

Measuring and Graphing the Length of Blue Whales

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 use digital media and hands-on activities to estimate and measure the length of a blue whale.

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 involves measuring a blue whale with a standard unit as well as with other objects. Visit the Resources to Support Content Knowledge links in the Lesson Plan section of this guidebook.
3. *How will you create the time and space to engage students in this lesson?*
When will you plan to create the life-size chalk outline of the blue whale on your playground? Who will help?
4. *What materials and other resources do you need for this lesson?*
What materials are needed for this lesson? See the Materials section of the Lesson Plan. What collaboration is necessary with administrators and other teachers to obtain the needed materials?
5. *How will you assess student learning?*
In this unit, students record their work in their Blue Whale Discovery Data Books. How will you use these books as an assessment piece? How might students learn from each other using their books?
6. *How can you promote a STEM focus in your instruction?*
What STEM experiences were students engaged in during this lesson? (See the "Elements of Effective STEM Instruction" below.) What are some others that you could include?

Elements of Effective Instruction	Elements of Effective STEM Instruction
<ul style="list-style-type: none"> - 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 	<p><i>In addition to the Elements of Effective Instruction left, effective STEM instruction can include:</i></p> <ul style="list-style-type: none"> - 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
<p>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</p>	

General STEM Information and Resources
<p>Utah STEM Action Center (n.d.). STEM Utah. Retrieved January 22, 2015, from http://stem.utah.gov/</p> <p>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</p> <p>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/</p> <p>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</p> <p>PBS Teachers. (n.d.). STEM education resource center. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/</p> <p>STEM Education Coalition (n.d.). Home page. Retrieved January 22, 2015, from http://www.stemedcoalition.org/</p>



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



Lesson Objective(s)

Students will investigate the length of a blue whale, comparing it to familiar objects and measuring it with a standard unit of measurement.

Key Concepts and Vocabulary

(See below for online resources that support content knowledge)

- Yard, feet (length)
- Estimate vs. predict: when to use each concept

Standards

- Compare the lengths of two objects indirectly by using a third object.
- Express the length of an object as a whole number of length units.

Assessment

Teacher will assess students' Blue Whale Discovery Data Books.

Prior Knowledge and Skills

Knowledge: Basic background knowledge of blue whales.

Skills: Making estimates, collecting and recording data, and comparing estimated with actual results; also, measuring an object with no gaps or overlaps in measuring tool.

Materials

- Blue Whale Data Discovery Books – one per student. Pages of the notebook are included at the end of this lesson plan. They include pages for activities not covered in this lesson.
- National Geographic's Blue Whale Interactive web page:
<http://animals.nationalgeographic.com/animals/blue-whale-interactive/>
- Electronic copy of the graph in students' Data Books that compares the blue whale's length to other objects (display this for review on interactive whiteboard).
- Enough chalk and blacktop space to draw a life-size blue whale outline
- 10-20 yardsticks, ruler to show relationship to yardstick



Lesson Plan – Measuring and Graphing the Length of Blue Whales (cont.)

Lesson Steps

1. Introduce lesson objective. In Blue Whale Discovery Data Books, estimate length of blue whale in comparison to other objects/animals on the National Geographic (NG) interactive site (see Resources above).
2. Introduce yard as a standard unit of measurement; show how it compares with a ruler.
3. As a class, engage with the NG interactive site and record actual numbers of objects equaling a blue whale's length compared to the numbers that the students had estimated.
4. Go outside to measure the life-size chalk drawing of a blue whale in yards and 1st graders, making sure to line up the yardsticks and first graders in a straight line with no gaps or overlaps.
5. Return to class and record the measurement data for yards and 1st graders in Data Books.
6. Students use their table of estimated/actual number of comparison items in their Data Books to identify which object or animal is represented by which column in the bar graph (also in the Data Book). They label each column by either drawing or writing the name of the object that belongs there. They share their responses with partners, make any adjustments based on peer feedback, then check their work with the teacher's version of the graph on the interactive whiteboard.



Differentiation

Students who struggle with writing can write less yet still demonstrate understanding by drawing the comparison items as labels for the bar graphs of their Data Books rather than writing them.

Resources to Support Content Knowledge

The Physics Classroom. (n.d.). The kinematic equations. Retrieved July 28, 2015, from <http://www.physicsclassroom.com/class/1DKin/Lesson-6/Kinematic-Equations>

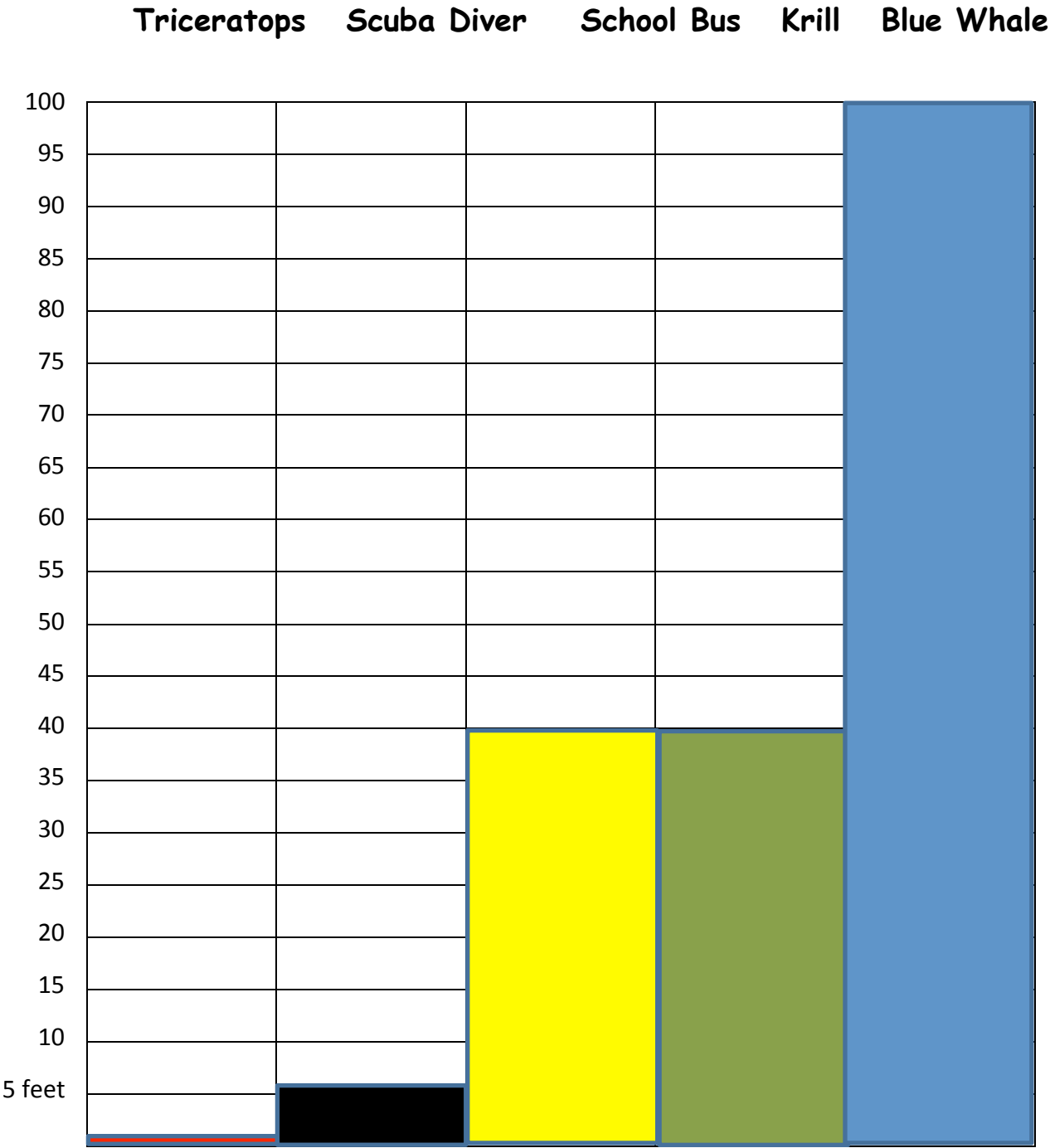
Education.com. (n.d.). First grade measurement worksheets and printables. Retrieved July 31, 2015, from <http://www.education.com/worksheets/first-grade/measurement/>

Related Video Lessons and Resources

5th grade: Measuring data and using bar graphs. Edivate. <https://www.pd360.com/index.html - resources/videos/5375>

1st grade measuring activity - primary. Edivate. <https://www.pd360.com/index.html - resources/videos/1022>

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?

