

Fulbright Teachers for Global Classrooms

Project Based Learning Unit Plan - Template

Name:	Neil Snedeker
School Type:	Rural Public K-12 school
Subject:	Engineering
Grade Level:	High School
Project Title:	Protecting Our Local Water Resources

Project Concept

Driving Question	Project Summary/Big Idea
<p>How can we monitor and improve the health of the East Branch of the Delaware River behind our school?</p> <p>How can our local solutions be applied to water sources throughout the world?</p>	<p>The world is covered by water but only a tiny fraction of it is safe for human consumption. As the human population continues to grow, the world becomes more polluted, and climate changes it is more important than ever to protect this crucial resource. Even though my school is several hours from New York City, the water from our region provides over nine million people in the NYC metro area with clean water every day. We must act as stewards of the land and our students should learn how to protect our water. Our water concerns are not just local but they are felt worldwide. This project will be aligned to the UN's Sustainable Development Goal #6.</p> <p>Students will begin by monitoring and analyzing the health of the stream behind our school. They will begin the course by taking weekly water quality samples. Once Spring arrives, students will explore and observe the portion of the stream that runs through the school property. They should look at the types of vegetation and will look for macroinvertebrates in the water.</p> <p>Next the students will begin to analyze the water quality data that they have collected. Using this data, and their observations of the stream, they will identify areas of concern. As a group they will research ways that they can mitigate these issues.</p> <p>As part of their work on the stream they will conduct a riparian restoration. The students will need to research local trees & shrubs and will</p>

	<p>need to map out where they want to plant some vegetation to improve the stream health.</p> <p>Throughout this project the students will be collaborating with local experts (as well as a global expert), keeping their own journals, and preparing to present their data. Ultimately the students will prepare a presentation that will be shared with the school administration, the town supervisor, and the local agencies that govern the watershed.</p> <p>As part of this project the students will be collaborating with a classroom in another part of the world. First the students will spend some time getting to know each other and to make connections. Next they will share some of their concerns related to water availability and water quality. If there are mutual concerns, the students could work together to come up with an action plan that could be implemented within each of their respective communities. It is this action plan that the students will be presenting.</p>
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Subject Content and Interdisciplinary Connections

Science - Monitoring stream health, testing water quality, researching local plant species, riparian restoration, macroinvertebrate study
 Math - Graphing & analyzing data
 ELA - communicating results, presenting action plan, journaling
 Social Studies - geography

Global Competencies

- 1.) Identify an issue, generate a question, and explain the significance of locally, regionally, and globally focused researchable questions.
- 2.) Examine perspectives of other people, groups, or schools of thought and identify the influences of those perspectives.
- 3.) Assess options and plan actions based on evidence and the potential for impact, taking into account previous approaches, varied perspectives and potential consequences.

Learning/Curriculum Standards

I will be basing my unit on the New York State Science Learning Standards as well as the NYS ELA standards

[New York State Science Learning Standards](#)

LS2.C: Ecosystem Dynamics, Functioning, and resilience

- Anthropogenic changes (induced by human activity) in the environment -- including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change -- can disrupt an ecosystem and threaten the survival of some species.

ESS2.A: Earth Materials and Systems

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes

ESS2.C: The Roles of Water in Earth's surface processes

- The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.

ESS2.E: Biogeology

- The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual coevolution of Earth's surface and the life that exists on it.

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

ETS1.A: Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges may also have manifestations in local communities.

ETS1.B Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

[New York State ELA Standards](#)

RST7: Translate scientific or technical information expressed as written text into visual form and translate information expressed visually or mathematically into words.

RST9: Compare and contrast findings presented in a source to those from other sources, noting when the findings support or contradict previous explanations or accounts.

WHST1: Write arguments focused on discipline-specific content.

WHST4: Write responses to texts and to events (past and present), ideas, and theories that include personal, cultural, and thematic connections.

WHST5: Conduct short as well as more sustained research projects to answer a question (including a self-generated question), analyze a topic, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating an understanding of the subject under investigation.

Authentic Product and Audience

Students will be preparing a presentation that could be shared with the local government as well as the agencies that oversee and protect the watershed. The presentation will include data on the water quality, steps that our community could take to address concerns, their plan for the riparian restoration, etc.

Project Management

Project Timeframe and Milestones (how many class periods/weeks is this PBL?)

This project will start at the beginning of the second semester (January). The students will collect water samples once per week until Spring. At this point the rest of the project will begin. The class meets every day for 45 minutes and the project is estimated to last approximately six weeks.

Individual milestones:

Week 1: Get to know students in partner school

Week 2: Identify potential concerns to the stream behind the school

Week 3: Rough draft of Action Plan

Week 4: Final Draft of Action Plan, Presentation completed

Week 5: Begin taking action

Week 6: Finish implementing action plan, short research paper

What will Students Need to Know and How will they Get to Know Them?

- How to conduct water quality tests - instructions that came along with the kit
- How to analyze the test results - kit instructions
- Local trees & shrubs - online research
- What is a riparian restoration - online research, Catskill Stream Buffer Initiative
- Macroinvertebrate identification
- Water issues around the globe - research
- Roles & responsibilities of local agencies - presentations
- Strategies for improving stream health - research
- How to read maps - Earth Science curriculum

Authentic Performance Based Assessment

- Remember! Authentic assessments have a product (such as book, Op ed or website) and/or audience (such as a presentation to community members or experts)

The students will need to put together an action plan based upon the issues that they wish to address. The action plan will be put into a presentation that they will share with school administration, town supervisor, and local watershed agencies. The students will then implement that action plan in connection with students in their partner school.

Differentiation and Scaffolds

- Including opportunities for student choice and input
- Students will be individually researching an area of the water that is facing some sort of water issue. It could be a water shortage, pollution, mismanagement, etc. They can choose an area and an issue that they find interesting or is personally relevant.

- Students may be able to break up into groups to research solutions to issues that interest them.
- The teacher will put together a collection of resources to share with students that may be struggling when conducting research.

Resources

Please list below, the following:

1. What real world EXPERTS would you like to utilize?
2. Which specific TEXTS (web research, articles, sites, images) will you and the students use? (Please list them)
3. What TECHNOLOGY will you use? (Please list them)
4. What other MATERIALS (equipment, maker space, etc.) will you and the students need?

Note: This is a great opportunity to engage the school and wider community. Often we forget about the resources around us!

1.) Experts

- a.) Catskill Watershed Corporation Representative
- b.) Watershed Agricultural Council Representative
- c.) Catskill Stream Buffer Initiative Representative
- d.) NYC Department of Environmental Protection Representative
- e.) Africa Water and Sanitation Local Authorities Network Representative
- f.) Town Supervisor

2.) Texts

- a.) [Link to Personal Water Use Chart](#)
- b.) [Sustainable Development Goals](#)
- c.) [NPR Radio clip - Did Cape Town Learn from 'Day Zero'](#)
- d.) [Article - What It's Like to Live Through Cape Town's Massive Water Crisis](#)
- e.) [Native Trees and Shrubs of New York](#)
- f.) [Potential Well Water Contaminants and Their Impacts](#)
- g.) [Freshwater Macroinvertebrates of NY](#)
- h.) [Lamotte Common Test Factors](#)
- i.) [A Billion-Dollar Investment in New York's Water](#)
- j.) [Two Texas Towns Run Out of Water](#)
- k.) [In Himalayas, Assessing Climate Threats to Ice, and Water Supply](#)
- l.) [Africa Water Solutions](#)
- m.) [Game-Changing Water Solutions for the Middle East and North Africa](#)

3.) Technology

- a.) Chromebook
- b.) Skype, Hangouts, or Zoom
- c.) Some sort of presentation software
- d.) Google Sheets
- e.) Mapping software (Google Maps, Caltopo, etc)
- f.) Virtual pen-pal program (such as classroom bridges)
- g.) Padlet

h.) Twitter - to follow #SDG6

4.) Materials

a.) Waders

b.) Kicknets

c.) Lamotte Water Testing Kit

d.) Trees/Shrubs

e.) Shovels

f.) notebook

Project Kick-Off and Building Background Knowledge

Kick-Off Event and Driving Question

- How will you introduce the project and driving question to the students?

Tip: Think outside the box. The more fun and engaging the better!

- The students will work on estimating the amount of water that they use per day. To do this they will fill out the Water Use Chart linked above. It includes a list of some daily activities and the amount of water each requires.
- Once each student has their estimate, they will be presented with a hypothetical situation. Due to drought and poor water management the wells in our town have run dry. The students will be allocated 13 gallons of water each day (amount residents of Cape Town, South Africa were allocated) and they will have to determine which of the daily activities they will use their limited water on.
- The class will have a discussion on which activities they gave up and why.
- The students will read two different articles: Two Texas Towns Run Out of Water & What It's Like to Live Through Cape Town's Day Zero
- At this point students will begin their collaboration with their partner class. If we cannot set things up that we can be online at the same time, students will create a video introducing themselves that will be shared.
- Students will be sharing their water usage to Padlet and can compare amounts between students in their class as well as students in the partner school
- The Sustainable Development Goal #6 will be shared with the students. The focus will be on the following sub-goals
 - 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
 - 6.B Support and strengthen the participation of local communities in improving water and sanitation management

Building Background Knowledge

- What strategies are used to foster student inquiry? How will these questions be answered or explored and applied to the work and learning of each student?
- How will students communicate and expand on what they need to know for successful project completion?
- Until the students begin collecting data on the stream, potential issues are unknown. There is no definite answer and an investigation will need to be conducted to determine the stream's health. As data is collected, the path of this project could change.
- Students will have time each period to discuss their findings, share their results, voice their concerns, and present their ideas. The students will be able to reach out to the local experts for assistance and/or feedback

Project Development Outline

Project Daily Outline - Overall Objectives and Practices for Each Class or Week

- Remember to build in time for teacher directed learning, guided inquiry project work and tuning, brainstorming, reflecting.

Prior to project beginning: This class will be offered during the second semester of the year. Since we cannot get outside and do much during winter, students will just be collecting as much water quality data they can during this time. This will give us data to look at once the project begins.

Science Journal: Each student will maintain a science journal where they will keep their data, their thoughts, and monitor the progression of their ideas. Each week will begin with some guiding questions to prepare the students for the week and it will end with some followup questions.

Class/Week 1 - kick-off event, graphing water quality data, researching what the data means, macroinvertebrate study, presentation by Department of Environmental Protection and Africa Water and Sanitation Local Authorities Network

- **Guiding Questions**
 1. What are some threats that we may face locally to our clean drinking water?
 2. How do the threats described above relate to the threats faced globally?
 3. Who is responsible for trying to remove these threats from our drinking water?

- Prior to beginning this week, students will have several weeks of water quality data in their notebooks.
- The class will take part in the kick-off activity where they will estimate their average daily water usage. Next they will have to figure out how they would utilize their allocation of water if rationing were put in place because of a drought.
- A day would be spent outside making observations of the stream. A quick macroinvertebrate study would be performed as well.
- In their notebooks they will record their observations, their questions, and things they are curious about. Students will be encouraged to sketch as well as write.
- Students will connect to their partner class from another part of the world. The first part of the class will be spent just getting to know each other. The second part of the class will be spent discussing how water is important within their community as well as their concerns regarding water. Once this initial face-to-face meeting is held, some of their communications can be done through email or a shared document. The students will be sharing their concerns regarding groundwater as well as the results of the kick-off activity.
- Presentation by the Department of Environmental Protection (DEP) & the Africa Water and Sanitation Local Authorities Network (AWSLAN)
 - a. The DEP will talk to the students about what their organization does, how they take care of the water supply, and water students can do
 - b. AWSLAN will talk to the students about their work in Africa.
- **To end the week students will respond to the following prompts in their notebook:**
 - 1.) **Why might this matter to me?**
 - 2.) **Why might this matter to the people around me?**
 - 3.) **Why might this matter to the world?**

Class/Week 2 - identify potential issues & concerns with the stream, research possible solutions, presentation by Catskill Watershed Corporation

- **Guiding Questions**
 1. **How have your thoughts about water usage changed through your work with our partner school?**
 2. **What are some specific parts of the world that are dealing with threats to their drinking water?**
 3. **What are those threats?**
- We will peruse through the latest posts for #SDG6 to get different global perspectives.
- Students will identify potential issues and concerns with the stream behind our school. This will be done through the analysis of their data or through visual observations.
- The students will share these concerns/issues with the students in their partner school and they will choose one or two to focus on.
- The students will conduct some research on another part of the world that faced a similar problem and how they dealt with it. Some articles were shared above.
- Presentation by the Catskill Watershed Corporation (CWC)
 - The CWC will talk about their program, what they offer to area residents, how they work to protect the water supply

- **Students respond in their journals**
 1. **What issue am I most concerned about?**
 2. **What issues are the students in the partner school most concerned about?**
 3. **How does understanding their situation help us to address our concerns?**
 4. **How has my perspective on the importance of water changed from the discussions with the partner school?**

Class/Week 3 - Research native trees & shrubs, researching riparian restoration, presentation by Catskill Stream Buffer Initiative

- **Guiding Questions**
 1. **What are some common themes between the agencies that work to promote clean drinking water? (DEP, AWSLAN, CWC)**
 2. **Will the same solutions to the threats to our water that we implement locally be the same solutions in other parts of the world? Explain**
- We will peruse through the latest posts for #SDG6 to get different global perspectives.
- Students will continue to collaborate with the students in their partner school by sharing data and ideas relating to the issue they are looking at.
- Presentation by the Catskill Stream Buffer Initiative (CSBI)
- Research into the native trees/shrubs found in the riparian buffer zone in our community as well as the community of the partner school
- Work with students in the partner school to begin coming up with an action plan to improve water quality and/or stream health.
- **Students respond in their journals**
 1. **How have the presentations in the past couple of weeks helped to further my understanding of our local stream health.**
 2. **Why must we consider the local species when planning a riparian restoration?**

Class/Week 4 - preparation of action plan, preparation of presentation, sharing of presentation

- **Guiding Questions**
 1. **How do you feel that incorporating input from our partner school has affected your learning process through this project?**
 2. **Why is it important to include other perspectives when dealing with an important issue like water quality?**
- We will peruse through the latest posts for #SDG6 to get different global perspectives.
- Finish planning out action plan
- Prepare a presentation to present action plan to administrators and town supervisor
- Each group will put together a quick 2-3 minute video introducing themselves and their school for the partner school to embed into the presentation.
- The presentation will be shared with our partner school and they will share theirs with us. This way we can provide feedback and ensure that multiple perspectives are considered. Since the two groups developed an action plan together it is important that all ideas are considered.

- Share presentation to administrators and town supervisor. Discuss the concern, what they want to do, how it will impact their community, why they want to do it, and how they will do it.
- **Students respond in their journals**
 1. **What difficulties did you have when presenting your action plan to the important stakeholders?**
 2. **How might we share this information with our local community to help them to become stewards of our water.**

Class/Week 5 - Take action that was presented, riparian restoration, share results with partner school

- **Guiding Questions**
 - 1.) **What has been the biggest shift in your thinking since the project began?**
 - 2.) **What are some other issues/concerns that people could address by working together?**
- We will peruse through the latest posts for #SDG6 to get different global perspectives.
- The students will begin implementing their action plan.
- Specific details are unknown at this time because they will depend on the course of action that the students want to take.
- **Students respond in their journals**
 - 1.) **What challenges did you have when implementing your action plan?**
 - 2.) **What do you feel are your successes with the implementation of your action plan?**

Class/Week 6 - Individual work - research water concern from somewhere else on the Globe. Discuss how what we learned while working with our partner school could be shared with other people who share similar concerns.

- We will peruse through the latest posts for #SDG6 to get different global perspectives.
- Students will be completing some independent research to end the project.
- The concern can not be related to the one that they put together an action plan for.
- By the end of the week the students will turn in a paper detailing what they learned as well as their reflection.
 - The students need to include properly formatted citations with their paper. This is something that I have worked on with them in the past and I will review it for this assignment.

Authentic Audiences

Student Connection with Authentic Audiences

- Who will students share their product with and what does that interaction look like?
- What preparations need to be made for sharing out and for students to be prepared?

- The students will be sharing their results with the school administration, the town supervisor, and the local agencies that oversee the watershed. They will be sharing their action plan for feedback prior to beginning.
- The students will be partnering up with students in another school to share ideas. As a group they will discuss their concerns and come up with an action plan to address it.
- It might not be feasible for students to make it to the town & school board meetings so it might be better to invite the school administration, town supervisor, and agency representatives into the classroom for a presentation.
- The students will share out their final results with the local agencies.

Student Reflection

How will students reflect on their growth and learning after the project? (journal, small group discussion, fishbowl discussions etc.)

- The students will be keeping journals throughout the project. These journals will include data, observations, thoughts, ideas, etc.
- After the action plan is complete the students will be conducting research on another part of the globe that is facing water issues. They will compare what they learned locally to the concerns facing the area they are researching.

Teacher Reflection

(To be completed after the project)

What am I proud of from the project? Describe a highlight moment.

How did my students grow during the project (think about core content, global competence and personal growth)?

What would I change or improve for next time?

