your project succeed):

Dr. Maria Florencia Fahnestock, Research Scientist III, University of New Hampshire

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? How long have you been participating in SEPA and how were you recruited to participate?***

I have been teaching in Pelham for 8 years, where I have started my professional teaching career. Before becoming a teacher, I was a student at the University of New Haven, where I earned my Bacheors of Science in Forensic Science, Biology, and my Masters of Science in the Teaching of Secondary Science Education. I have had the pleasure of also earning my Master of Educational Leadership in Curriculum, Instruction and Design from Southern New Hampshire University. I have been able to put all of my degrees to work writing curriculum for the science department in Pelham reworking the Biology curriculum and writing a Forensic Science curriculum. I am currently in the process of writing an Environmental Science curriculum as well. I am passionate about curriculum writing and implementation. I am someone who enjoys diving into standards and working to translate them to classroom activities and lessons that students would enjoy.

Outside of school, I am a competitive baton twirling coach for a team out of Nashua, New Hampshire, where I have the opportunity to take my 16 years of National and International competitive baton twirling experience and pass it to the next generation of twirlers. I am a mom to an energetic 2.5 year old son, a black lab rescue boy from Puerto Rico, and a wife of 7 years. I love to spend time with my family and read, when my busy schedule allows it.

I became passionate about the All About Arsenic+ project Through my work with Dr. Janet Holden, the previous Pelham Teacher on the grant. I grew up with well water, and working in a town that has high levels of toxic metals wants me to continue to pursue this work to help students live healthier lifestyles, by learning the negative effects of the toxic metals on the body. This is my second full year participating in the grant, as Janet Holden is preparing for her retirement from the educational field.

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…). Did students use the **Science Communication Toolkit** and/or Solutionaries Framework to prepare for this outreach event or guide their participation in SEPA this school year? Did students participate in an **Intergenerational Learning** activity (pH exercise etc.)? Please include anecdotes or stories in this section!

Pelham High Schools participating in the 2024-2025 SEPA grant allowed a new group of students to immerse themselves in the understanding of toxic metals in drinking water. Students in the AP Environmental class were able to take the classroom curriculum, as outlined in the AP Environmental curriculum by AP College Board, and apply it to their lives. Homes in Pelham are built on ground that is highly affected by toxic metals. The well water of the homeowners tested have shown elevated levels of toxic metals. Students had the opportunity to share literature with the public during National Voting Day on November 5, 2024. While sharing literature with the town, students also handed out water test kits to individuals who were interested in having their well water tested. We were able to collect approximately 40 water samples for analysis. AP Environmental students used the data analyzed by scientists to become experts, and share their findings with their peers on the sources, harmful effects and remediation techniques on one of the toxic metals plaguing the town of Pelham.

Students used the Science Communication Toolkit to learn how to best translate their findings into a language that the average person could understand. As part of the AP Environmental curriculum, students study land and water use and disuse. This curriculum felt like a natural integration of toxic metals and how they impact the community. Students were able to use Google Sheets to explore the data from previous years and compare it to recent data to draw conclusions of “pockets” of elevated toxic metals around the town. Students also were able to hypothesize the effects of the toxic metals on the human population. Allowing students to become an expert on one of the toxic metals allowed students to learn and teach others about the hazards and harmful effects of consuming, or absorbing, some of these toxic metals into the body. Students were then able to draw conclusions on the effects of all of the toxic metals, if consumed or absorbed, by the body.

Although students were unable to access the TUVA software, they were able to explore data through Google Sheets. Through use of the Science Communication Toolkit, students were able to learn the importance of communicating with others in a way that does not speak above the knowledge of the general public. By practicing with their peers, students were then able to work on their communication skills in the whelm of science in a way that draws the attention of the public. Students were not able to complete Intergenerational Learning activities due to the time constraints of the AP Environmental course, and the amount of curriculum that is required to be covered by College Board. Despite this, students were able to take away a lot of knowledge about the hazards of toxic metals in water and the best ways to communicate those findings with the public in a way that is most appropriate to the audience in which they are trying to reach.

Details

Did you…

	No	Yes	If yes, how many?
Collaborate with your Scientist Partner? - If so, how?	☐	☑	Dr. Fahnestock came to speak to the AP Biology and AP Environmental classes about her work in Geology and how that impacts what we are seeing in our well water here in New Hampshire
Use the Science Communication Toolkit? - If so, how?	☐	☑	Students used the pieces of the Science Communication Workbook when working on their toxic metal research.
Use the Solutionaries Framework? - If so, how?	☑	☐	_____
Use any Intergenerational Activities? - If so, how?	☑	☐	_____
Collaborate with any other teachers in your school? - If so, who and what do they teach?	☐	☑	Janet Holden AP Biology and Biology
Conduct any experiments? - If so, what kinds of questions did students ask?	☐	☑	AP Environmental Science did an algae growth experiment and an aquaponics experiment. Algae research began as a population density experiment and adapted to a bioassay with brine shrimp. Students found interest in this experiment through the changes of the variable in the water that

			affected the growth of the algae and the impact on the brine shrimp. Aquaponics focused on the various environmental factors that affect populations and solutions to keep both the plants and animals alive.
Go on any field trips? - If so, where and why?	☑	☐	_____
Have any guests visit your classroom? - If so, who and why? What did the guest do?	☐	☑	Scientist partner came in to speak to the AP Biology and AP Environmental classes.
Have a Community Meeting? - If so, where was it, what did the students do, how many people attended, etc…?	☐	☑	Students handed out literature and water test kits during voting day on November 5. 10 students volunteered to work throughout the day to inform the town of the work of the All About Arsenic+ grant.
Have other Outreach Events? - If so, where were they, what did the students do, how many people attended, etc…?	☑		_____
Use your stipend to purchase anything for your classroom? - If so, what, and how did you use it?	☐	☑	$244 Shipping costs, digital camera for video footage and memory cards for classroom footage.

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? Please include anecdotes and stories here.

Senior student, Sarah, has been invested in the work of this grant over the last two years. She is highly interested in the Environmental Science and Engineering fields. She has been devoted to help spread awareness and education to other students and the community members about the dangers of what is inside our water in Pelham. Sarah was excited to help lead the voting day initiative, handing out literature and working with other students to spread knowledge about the effects of toxic metal on the human body. Her natural intuitive personality drew her further into the grant, working alongside myself and Dr. Janet Holden to help get a better understanding of what the dangers of the toxic metals are.

AP Environmental Students used their knowledge of land and water use and misuse from Units 5, 6 and 7. Using their knowledge from the curriculum, students were able to interpret the data collected from previous years water samples, as this year had not come in by the time we were doing this unit, and draw conclusions to where the sources of the toxic metals could be coming from. AP Environmental students were shocked to learn that the increased amounts of toxic metals in the water in Pelham could be from human activities. They broke into groups focusing on the primary toxic metals outlined in the AP Environmental curriculum: manganese, lead, arsenic, uranium, chlorine, and iron. Each group became a content expert on their toxic mental and shared their findings to the class. The class is a one semester class, but students expressed they wished they could have had time to extrapolate on their findings to be shared with the greater public.

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? Please include anecdotes and stories here.

The AP Environmental Students tied their learning of water and land use and disuse from their curriculum to what they were interpreting in the data from the previous years of the grant to help better understand the environment in which they live. Students were able to break into groups and work together to become "experts" on their toxic metal and share it with the rest of the class. In a perfect world, I would have liked to have them turn their presentations into mini commercials to be shared on the Public Television Network in town. However, students were able to gain a lot of knowledge about the hazards and sources of toxic metals, and the impacts on the human body throughout their classwork. By becoming experts on their toxic metal, students were able to share out and communicate with the rest of the class the sources, human impacts to the increase of the toxic metal in the water, and the human health effects of the toxic metal to the rest of thier class. They were able to bring together their knowledge from Biology, the presentation from our scientist partner, and the data from previous years All About Arsenic+ projects to draw conclusions and communicate their findings with their peers.

If you are a teacher who has participated in both SEPA grants, how have you shifted your teaching to include the additional goals of science communication and intergenerational learning?

I have had the opportunity to be a background participant in the communication goals as part of the SEPA grant, as well as a participant in the intergenerational learning grant. I have worked to shift the focus on how to best communicate across the generations with the work the students are doing with the grant. I focus with the AP Environmental students on the importance of communicating, but also how to communicate to various audiences of people who may not have as much of an understanding of science as the students. My goal moving forward is to have students, when creating presentations on toxic metals to use language that the average adult would be able to understand, as well as creating learning materials for the younger generations of students.

How did you use our Tuva drinking water dataset? 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? Please include stories that illustrate students understanding the link between data visualization and literacy and science communication. If

you are a teacher who has participated in both SEPA grants, how have you shifted your data literacy focus to include this grant's science communication goal?

Due to technological difficulties, we were not able to access Tuva this year on student chromebooks.

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

Due to bandwidthing issues within our school, and the age of the student chromebooks, we were not able to have students work on Tuva on the website. We were able to print data samples from Tuva and have students look at and manipulate the data. We also had students look through the data collected from previous years to identify trends, patterns or anomalies they may have found.

If you did not use Tuva this year, how did you analyze drinking water data? Please explain why you did not use Tuva. What challenges and successes did students experience with your chosen data analysis/visualization tool?

Students accessed the data using Google Sheets to identify trends, patterns or anomalies in the data. Students worked together to color code a copy of the data from previous years to help them identify the trends on their particular toxic metal they were studying for their communication to their peers. Tuva has been proving difficult for our students over the last few years. They have not been able to load Tuva on their school issued chromebooks, due to either age of the devices or bandwidthing issues within the school. We have gone through troubleshooting with Tuva and our school IT Department, but have not been able to come up with a solution to allow more than two (2) students in the classroom to log into the system at once. When we have several students, or more than one class trying to get into Tuva at the same time, we find that the system portrays as if it is overloaded and becomes slow, glitchy and nonfunctional.

How did you enhance your own Data Visualization and Science Communication skills As an educator or scientist partner?

Students were engaged in working with previous years of data from Pelham to compare how the samples have changed throughout the years of participation in this grant. They were able to draw conclusions connecting the increased/decreased levels of the toxic metals as a ratio, of sorts. At times, they did establish a correlation between the increased percentage of toxic metals in the samples due to increased sample population size. However, there were times where they identified a smaller sample pool with elevated toxic metal numbers. This helped them draw the conclusion that we could be looking at isolated pockets in town where samples all came from (i.e. one neighborhood) that all tested in the same area. This raised questions from the students regarding the isolated pockets being higher than others and if there is something different in that area of town that is causing the elevated amounts of toxic metals.

<u>Science Communication Outreach</u>

What kinds of science communication outreach products did your students produce?

The students, a combination of AP Biology and AP Environmental students, used literature about the hazards of toxic metals in water and the hazards associated with having that water absorbed into the body, either through consumption or showering. This literature was handed out during national voting day on November 5, 2024, along with water sample kits to townspeople who were coming to vote.

Did your students work with the Science Communication Toolkit this year? Yes X No ☐

If yes, please describe how it went. What worked best? What improvements could be made?

Students used the Communication Toolkit as a starting point about how to best communicate their findings as budding scientists. Students were able to understand the importance of using language that the people of town would understand, as if they had minimal exposure to scientific readings. Some improvements students felt could be made were to make the science communication toolkit a bit more user friendly. Although, once they got familiar with working with the toolkit, they said it was fairly easy to use.

Please include anecdotes or stories here. If you did not use the Science Communication Toolkit, why not? What other resources and activities did you use to teach of facilitate science communication? Did the science communication skill building inspire outreach or build capacity in your students in ways not directly associated with the SEPA project?

Students at all levels benefited from understanding the importance of communicating scientific knowledge to others around them. While students are relatively good at communicating their findings to others, they tend to struggle with communicating to a non-science community. The Communication Toolkit helped students understand why communicating in a way that all can understand is important. Students in AP Environmental Science worked with the Science Communication Toolkit to become experts on their toxic metal throughout Units 5-8 in the curriculum. Students shared that it was helpful to learn the importance of communicating in a way that all can understand, and not just share their knowledge with their peers learning the same content as them. They shared that they enjoyed being able to learn how to share scientific knowledge with others in a way that will continue to assist them through life. Reminding them that not everyone has a base understanding of science the way they did, aided them in their learning of how to best communicate their findings with others around them.

Don't forget to add all final student products to your teacher folder on the shared google folder! (Feel free to add additional products that led to the final products. Simply create a separate folder under your teacher folder.)

Intergenerational Learning

Did you send an intergenerational activity home to parents? Yes ☐ No X

If yes, please describe the activity. What are stories and anecdotes you can include about student participation in intergenerational learning activities?

N/A

If no, please describe why. What other resources or activities did you use to teach about or facilitate intergenerational learning?

Due to our involvement with the town voting day on November 5, 2024, we did not do any send home intergenerational learning activities. We did focus on the education of the general public, using materials from the Science Communication Toolkit about the grant to help the people in town better understand what could be in their water and what ways those toxic metals can be removed.

What worked best? What improvements could be made?

Having no additional experience with this grant, I am willing to try new things next year. We are moving to a model where AP Environmental Science will not be running every year. I feel as though this can be helpful with students in the lower leveled courses to communicate home some of the topics we are discussing in class. This will help intergenerational learning by allowing students to have open conversations about what they are learning in school and how it will continue to impact their daily lives.

Did the intergenerational activity go home at the same time as the drinking water samples? Yes ☐

No X ***Please explain.***

What feedback did you hear about the activity?

No feedback was provided as the activity was not completed this year.

Solutionaries Framework

Did you use the Solutionaries Framework in your class? Yes ☐ No X

If yes, please describe.

What worked best? What improvements could be made?

If no, why not? Please include other activities or resources you used to teach about or facilitate systems thinking, placed-based discovery, or project-based learning.

The AP Environmental Science curriculum naturally leads to these thingings and ideologies. The bulk to the AP Environmental curriculum in inquiry based and project-based learning. Students are presented with problems that are raging the world around them and must use classroom knowledge to conclude healthy and sustainable solutions to the problem to help better the world.. Additionally, the biology classes use place-based discovery and project-based learning to understand the world around them. During the Ecology unit in the Biology curriculum, students learn about the environment in their town by studying the nature reserve on school property. This is a beneficial way for students to see the impact of the environment on humans, and the importance of human activity on the environment, in both good and bad ways.

Did you attend the Institute for Humane Education series on the solutionaries framework in your class?

Yes ☐ No X

Which aspects of this Communicating Data project will you repeat next year?

I truly believe that all students have the ability to read, interpret and communicate their findings in relation to data collection. I have used the skills shared in the Communication Toolkit with all of my classes when we perform labs to help them best understand how they should be sharing their findings within their reports. Students, especially those in lower level classes, often assume that the person reading their work will always know what the data is trying to explain. By using some of the tools in the Toolkit, I have been able to help students see that they need to express themselves through a lense that the reader may not always have a baseline understanding of science. I will continue to help students with their science communication in a way that helps them best understand that they need to explain their findings in a way that a non-science reader can understand.

Which aspects of this project will you change next year?

Next year, I will not be running the AP Environmental Science course, as the school is moving the course to an alternating schedule with AP Chemistry. Due to this factor, I will be changing how I approach the project with the unleveled and Level 1 Biology courses. All biology courses touch upon the environment and human impact on it, but I will be integrating more emphasis on toxic metals within the Biology curriculum to help all students see the impact of toxic metals in Pelham.

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

AP Environmental Science CER
AP Biology CER
Aquaponics Lab
Aquaponics Videos
Brine Shrimp Algae Lab (Algae research supply)

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

AP Environmental Science CER
AP Biology CER
Aquaponics Lab
Aquaponics Video
Hydroponic Lab
Brine Shrimp Algae Lab

Add addendums such as stories and anecdotes, photos, student assessments, testimonials from parents/students, etc.

What were gaps or barriers you experienced this year?

TUVA proved to be our biggest difficulty/challenge this year. Our school Chromebooks do not have the capability to run TUVA in the classroom when there is more than two people trying to access the data set. We have worked with the TUVA representatives and have not been able to figure out a solution to the issues we are facing.

Additionally, the U&I meetings are at a time that is not conducive to our schedules. I have spent a good deal of time watching the recordings, which is greatly appreciated.

What are the anticipated needs for the 2025-2026 school year?

In preparation for 2025-2026, we will be working with the same supplies and resources that we have been for the last few years.

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