



Swimmable and Fishable in 7 Years

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BACKGROUND:

Lesson Background:

This unit focuses on bioremediation and the Ala Wai Canal, but is designed for middle school students who may not know what those things are. I wrote this unit primarily because many of my students come from military families, and many of them did not know what the Ala Wai Canal was either. To spark student interest, the beginning lessons are designed to be more hands-on and conceptual.

The main community partner for this unit is the [Genki Ala Wai Project](#), a non-profit organization that works with schools. The organization educates teachers about bioremediation, and shows them how to apply the technology by making mud balls called Genki Balls. They also help coordinate visits to the Ala Wai Canal, where participants can throw their Genki Balls into the canal to help digest the sludge. Two other important community partners are the Waikiki-Kapahulu Public Library, and the Waikiki Community Policing Team. They provided facility use, and ensured safety when visiting the canal.

It's ok if you are not an expert on bioremediation or the Ala Wai Canal. Read through the lessons on your own, and reach out to community partners if you need clarification. Go into the unit with an open mind and learn from how the students react to the lessons as well.

Unit Overview:

The purpose of this unit is to build relationships through students, teachers, and the community collaborating towards a common goal - cleaning the sludge of the Ala Wai Canal. The unit is designed to start with the 5E model, to first build knowledge of bioremediation through a hook, exploration, clarification, and application. The evaluative stage of the 5E model segues nicely to a framework focused on the STEMS² pillars, where understanding can be assessed through authentic audiences.



STAGE 1:

It's important for students to understand that no matter how big a problem may seem, it is possible to fix it through small steps over time. The big problem this unit focuses on is the sludge of the Ala Wai Canal.

Students already know why clean water is important to them. They recently had firsthand experience due to petroleum leaking into their water supply. Many of our military families were temporarily relocated to hotels in Waikiki, while waiting for clean water to run through their pipes at home again.

Students are always curious about technology, and using it to solve problems. Feeding on that curiosity, students will attempt to address the problem of unclean water in the Ala Wai Canal by using the bioremediation technology they make in class.

Unit Plan Title:

Swimmable and Fishable in 7 Years

Essential Question:

How can we encourage others to care?

Enduring Understandings:

1. It can be difficult to pinpoint the sole cause of a problem.
2. Problems can have more than one solution.
 - a. There are multiple ways to address the Ala Wai Canal's pollution.
 - b. There are multiple ways to encourage people to care.
3. Changes to the physical environment affect populations.

Driving Questions:

- Whose fault was it when the mound of flour collapsed?
- What is the difference between blame and responsibility?
- How would you stop someone from illegally dumping trash?
- Which is more effective, punishment or encouragement?

- How many Genki Balls would we need to completely clean the canal?
- How many people would we need to do that?
- How do we get all those people?

Standard Benchmarks and Values

Science	Technology	Engineering	ELA	Social Science	Beyond
<p><u>Standards Addressed</u></p>					
<p>NGSS</p> <ul style="list-style-type: none"> ● MS-LS2-1 (practice) Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. ● MS-LS2-3 (practice) Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. ● MS-LS2-4 (practice) Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. ● MS-LS2-5 (introduce) Evaluate competing design solutions for maintaining biodiversity and ecosystem services. 					
<p>ISTE</p> <ul style="list-style-type: none"> ● 1.3 Knowledge Constructor (practice) Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. ● 1.6 Creative Communicator (practice) Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. 					
<p>NGSS (Engineering)</p> <ul style="list-style-type: none"> ● MS-ETS1-2 (introduce) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of a problem. 					
<p>ELA</p> <ul style="list-style-type: none"> ● CCSS.ELA-LITERACY.RST.6-8.3 (practice) Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. 					
<p>C3</p> <ul style="list-style-type: none"> ● D2.Geo.4.6-8. (introduce) Explain how cultural patterns and economic decisions influence environments and the daily lives of people in both nearby and distant places. 					

- D2.Geo.9.6-8. (introduce)
Evaluate the influences of long-term human-induced environmental change on spatial patterns of conflict and cooperation.

Sense of Place (Nā Hopena A'o and beyond)

- Belonging ("our" water)
 - *Build relationships with many diverse people*
 - *Care about my relationships with others*
 - *Am open to new ideas and different ways of doing things*
 - *Communicate with clarity and confidence*
 - *Understand how actions affect others*
- Responsibility (we all pollute "our" water, so we have a responsibility to fix it)
 - *See self and others as active participants in the learning process*
 - *Question ideas and listens generously*
 - *Set goals and complete tasks fully*
 - *Reflect on the quality and relevancy of the learning*
 - *Honor and make family, school and communities proud*
- Excellence (creating a quality newsletter / PSA to spread awareness)
 - *Define success in a meaningful way*
 - *Utilize creativity and imagination to problem-solve and innovate*
 - *See failure as an opportunity to learn well*
 - *Assess and make improvements to produce quality work*
- Aloha (learning empathy towards others' views)
 - *Assess and make improvements to produce quality work*
 - *Communicate effectively to diverse audiences*
 - *Respond mindfully to what is needed*
 - *Share the responsibility for collective work*
 - *Spread happiness*
- Total Well-Being (working with others)
 - *Engage in positive, social interactions and has supportive relationships*
- Hawaii (our water)
 - *Treat Hawai'i with pride and respect*

Standards Assessed

- MS-LS2-1 (mastery)
Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-4 (mastery)
Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- CCSS.ELA-LITERACY.RST.6-8.3 (mastery)
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- 1.6 Creative Communicator (mastery)
Students communicate clearly & express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.

Critical Skills and Concepts:

- Skills
 - Taking precise measurements
 - Measuring ingredients to make Genki Balls.
 - Reading and interpreting graphs
 - Looking at data on how the effective microorganisms perform in experimental settings.
 - Clear communication
 - Students teaching others about Genki Balls.
 - Digital media presentation
 - Students reaching out to others about Genki Balls.
- Concepts
 - Resource availability affects the survivability of organisms.
 - Changes to the physical or biological components of an ecosystem affects populations.
 - It is often difficult to pinpoint the sole cause of a problem.
 - Problems can be solved, or mediated, in multiple ways.
 - Bioremediation is a form of technology that can clean water.
 - Changes in human behavior can also mediate environmental problems.
- Students are getting good at:
 - Being empathetic.
 - Understanding that solutions are often complex.
 - Understanding the issues of the canal, and bioremediation.



STAGE 2:

By the end of the unit, students should have learned about the problems of the Ala Wai Canal, along with the causes and potential solutions for them. Through practice, students have grown to recognize that there are different ways to encourage people to care, such as being informed, active participation, and being included. Students will apply that knowledge by making a newsletter.

Authentic Performance Tasks:

One focus of this unit is the STEMS² pillar of a`o, which promotes the students taking on the role of teacher. After learning about the canal, they will practice a`o with family members and with the school's faculty (Task #1). Upon visiting the canal and actively participating in its cleanup with Genki Balls, students will share their experiences and mo`olelo (Task #2) with the people they engaged in during task #1. Ultimately, the end goal is to have students advocate for the canal to other community groups, using the experiences they've gained from this unit (Task #3).

- Task #1 - Students make individual Genki Ball kits, and take them home to teach a family member. The students return with the completed balls, and reflect on the experience. Students do the same with the faculty as well.
- Task #2 - Students create a newsletter documenting their learning journey, to keep the faculty in the loop about the Genki Balls. Students will explain:
 - The Genki Ball making process.
 - Why cleaning the canal is important.
 - Why the faculty's involvement was important.
 - Personal observations of the canal.
 - What happened on the toss day.
 - What they remember about the toss day.
- Task #3 - Students research and reach out to local organizations, inquiring if they would like to join our school in cleaning the canal. Students would send out their newsletter to those groups.



- The standards assessed would be:
 - MS-LS2-1 (mastery)
Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
 - MS-LS2-4 (mastery)
Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
 - CCSS.ELA-LITERACY.RST.6-8.3 (mastery)
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
 - 1.6 Creative Communicator (mastery)
Students communicate clearly & express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.

Authentic Audience:

- Students will teach their families about Genki Balls.
- Students will teach the faculty about Genki Balls.
- Students will keep the faculty in the loop with a newsletter.
- Students will reach out to local community groups about the Genki Balls.

Other Evidence:

- Students' views towards relationships, blame and responsibility can be formatively assessed through:
 - Behavior observation of the flour game from Lesson 1.
 - Class discussions from Lesson 1.
 - Class discussions from Lesson 3.
- Student character growth can formatively be assessed through reflective pieces, when asked what they learned about themselves, or what they learned about caring.
- Student content understanding can be formatively assessed through:
 - Their science notebooks.
 - Building their watersheds.
 - Creating their Genki Ball instruction card.
 - Creating their newsletter drafts.



STAGE 3:

When learning a new topic, one way that students learn best is by generating interest. This can be done through hands-on activities (engage and explore). Once students are hooked, you can reinforce the conceptual learning with content (explain). When students can apply their knowledge (elaborate) they often are excited to share what they know (evaluate). The last 4 lessons provide multiple opportunities for students to practice their skills through all of the STEMS² pillars, with an emphasis on a`o (reciprocal teaching) and advocacy.

Learning Plan:

Lesson Plan Overview		
Week 1	<p>Lesson 1 - Engage 45 minutes</p> <p>Responsibility is learned through a game of don't knock down the tower of flour.</p>	<p>Lesson 2 - Explore 40 minutes</p> <p>Students build a watershed, and observe the movement of pollution when water is added.</p>
Week 2	<p>Lesson 3 - Explain 40 minutes</p> <p>Students learn about the Ala Wai Canal, pollution, dredging, and bioremediation.</p>	<p>Lesson 4 - Elaborate 60 minutes</p> <p>Students apply bioremediation to make mud balls (Genki Balls) to digest the canal's sludge in.</p>
Week 3	<p>Lesson 5 - Evaluate 1 40 minutes</p> <p>Students make individual Genki Ball kits to teach a family member.</p>	<p>Lesson 6 - Evaluate 2 40 minutes</p> <p>Students make individual Genki Ball kits to teach a faculty member.</p>
Week 4	<p>Lesson 7 - Evaluate 3 60 minutes</p> <p>Students go to the Ala Wai Canal to toss in their Genki Balls.</p>	<p>Lesson 8 - Evaluate 4 *Varies</p> <p>Students create a newsletter to document their learning journey from start to finish.</p>