

## CASTLE K-16 ENGINEERING PIPELINE PROJECT

**UbD STEM UNIT PLAN TEMPLATE** (ONR Engineering Success in STEM Project)

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<b>Content Area:</b> Science	<b>Course Name:</b>  Second Grade	<b>Period:</b> Afternoon blocks M, T, F
<b>Unit Title:</b> Screen It and Clean It		<b>Approximate Time Frame:</b> 2-3 Weeks
<b>Essential Vocabulary:</b> water pollution contamination filter filtration engineer engineering surface		

**STAGE 1: Desired Results**

<b>Learning Goal (Student Learning Objectives):</b> (Skills, content knowledge and understandings, values, etc.) Students will be able to...	<ul style="list-style-type: none"> <li>● Describe the importance of water as a natural resource.</li> <li>● Discuss and analyze the consequences of water pollution and its effect upon the environment, and wildlife.</li> <li>● Using the STEM design process, construct an apparatus which can filter out unwanted debris from a designated area of water.</li> <li>● Participate in collaborative conversations about their designs and the results of their trials.</li> <li>● Write about their design and experience in an informative paragraph.</li> </ul>
<b>Essential Question(s):</b>	<ul style="list-style-type: none"> <li>● How does pollution affect our natural resource of water?</li> <li>● What effect does water pollution have on the plants and animals in our environment?</li> <li>● What is a possible method of removing debris pollutants from our water without damaging the environment further?</li> </ul>
<b>Enduring Understandings (Big Ideas):</b> (Broad understandings that are not tied to place, time, specific people, etc.)	Students will understand that water is an important natural resource that must be maintained through conservation, preservation, and purification.
<b>Standards/Benchmarks:</b> HCPS III or Common Core/C3	<u>SC 2.5.1</u> Identify distinct environments and the different kinds of organisms each environment supports <u>SC.2.8.1</u> Identify different Earth materials and classify them by their physical properties <u>SC.2.8.2</u> Identify the limited supply of natural resources and how they can be extended through conservation, reuse, and recycling

<b>Standards/Benchmarks:</b> NGSS	<p><u>2-PS1-2</u> Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]</p> <p><u>K-2-ETS1-1</u> Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool</p> <p><u>K-2-ETS1-2</u> Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.</p> <p><u>K-2-ETS1-3</u> Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.</p>
<b>Standards/Benchmarks:</b> Common Core Literacy Standards	<p><u>2RL1 /2RI1</u> Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.</p> <p><u>2RL2</u> Recount stories, including fables and folktales from diverse cultures, and determine their central message, lesson, or moral.</p> <p><u>2RL3</u> Describe how characters in a story respond to major events and challenges.</p> <p><u>2RL7</u> Use information gained from the illustrations and words in a print or digital text to demonstrate understanding of its characters, setting, or plot.</p> <p><u>2W2</u> Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.</p> <p><u>2W7</u> Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).</p> <p><u>2W8</u> Recall information from experiences or gather information from provided sources to answer a question.</p> <p><u>2SL1</u> Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.</p> <p>a. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care. speaking one at a time about the topics and texts under discussion).</p> <p>b. Build on others' talk in conversations by linking their comments to the remarks of others.</p> <p>c. Ask for clarification and further explanation as needed about the topics and texts under discussion.</p> <p><u>2SL2</u> Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.</p> <p><u>2SL4</u> Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.</p>

**Stage 2: Assessment Evidence**

<p><b>Summative Assessment/ Performance Task</b></p> <p><b>Design Challenge</b></p> <p><b>Ask:</b> Need Identification, Problem Statement, Client(s), Specifications</p> <p><b>Imagine:</b> Research, Brainstorm Solutions</p> <p><b>Plan:</b> Pugh Chart, Gantt Chart, Materials, Equipment, Procedures</p> <p><b>Create:</b> Prototype/Model, Test</p> <p><b>Improve:</b> Reflect, Improve/Modify, Test</p>	<p><b>ASK: (NeedS Identification, Problem, Statement, Client(s), Specifications))</b></p> <ol style="list-style-type: none"> <li><b>1. Storybooks <u>Gary and Harry</u>, and <u>The Journey Home</u> with Discussion Questions</b> <ol style="list-style-type: none"> <li>a. What is the problem?</li> <li>b. How did the problem occur?</li> <li>c. Who created the problem?</li> </ol> </li> <li><b>2. Connect to Self: Collaborative sharing</b> <ol style="list-style-type: none"> <li>a. Have you seen this before happening?</li> <li>b. Where, When, How did happen?</li> </ol> </li> <li><b>3. Needs Identification</b> <ol style="list-style-type: none"> <li>a. Pictures or background Articles (i.e. The Great Pacific Garbage Patch, wildlife caught in nets, recall Wonders story <u>Turtle,Turtle, Watch Out!</u>)</li> <li>b. Multi-flow Map(causes and effects of debris pollution in the water)</li> <li>c. Circle Map(Types of Trash found in Water)</li> </ol> </li> <li><b>4. Development of Problem Statement</b> <ol style="list-style-type: none"> <li>a. Collaborative Conversation Circle Map Topics: What can we do to help?, How can we clean/extract/filter the trash out of the water? What is preventing us now from getting the trash out of the water?</li> <li>b. Post &amp; Record the problem statement: "What we design to filter debris from the water?"</li> </ol> </li> <li><b>5. Specifications (discussion w/guiding questions)</b>  <b>*Desired Outcome: Must be able to filter plastic bags, soda rings, plates, straws, water bottle caps from the water)</b> <ol style="list-style-type: none"> <li>a. Discuss how we can tell that water has been cleaned of trash.</li> <li>b. Explore possible specifications &amp; record on Tree Map (time limit, distance, degree of success) before agreeing upon the specific requirements/ limitations/ qualifications</li> <li>c. Ideas for Guiding questions: <ol style="list-style-type: none"> <li>i. Will it be used in fresh or salt water?</li> <li>ii. Should it pick up only surface or from different levels? If so, how deep?</li> <li>iii. How much water will it take out as the trash is removed?</li> <li>iv. What's the time limit?</li> <li>v. What amount of trash should be picked up in within the time frame?</li> <li>vi. What size of trash will it pick up?</li> <li>vii. What materials will we be limited to?</li> <li>viii. How many people will operate the structure?</li> </ol> </li> </ol> </li> </ol>
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**IMAGINE (Research, Brainstorm Solutions)****1. Research**

- Describe what you do when you see trash in the water? (i.e. juice, pool, beach, bathtub, etc)
- Chip Challenge (Each student must extract items from a water tray in 2 different ways using a fork, spoon, OR chopstick without leaving a huge water spot on the paper towel)
- Interview parents: How do you filter water or remove objects from the water.

**2. Brainstorm Solutions**

- video [Saving Salila's Turtle Youtube Salila](#)
- Video/articles about Spills,Clean Ups,etc.
- Possible designs
- Discuss materials that can be used(waterproof, sturdy, light,etc)

**PLAN (Pugh Chart, Gantt Chart, Materials, Equipment, Procedures)**

- Create 2 design diagrams in booklet(must be labeled & justification for design will be provided in the description)
- Materials will be described for each part of the design and an explanation for why they were chosen will be required.
- Collaborative Conversations will take place with a consultant colleague (students will share what they think will work/not work and explain why, elaborate, clarify)

**CREATE(Prototype/Model, Test)**

- Students will construct a prototype of an apparatus that will be able to filter debris from a pool of water.
- Materials used will be determined by the students? Provided by the teacher?
- Creation Station(pipe cleaners, duct tape, etc)
- Students will record their creation with iPad photos

**TEST(Prototype/Model, Test)**

- Students will test their filter structure in a pool filled with water and debris(plastic plates, soda rings,plastic bottles, straws, bottle caps, plastic bags)
- Using the rubric of specifications they will evaluate their model design and highlight/check their results as data
- Trials will be recorded with the iPad

	<p><b>IMPROVE (Reflect, Improve/Modify, Test)</b></p> <ol style="list-style-type: none"> <li>1. Reflect upon the positive outcomes &amp; record</li> <li>2. Improvement models will vary between classrooms (teachers will decide upon their goals as a class, and determine whether improvement will be done as a whole class, in teams, or by individuals)</li> <li>3. Two choices may be provided for improvement <ul style="list-style-type: none"> <li>• Choice A: Take one block of the rubric to improve upon (keep all other variables constant)</li> <li>• Choice B: Design a model that will pick up other substances (oil, sunken heavy debris perhaps metal?)</li> </ul> </li> <li>4. Possible Extensions <ul style="list-style-type: none"> <li>• Videos: Clear Blue Sea(addresses pollution on a larger scale)</li> <li>• Parent Connection (construct structure that can filter glass, metal, golf ball from the pool) with a parent</li> <li>• Molasses Spill Lesson (CNN video/article)</li> <li>• Fieldtrip Waimea Falls Park</li> </ul> </li> </ol>
<b>Rubric(s) for Summative Assessment/Performance Task: (Attach documents)</b>	
<b>Formative Assessments:</b>	
<b>Rubrics for Formative Assessments:</b>	
<b>Worksheets, Checklists, Rubrics, etc. for Formative Assessments: (Attach documents)</b>	
<b>Other Evidence:</b>	

**Stage 3: Learning Plan** (Each unit should have a minimum of 5 Activities per unit which includes the five EDP components: **ASK, IMAGINE, PLAN, CREATE, IMPROVE**) Include brief narrative of activities, instructions, groupings, differentiated instructional and engagement strategies, and digital literacy tool(s).

### **Activity 1: Background (3-5 class periods)**

- Complete Natural Resource Lesson Packet: Students will identify Earth's precious natural resources, describe their importance, and analyze threats to their sustainability (SS, Sci)
- Introduce Engineering/STEM: Students will explore the concepts of engineering and STEM (Tara)
- Introduce the Water Cycle & what happens with human interaction: Students will view 3-2-1 Contact (Down the Drain) after learning about the water cycle and how water flows to the reservoirs, streams, lakes, oceans, etc.
- View videos "MSB Waterworks"

### **Activity 2: Introduction (1-2 class periods)**

1. Read Storybooks: Gary and Harry, and The Journey Home
2. Conduct a discussion targeting a description and source of the problem, and connection to self-experiences
3. Create a Multi-flow Map identifying cause/effect of debris water pollution
4. Use Circle Maps to brainstorm the types of trash found in our water supply and ocean
5. Create a Problem Statement, and generate specifications using a Tree Map

### **Activity 3: Explore Solutions/IMAGINE (1-2 class periods)**

1. Students discuss their own experiences with removing trash or items from water without dumping the water out.
2. Chip Challenge (exploring materials to extract items from water tray)
  - a. 2 different ways
  - b. Materials (fork, spoon, chopstick)
  - c. Individual challenge not to have water spot on paper towel
  - d. Draw/explain 2 solutions
3. Parent Interview Homework: How do you successfully remove or filter objects from water?
4. View video "*Saving Salila's Turtle*" and discuss the 5 Rs (Respectful, Resourceful, Resilient, Relationships, Responsible) Focus upon the way she perseveres to find a solution that worked.
5. Research/Show clean ups and articles pertinent to Hawaii (What have people done)
6. Brainstorm possible solutions and materials that might be used

### **ACTIVITY 4: EXPERIMENT/PLANNING(2 class periods)**

1. Review Specifications: Must be able to extract objects out of the water (plastic bags, juice rings, plastic bottles, plates, straws, water bottle caps)
2. Create a rubric of self-assessment with class.
3. Create 2 design diagrams which must be labeled and explained
4. List and describe materials to be used for the design.
5. Collaborate with a colleague about which design would be more efficient and successful.

### **5: CREATE/TEST(2 class periods)**

1. Students will construct a prototype of a filtering apparatus.
2. There will be a Creation Station with materials to choose from.
3. Students will record with Ipad, and evaluate their design before testing.
4. During the test phase, students will be using their designed prototype to remove debris from a water-filled pool, record and analyze data using a rubric of specifications, and record their trials using an Ipad.

### **Lesson 5 IMPROVE**

1. Reflect upon the positive outcomes and record discussions
2. Students will construct improvement models which may vary between classrooms.
  - a. Choices for improvement will be provided.
  - b. Parents may or may not be included as a community connection and global awareness effort.
3. Extensions
  - a. Molasses Spill
  - b. In the Clear Blue Sea
  - c. Waimea Falls Park

### **Materials, Equipment and Resources Needed to Implement Unit**