Diving into Makerspace (With Sharks!)

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Target Grade: 2nd Grade STEM

Time Required: 60 minutes

Standards:

TN Science Standards

- 2.ETS1: Engineering Design
  - Define a simple problem that can be solved through the development of a new or improved object or tool by asking questions, making observations, and gather accurate information about a situation people want to change.
  - Develop a simple sketch, drawing, or physical Process that communicates solutions to others.
  - Recognize that to solve a problem, one may need to break the problem into parts, address each part, and then bring the parts back together.
  - Compare and contrast solutions to a design problem by using evidence to point out strengths and weaknesses of the design.
- 2.ETS2: Links Among Engineering, Technology, Science, and Society
  - Use appropriate tools to make observations, record data, and refine design ideas.

TN Visual Arts Standards

- 1.1.3 Execute the intended use of tools and proper care of work space as facilitated by the teacher.

Lesson Objectives:

Students will:

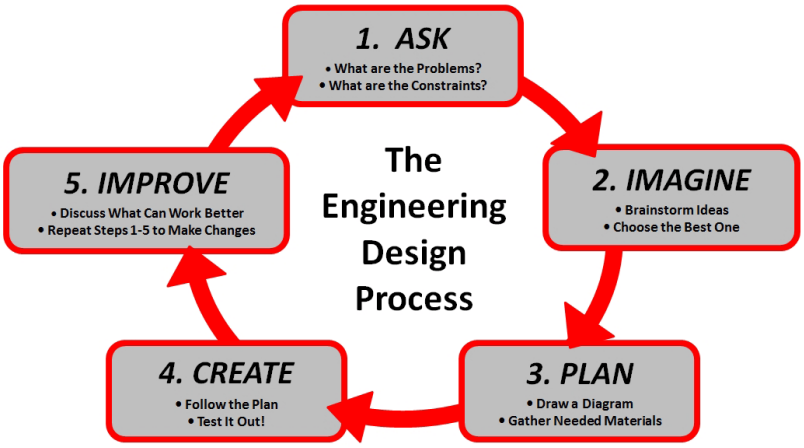
- Use the Engineering Design Process to design, build, and test a shark cage.
- Use tools from the makerspace appropriately.
- Design a shark cage that will sink and protect a diver by choosing from a variety of materials.

Central Focus:

Students are introduced to the dangerous work of scientists who study great white sharks. They work in engineering design teams to select appropriate materials from a makerspace to design a shark cage that will help a diver submerge safely into a tank of sharks.

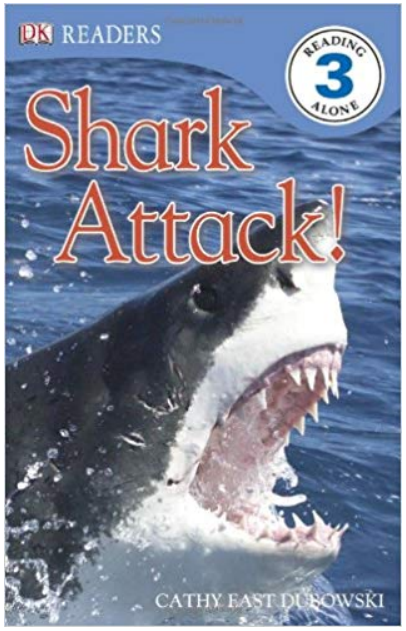
Background Information:

Students are in their "Shark Week" unit in their core class, reading books, and doing activities centred on sharks. Students should also have some background of using the Engineering Design Process, or Cycle. Below is a simplified graphic and description of each of the steps of the Engineering Design Process.



Materials

- *Shark Attack!* by Cathy East Dubowski
- Large tank or clear plastic bin filled with water and plastic sharks
- Engineering Design Process Planning Sheet
- Engineering Design Process assessment
- Lego Man or other character "diver"
- Photos of shark cages
- Pencil
- Assortment of items in makerspace for students to build with. Possible materials listed:
    - Tinker toys
    - Pipe cleaners
    - Metal hooks for anchors
    - Foam blocks
    - Paperclips
    - Toothpicks



- Flat plastic pieces
- Popsicle sticks
- Wire
- Wooden blocks
- Place value blocks
- Straws
- Rubber bands
- Tape

Instruction

Hook: (5 minutes)
Teacher explains to students that they have the very important job of being an engineer responsible for protecting a scientist. Show students this informational video about sharks: https://www.youtube.com/watch?v=tfWMwG6aYzQ

Introduction: (10 minutes)

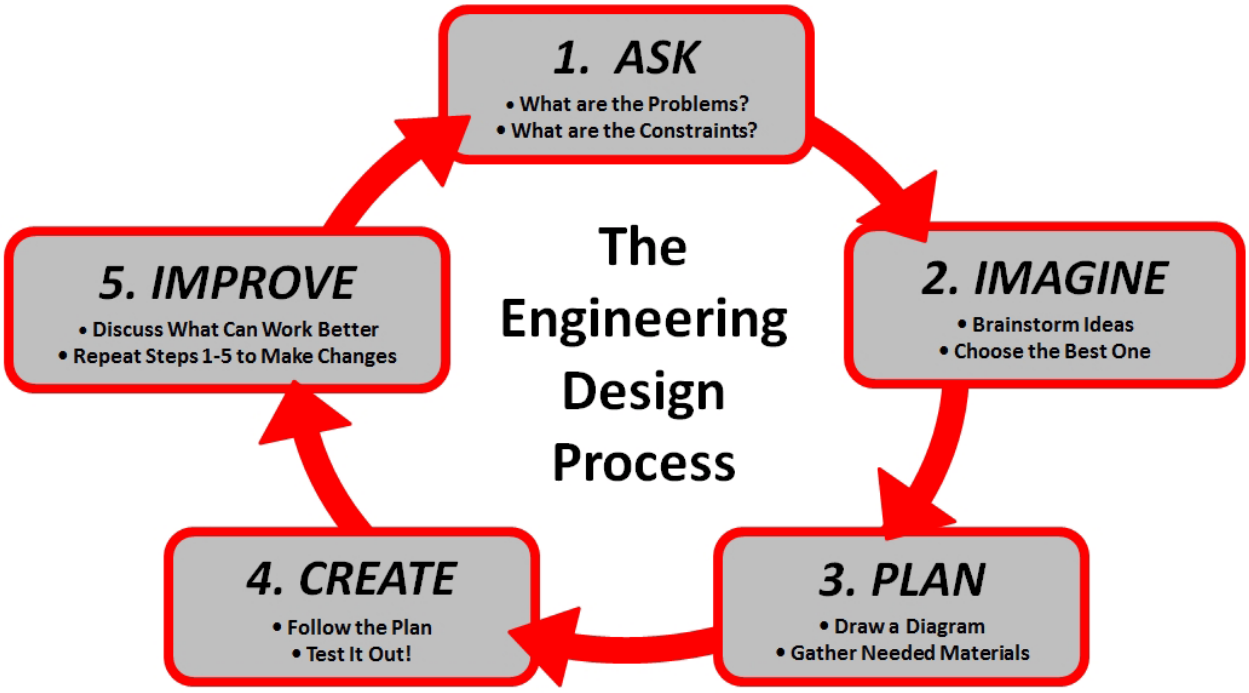
1. Show students the book, *Shark Attack!* By Cathy East Dubowski (students have had an opportunity to read this book prior to this lesson in their reading class).
2. Share the pages with images of Great White Sharks. Discuss the dangers scientists face studying sharks.
3. Show students the page with the shark tank. Talk about the vocabulary words “shark cage” and “aquarium” from the book.
4. Display photos of shark cages and ask students to discuss in their groups reasons why the scientist must remain in the cage when studying sharks.
5. Discuss as a whole group why the cage is needed for protection and how it works, calling on students from different groups to participate.
6. Additional questions for whole group discussion could be:
    a. What challenges do scientists face when studying sharks?
    b. How are sharks affected by those who wish to view them?
    c. What are some reasons why sharks are vulnerable to extinction?
7. Tell students that today they will design and build a shark cage for a scientist that wishes to study sharks up close. The scientist will be submerged in a cage designed by the students that will protect the scientist.
8. Show students the aquarium test area and scientist diver (Lego person).
9. Students will be divided into engineering design teams of 2-3 students depending on class size and dynamic.

Guided Practice: (15 minutes)

1. Remind students that our classroom makerspace is a place for students to be creative and try new solutions!
2. Review the rules for the classroom makerspace:

   a. Be respectful (to the makerspace, each other, and each other's ideas)
   b. Work with purpose
   c. Clean up
3. Explain to students that they will be using materials in the classroom makerspace to create a shark tank for a scientist diver to study sharks up close.
4. Show students the available tools for building the cage in the makerspace.
5. The teacher will use the makerspace to build a quick example using place value blocks and toothpicks to give students and idea of what the project is asking.
6. Tell students their projects will be successful if their design meets the following criteria:
   a. The diver is visible in the cage.
   b. The cage sinks.
   c. The diver stays inside the cage in the water.
   d. Directions were followed when building the cage.
7. Ask students if the shark cage example that the teacher built meets all the criteria for success.
8. Discuss why the design would not meet all criteria (the foam blocks do not sink and the diver my slip through the toothpick bars).

9. Remind students of the Engineering Design Process:



https://engineeredtoday.wordpress.com/2015/09/11/the-engineering-design-process-not-only-applies-to-engineering/

Group Work: (15 minutes)

1. Students will use the Engineering Design Process planning sheet to draw a plan with their engineering design team.
2. Once students have finished their plan they may begin creating their shark cage. Students will have 15 minutes to assemble their cage.
3. Students will use the makerspace to gather the needed supplies.
4. Using their chose supplies, students will work together to design a shark thank that has a scientist diver visible inside, will sink and will hold the diver once the cage is submerged in the water.

Testing: (5 minutes)

1. When the 15 minutes is up, students will watch each group test their cage in the aquarium.
2. As students place their tanks in the water, they will record the results on the planning sheet.

Reflection/Closure: (10 minutes)

1. Review objectives with class
2. Say: Today we used the Engineering Design Process to design, build, and test a shark cage.

3. Tell students to review each step of the Engineering Design Process with their partners. Allow for time to do so.
4. Remind students that engineers are always looking for ways to improve their work, and when you improve it, it makes it even better!
5. The students will respond to the final question on their Engineering Design planning paper to complete the final step in the Engineering Design Process, Improve.

Differentiation

ELL students will receive additional small group instruction as needed. Peer helpers will be available for any struggling learner that needs it. Students who have an IEP or some ELL's as necessary can receive an abbreviated assessment.

Assessment

The students will complete the Engineering Design Process matching quiz.

Possible Extension:

Use Google Expeditions to share a virtual reality field trip using the expedition, *Sharks* or *A Closer Look at Sharks.*

Name:_____

Engineering Design Process

ASK- How can we build a cage that will keep a diver safe in a tank full of sharks?

PLAN- Which materials will you use?

Draw a picture

Our design will be successful if:

- ☐ the diver is visible in cage
- ☐ the cage sinks
- ☐ the diver stays inside the cage in the water.
- ☐ directions were followed when building the cage.

Score: ____/4

On the back, Explain two ways in which you could improve your design. How would these changes differ from your first design?

Name:_____

Engineering Design Process Matching Assessment

Draw a line to match each step of the Engineering Design Process with it's description.

This step includes the engineer brainstorming ideas.	Ask
The first step in the Engineering Design Process.	Imagine
This is the step in which the engineer makes the design better.	Plan
This is the step in which the engineer makes and tests the design.	Create
This is the step in which the engineer draws the design.	Improve

Name:_____

Engineering Design Process Matching Assessment KEY

Draw a line to match each step of the Engineering Design Process with it's description.