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| **Title** | **Building Deep Sea Tools to Search for Sharks Teeth** |
| **Introduction** | Students are completing a unit on sharks. The unit is investigating different types of sharks, concept of sinking and floating and engineering tools that can solve a particular problem. Students will work in teams to solve the problem of retrieving shark teeth from the bottom of a container and conduct research after they have completed their task. |
| **Learning Outcomes** | Students will:   1. Be able to identify which shark their tooth has originated from through research 2. Be able to measure and compare the different teeth found 3. Work as an effective member of a team and collaborate to build a tool that can complete the design challenge using the engineering design process |
| **Curriculum Alignment** | NCSCOS Grade 1  Math Goal 2 Measurement  2.01 a, b: for a given object, select an attribute to measure (length & possibly mass). Compare using appropriate language  Math Goal 5 Algebra  5.02 Use Venn Diagram to illustrate similarities and differences in two sets  Science Competency Goal 3  3.03: Classify solids according to their properties: color, texture, shape (ability to roll or stack), ability to float or sink in water.  *\*Could be used Kindergarten-2nd Grade (Math Goals would correlate, particular standards would change. Data Collection would be a heavier focus. Science Goal would not correlate, but could be used as a reinforcement or introduction)* |
| **Classroom Time Needed** | 4-5 classes  Each class 45-60 minutes each (4- 5 hours total) |
| **Materials Needed** | Variety of shark teeth: minimum of 3 different types (need at least 15 total – 5 of each)  7 - 40quart (exact size not needed) plastic containers (two clear & five not clear)  4 bags of playground sand  Building supplies for design challenge: (not limited) straws, toothpicks, sis kabob sticks, yarn, fishing line, plastic and foam cups, tape, hot gun and glue, tongue depressors, craft sticks, etc.  Film canisters with a variety of beads, marbles, sand to be put in them (at least one for each student in class)  Water  Food coloring  Chart paper  Rulers & beans for measuring teeth  Notebook entry masters (assessment section for masters)  \*Room used tables, if using desks-arrange room in groups |
| **Technology Resources** | Computers to be used for research of the shark teeth upon completion of design challenge  If applicable: SMART Board and Document to look closer at the teeth found, webcam to use as a video science journal entry, cameras (digital and video) to document their learning |
| **Pre-Activities** | Before this lesson, students wrote letters to my parents who live in Venice, Florida (Shark tooth capital of the world). They discussed how they were learning about sharks and if they could send them any shark teeth they found on the beaches there. In turn, my parents wrote them back with some brief facts about sharks and websites they could visit. They let them know that the teeth were sent to me and they had to complete the design challenge to earn them.  Students have been introduced to the engineering design process and have been introduced to concept of sinking and floating.  Before the next lessons: you have to prepare the containers. The two clear containers are to be used as demonstration models. They need to be filled with water only. The film canisters are to be filled with a variety of materials (beads, marbles, sand, water, foam/ additionally, they should have one that is full and another that is half full of the same material in order. Make two exact sets (one for each clear container/group of students). The other containers should be filled with and inch or two of sand on the bottom with the shark teeth put into them. The water should be colored so the students cannot easily see the bottom. Building materials should be readily available for students and placed in an easily assessable location, I always ask parents for random supplies found at home. The greater the variety of supplies the better ideas will be developed from the students. Each team should have building tools (scissors, tape, pencils, scratch paper, etc. at their tables) |
| **Activities** | Day One: Exploring sinking and floating   1. Break the class into 2 groups 2. Each student should receive their own film canister with a material put into it 3. Pass out the Notebook Entry (or digitally if available, found at the end of this lesson plan) 4. Students should complete the first section of their Notebook entry (draw canister and make prediction on whether it will sink or float) 5. Discuss the directions for the activity: each student will make a prediction (in notebook entry) if each item will sink or float before the student places the canister in the water. Students will place the canisters in the water one by one and the group will record the results (may help to demonstrate this with students) 6. Students work to complete the activity. Actively monitor the groups, probe them with questions regarding the observations taking place. These questions will help them on their final section of the notebook for today. 7. Upon completion: create a class discussion on what happened in their groups 8. Students finish the lesson with completing the last section of their notebook “new learning”   Day Two: Design Challenge “Imagine, Plan, possibly Create”   1. Break the students into 5 groups 2. Start with: “Shark teeth are found on beaches and in the oceans everyday. People can use the teeth to figure out a lot about the sharks they come from. Each shark tooth has special characteristics…” 3. Introduce the design challenge, read card aloud to the class as they follow along (card found at the end of this lesson plan): “You’re a deep sea ocean explorer. We have been notified that there are shark teeth in the bottom of your group’s container in the sand. Your group has to create/build a tool to allow you to gather the shark teeth for further investigation…” 4. Read the requirements from card 5. Briefly go through the building supplies you have for them to use in the room 6. Discuss how to effectively work as a team. Identify that members of a team listen to everyone’s’ ideas. The only bad ideas or questions are the ones that are not said. Remember teams can watch other teams, it’s not stealing ideas it’s sharing. Engineers do not recreate the wheel, they improve it. Etc. 7. Students work on part 1 of their daily notebook entry (imagine through discussion), if your group struggles with discussions, try utilizing a talking stick or Pass the Lotus technique with the group   (Talking Stick: only the person with the stick may talk and it is passed around the group/ Pass the Lotus: It is a tic tac toe board where each member puts their ideas in one of the boxes and it is passed around the group, each person must include an idea but cannot repeat and idea already written down).  Then complete part 2 (draw a design). Let them know they can design individually, with a partner or a group, but they must agree as a group before moving forward.   1. Groups need to pick one design and show you before starting on building. It is okay to combine parts from multiple designs, but they have to be able to describe it to you. 2. Groups start building their tool   Day Three possibly Day Four: Create, Test, Improve and Compare   1. Groups finish creating their tools 2. They can test when finished, if they need to make changes after testing they can as long as they document it in their notebook 3. Students find shark teeth 4. Students complete notebook entry (drawing different teeth and comparing them on a Venn diagram) 5. When groups finished, each group has to present the tool they created to the class and explain what band why they built what they did.   Day Four possibly Day 5:   1. Students conduct research on their teeth to identify which shark they came from. This is easily done through the use of computers. |
| **Assessment** | Use the Word documents of the Daily Notebook entries at the end of this plan to be used as an assessment.  Correlation of entries to standards mentioned above  Entry Day 3: Math 2.01: Was student able to measure the tooth accurately? Math 5.02: Did they compare and contrast similarities and differences of the different teeth they found?  Entry Day 1: Science 3.03: Did they understand sinking and floating? |
| **Modifications** | Notebook can be done on the computer; pictures can also be acceptable form of response in their entries.   1. This task is meant for any style of learner. The SMART Board template or PowerPoint of same material supports learners with ELL, LD restrictions because it provides visual representation of material being covered. 2. Working in teams, allows for different levels of learners to share and understand together. With grouping students, make sure to create heterogeneous groupings to allow for students to help teach and learn from each other. 3. Using different ways of responding to the discussions questions is a modification to be used to meet various IEP or ELL needs. If students struggle with written responses, use a version of the webcam or oral discussion of answers to questions. 4. This is a real world activity that is built upon 21st century learning format and environment which enables for modifications to be built within and tailored to each learning style |
| **Alternative Assessments** | 1. The notebook could be given through one on one verbally 2. The format of this lesson does not allot for the need for an alternative assessment. There are plenty of opportunities for students to show you what they learn as they are working in small groups. If they struggle with written documentation, modeling expected results could help. 3. Verbal questioning groups and students in particular with questions that are aligned with the standards covered could also be used as a supplement |
| **Supplemental Information** | United Streaming by Discovery Channel: good source for videos, pictures, etc. <http://streaming.discoveryeducation.com/>  Interactive Online Tools, Games, etc. <http://dsc.discovery.com/convergence/sharkweek/games/games.html> |
| **Critical Vocabulary** | Engineering design process: Ask, Imagine, Plan, Create, Improve  Buoyancy  Sink  Float  Observation  Documentation  Different sharks: Great White, Mako, Sand, Tiger, etc. |
| **Websites** | Design Process: <http://teachengineering.com/engrdesignprocess.php>  Boston Museum of Science Engineering is Elementary: <http://www.mos.org/eie/>  SMART Board free download of software: <http://www2.smarttech.com/st/en-US/Support/Downloads/SBS/Windows/SBSv97Win.htm> |
| **Comments** | 1. The idea of buoyancy is briefly covered in the standard course of study in first grade, and not addressed again throughout 2-5 directly. I believe it is a way to have students to dig deeper into a really difficult concept. 2. The implementations of engineering tasks, in my opinion, are most successful after the science foundation has been taught. Due to this view, I complete this lesson after the solids liquids and gases unit is completed in the NCSCOS. 3. The better the availability of the materials for the students the more creative they are with engineering design challenges. 4. If completing an engineering challenge using the 5 step process, please do not skip steps to cut time. Each step is equally important in students learning. Remember, during the imagine step, do not limit their ideas by constraints or restrictions. Introduce constraints, restrictions, or criteria after the imagine step. 5. Engineering is a field where there are so many standards being addressed at once. They are perfect opportunities to support, enrich or remediate students at all levels. |
| **Author Info** | Justin Osterstrom  A.B. Combs Leadership Magnet elementary school in Raleigh, NC  STEM/21st Century Skills Specialist teaching grades K-5  7 years teaching (3 in 4th grade, 2 in 5th grade, 2 as a specialist)  NBCT  Class of 2011 Kenan Fellow  This is part of my unit being developed for my Kenan Fellowship implementing problem solving skills with focusing on engineering curriculum and STEM applications in grade K-5  Mentors of Kenan Fellowship: Dr. Laura Bottomley and Liz Parry, NC State Department of Engineering |

**21st Century Skills: Daily Observation Notebook**

***‘Shark Unit’ Day One***

**Draw Your Canister**

**Prediction: Will it sink or float? Why** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Group Activity**

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| **Objects in Canister** | **Prediction: Sink or Float?** | **Actual Result** |
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**New Learning: On the back, please write two new things you learned today?**

**21st Century Skills: Daily Observation Notebook**

***‘Shark Unit’ Day Two***

**IMAGINE:** Discuss with your team members your ideas on what kind of tool you can create. Remember to listen to everyone, think of what you learned with the canisters yesterday and follow the requirements on the design challenge card.

**PLAN:** Create a plan either individually or with your group. Your group must agree on what design you will use before you are allowed to get started.

**21st Century Skills: Daily Observation Notebook**

***‘Shark Unit’ Day Three***

**Draw Teeth: Measure them with a ruler and beans, write each in the box with the tooth**

**Compare and Contrast the teeth in the Venn diagram below**

**IMPROVE: If you made any improvements/changes to your tool, document on the back**

C:\Documents and Settings\Kenan Fellow\Local Settings\Temporary Internet Files\Content.IE5\BKKVZ33K\MC900020562[1].wmf **‘Shark Unit’ Design Challenge**

*You’re a team of deep sea explorers. You are on a boat and in the water below are a variety of shark teeth. Your team must find a way to get them on your boat to successfully complete your mission.*

**Requirements:**

1. Your team cannot put your hands into the water and grab the teeth
2. You have to create a tool made from the available building supplies that is powered by you to retrive the teeth from the bottom
3. Everyone on your team must actively participate in the challenge
4. You have to brainstorm and create a design before you build
5. You can improve your tool after you test it in the water, but you must document it