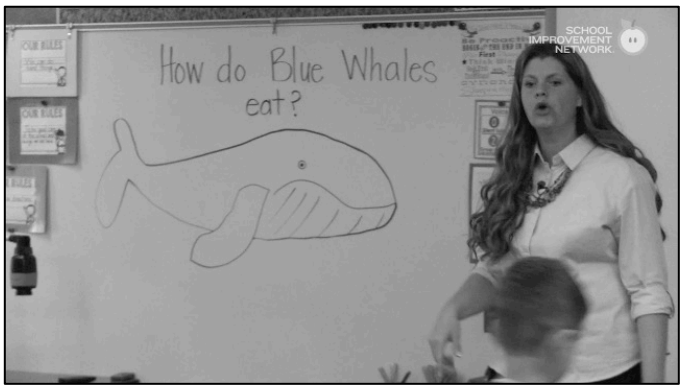
Modeling the Baleen of the Blue Whale, Part 1

STEM: Science, Technology, Engineering, Mathematics



STEM Classroom Series

The STEM Classroom Series features lessons that promote understanding of STEM content knowledge, integrate STEM with non-STEM subjects, and increase students' exposure to STEM-related career options.

About This Segment

At Green Acres Elementary in North Ogden, Utah, Ms. Lori Barker's 1st graders are engaged in a STEM unit about blue whales. During this lesson, they discuss the structure and purpose of baleen and reinforce their new knowledge by creating functional models of it.

Application activities (complete all that meet your goals for viewing this segment)

A. Learn more about STEM education

1. In the table on the next page, identify the elements of effective instruction, as well as the elements of effective STEM instruction, that you observed in this lesson.

2. How could the teachers enhance or add to the elements of instruction in their lesson?

3. How could the teachers enhance or add to the elements of STEM instruction?

C. Infuse STEM principles into your own lessons

1. Apply the six questions in the "Replicate this lesson" activity to one of your own lessons.

2. Determine challenges you might face in applying these STEM concepts to your own lesson. How can you overcome these challenges?

B. Replicate this lesson

1. *What are the learning objectives you want your students to achieve?*
   How would you modify the lesson's objectives, outlined in the Lesson Plan below, for your own students and curriculum? What other objectives, if any, will you set?

2. *What content knowledge do you need to acquire or expand?*
   This activity engages students in reading about, discussing, and creating models of baleen. To strengthen your background knowledge, visit the links in the Resources section of the lesson plan.

3. *How will you create the time and space to engage students in this lesson?*
   How much time will this learning activity take to plan and carry out? How can you integrate its activities into your current curriculum map?

4. *What materials and other resources do you need for this lesson?*
   What resources are needed for this lesson, including collaboration with other teachers and with administrators? See the Resources section of the lesson plan.

5. *How will you assess student learning?*
   In this lesson, students created a model of baleen and informally evaluated their effectiveness. How might you assess their content knowledge in more concrete ways?

6. *How can you promote a STEM focus in your instruction?*
   Read through the "Elements of Effective STEM Instruction text box on the next page. According to the list, what kinds of STEM experiences were students engaged in during this lesson? What are some others that you could include?

Elements of Effective Instruction	Elements of Effective STEM Instruction
- High expectations for all students - Rigorous content - Authentic performance tasks - Real-time assessment adapted to student needs - Student-driven learning - Strong relationships among students and between teacher and students - Equitable, culturally relevant content and practices - Evidence of 21st century skills, e.g. critical thinking, problem solving, collaboration, creativity, communication - Technology that enhances learning - Cross-curricular (interdisciplinary) integration	*In addition to the Elements of Effective Instruction left, effective STEM instruction can include:* - Teachers who develop solid STEM-related content knowledge - Hands-on problem-solving activities that have real-world relevance - Integration of STEM into non-STEM subjects, especially art and design - Use of industry-standard software, tools, and procedures such as the engineering design cycle - Increased awareness of STEM fields and occupations, especially among underrepresented populations - Enthusiasm about further STEM-related learning - Connections between in-school and out-of-school learning opportunities - Industry and higher-ed partnerships that encourage hands-on student exploration of STEM-related careers

Sources: California Dept. of Education. (2015). Science, technology, engineering, & mathematics. Retrieved February 21st, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

President's Council of Advisors on Science and Technology (PCAST). (2010). Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future. Retrieved from the Whitehouse.gov website: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

General STEM Information and Resources

Utah STEM Action Center (n.d.). STEM Utah. Retrieved January 22, 2015, from http://stem.utah.gov/

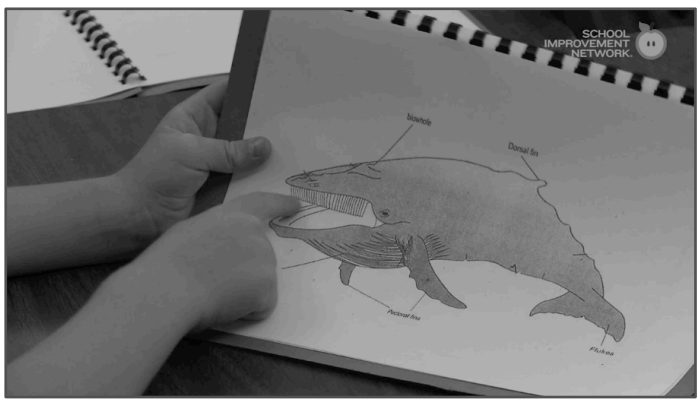
California Department of Education (n.d.). Science, technology, engineering, and mathematics. Retrieved January 22, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

National Education Association. (n.d.). The 10 best STEM resources: Science, technology, engineering & mathematics resources for preK-12. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics. Retrieved March 23, 2015, from http://www.stemreports.com/wp-content/uploads/2011/06/NRC_STEM_2.pdf

PBS Teachers. (n.d.). STEM education resource center. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

STEM Education Coalition (n.d.). Home page. Retrieved January 22, 2015, from http://www.stemedcoalition.org/



Modeling the Baleen of the Blue Whale, Part 1 Lesson Plan

Teacher: Lori Barker	**Grade/Content Area**: 1st Science
School: Green Acres Elementary, North Ogden, Utah	**Lesson Duration**: 90 min.

Lesson Objective(s)

Students will learn about the structure and function of baleen in blue whales by reading, discussing, and creating models that they will design, test, and redesign.

Key Concepts and Vocabulary

(See below for online resources that support content knowledge)

- Blue whale anatomy: baleen, ventral pleats
- The size of krill, particularly in comparison to blue whales

Standards

- Read with sufficient accuracy and fluency to support comprehension.
- Explain how the physical characteristics of living things help them meet their basic needs.

Assessment

The culminating assessment task for this unit is a research paper about blue whales. The teacher will ensure that students are recording their learning from this lesson in their Blue Whale Discovery Data Books to inform the writing of their research papers.

Prior Knowledge

Students have learned about the basic anatomy and size of blue whales, as well as their feeding habits.

Materials

- iPads and access to the online article about blue whales: http://animals.nationalgeographic.com/animals/mammals/blue-whale/
- Diagram of blue whale showing key anatomical features (See the page at the end of this lesson plan; it's taken from the students' "Blue Whale Discovery Data Book." Other pages of the book are also included at the end of the lesson plan.)
- Half-sheet of paper per student to fold and simulate the ventral pleats
- Small, short paper cups with half of the bottom cut out by the teacher
- A variety of materials, like pipe cleaners, felt, cotton balls, feathers, shredded paper, paper towels, etc.
- Hot glue gun (to be used only by an adult) and hot glue, a large bowl of water, glitter, 1/3 sheet of plain paper

Lesson continues on the following page.

Activity Plan

Video segment 1 (part 1 of lesson):

1. Review prior knowledge about the size of blue whales and the size of krill leading into the lesson's essential question: How do blue whales eat?
2. In partners, students read the National Geographic article on their tablets, first silently and then aloud as a class.
3. Teacher asks students what other questions they have about how such a large animal eats such small creatures.
4. Teacher introduces the anatomical term "ventral pleats" by showing students how to fold a half-sheet of paper accordion-style and holding it under their chins to simulate the action of the whale's ventral pleats.

Segment 2:

5. The teacher explains the engineering project and shows the students the materials they can choose from. They will collaborate and share their ideas as they draw a plan on the plan page in their Blue Whale Discovery Data Books.
6. When their plan is complete, students share their plans with each other and add to their design.
7. Then, students will each get a cup with half of the bottom cut out. They will choose from the materials and with the help of the teacher, they will hot glue the material in the open part of the cup. An adult will help them glue it by using the hot glue gun.
8. Next, students will test their baleen prototype by scooping up water with glitter in it. The water will be like the gulp of water the whale takes with each bite, and the glitter will represent the krill. The students will let the water drain out through the bottom of their cup and observe roughly how much "krill" (flecks of glitter) their baleen design kept inside the "whale."
9. Students will return to the page in their data discovery books and record the results of their test, including a description of any elements they would redesign. Students can then go around and look at each other's creations to see which structure held the most krill.

Resources to Support Content Knowledge

National Geographic. (n.d.). Blue whale. Retrieved November 13, 2015, from http://channel.nationalgeographic.com/channel/content/kingdom-of-the-blue-whale-3302/blue-whale-facts/ - /compare/length

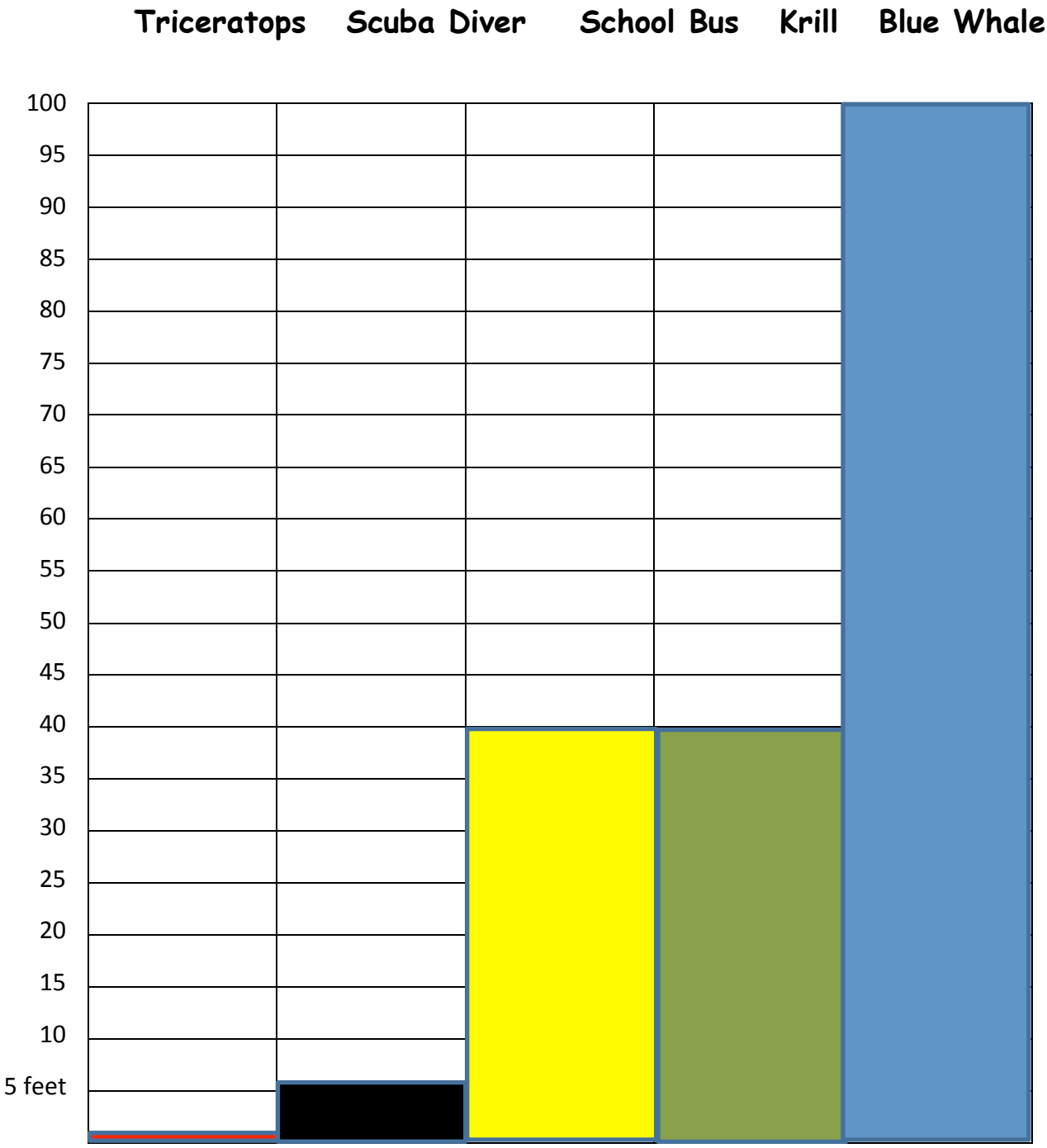
NOAA Fisheries. (n.d.). What should I know about baleen whales? Retrieved November 13,2015, from http://www.afsc.noaa.gov/nmml/education/cetaceans/baleen1.php

Related Video Lessons and Resources

1st grade STEM: Supporting STEM learning – reading, writing, and guided imagery. Edivate. https://www.pd360.com/index.html - resources/videos/10766

1st grade STEM: Measuring and graphing the length of blue whales. Edivate. https://www.pd360.com/index.html - resources/videos/10765

Label each column in the graph with the item that represents its length. You may draw a picture of the item if you prefer.



Compare the length of each object to the length of a Blue Whale. How many of each are as long as a Blue Whale? Write your estimate first and then write in the answer you discover.

Object	Estimate	Answer
School Bus		
Triceratops		
Scuba diver		
Great White Shark		
First Graders		
Yards		

Design plan for blue whale baleen.	Redesign. What will you do differently?

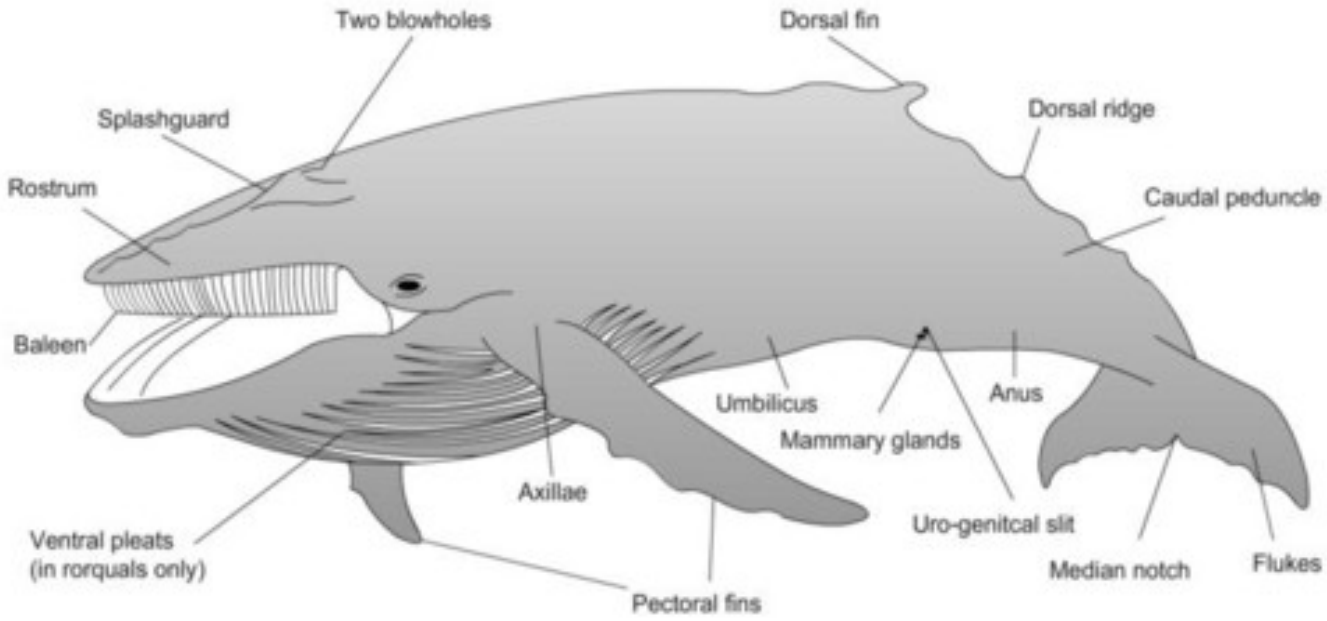
Draw a picture of a filter used in our lives that works like the blue whale's baleen.

Writing

What I learned about blue whales:

Suggestions of questions to answer in your writing: How long are they? What do they eat? Where do they live? What technology is used to study them? What math do you need to know in order to study them?

Why is a blue whale's sound so low?



Baleen Whale (Mysticeti) Physical Characteristics

http://rjfisherjoanides.pbworks.com/f/whale%2520anatomy%2520diagram.JPG