Bones-on Display



Lesson Plan

Author

Jennifer Lawson



Science
Technology
Engineering
Arts
Mathematics

S

Teacher Created Materials

5301 Oceanus Drive Huntington Beach, CA 92649 www.tcmpub.com

TCM 28985 (i21002) ISBN 978-1-4938-6770-7 © 2019 Teacher Created Materials, Inc.

Smithsonian

© 2019 Smithsonian Institution. The name "Smithsonian" and the Smithsonian logo are registered trademarks owned by the Smithsonian Institution.



ers

Series Consultant

Sally Creel, Ed.D. STEM & Innovation Supervisor/ Professional Development Consultant

Grade Level Consultants

Sharon Banks Elementary Teacher Duncan Public School

Standa**rd**s

reserved.

Publishing Credits

Rachelle Cracchiolo, M.S.Ed., Publisher Conni Medina, M.A.Ed., Editor in Chief Diana Kenney, M.A.Ed., NBCT, Series Developer Emily Smith, M.A.Ed., Content Director Véronique Bos, Creative Director Melissa Laughlin, Editor Robin Erickson, Art Director Mindy Duits, Senior Graphic Designer Stephanie Bernard, Associate Editor

Carol O'Donnell, Director, Smithsonian Science Education Center Carol LeBlanc, Senior Vice President of Consumer and Education Products Brigid Ferraro, Vice President of Consumer and Education Products Smithsonian Science Education Center

Image credits

all images from Shutterstock and iStock

Disclaimer

The classroom teacher may reproduce copies of materials in this book for classroom use only. The reproduction of any part for an entire school or school system is strictly prohibited. No part of this publication may be transmitted, stored, or recorded in any form without written permission from the publisher. Website addresses included in this book are public domain and may be subject to changes or alterations of content after publication of this product. Teacher Created Materials does not take responsibility for the future accuracy or relevance and appropriateness of website addresses included in this book. Please contact the company if you come across any inappropriate or inaccurate website addresses, and they will be corrected in product reprints.

References to digital components are included for educators who purchased the full kit: *Smithsonian STEAM Readers: Grade 2*. Please disregard digital component references if this lesson was purchased in a different product configuration.

Answer Key: Bones on Display

page 10—I Want to Know

of WIDA-www.wida.us.

Students should have at least two questions about preparing bones and two questions about designing and building exhibits. Check that questions are answered correctly, if possible.

© Copyright 2010. National Governors Association Center for Best

ISTE Standards for Students, ©2016, ISTE® (International Society for

Technology in Education), iste.org. All rights reserved. © 2014 Mid-continent Research for Education and Learning

By States. Washington, DC: The National Academies Press.

© Copyright 2007–2018 Texas Education Agency (TEA). All rights

NGSS Lead States. 2013. Next Generation Science Standards: For States,

© 2007 Teachers of English to Speakers of Other Languages, Inc. (TESOL)

© 2014 Board of Regents of the University of Wisconsin System, on behalf

page 11—Day at the Museum

Narratives should describe what students saw, heard, and felt during a visit to the Bone Hall exhibit.

page 17—Bones on Display Quiz

D



B

2.

3. D

 Answers should include some or all the following: Bone displays allow others to see where animals lived, what they ate, where they lived, what they looked like, and sometimes even what they sounded like or how they moved.

Bones on Display

Materials

- Bones on Display books
- copies of student activity sheets (pages 9–19)
- chart paper
- notecards and tape
- STEAM Challenge materials include but are not limited to the following:

✓ glue

✓ paint

✓ scissors

✓ tape

✓ pipe cleaners

✓ shoebox (one for each team)

- books with pictures of animals in their habitats
- (optional)
- ✓ clay
- ✓ colored pencils and/or markers

Learning Objectives

- **Reading:** Ask and answer such questions as *who*, *what, where, when, why*, and *how* to demonstrate understanding of key details in a text.
- Writing: Write narratives in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.
- Speaking and Listening: Participate in collaborative conversations with diverse partners about grade appropriate topics and texts with peers and adults in small and larger groups.
- **Engineering:** Define an engineering problem, design and evaluate solutions, and optimize a design based on test results.

Phenomena

Different animals have different bones and skeletal structures.

Lesson Timeline

Day I	Day 2	Day 3	Day 4	Days 5-10
Introductory and Before Reading Activities (page 4)	During Reading Acti	vities (page 5)	After Reading Activities (page 5)	STEAM Challenge and Assessments (pages 6–8)
Define the STEAM Challenge, and preview the text to ask questions about bones on display in exhibits.	Research how people study and display bones, find answers to questions while reading the text, and brainstorm design solutions.		Write narratives describing a visit to the Bone Hall exhibit.	Design, build, test, improve, reflect on, and share bone display models. Complete the assessments.



Unit I: Animals

Bones on Display (cont.)



exhibits fieldwork fossils

habitats ligaments

Introductory Activity

Define the Problem

- I. Display page 7 of the *Bones on Display* book. Create a two-column table on the board or chart paper and label the columns *Notice* and *Wonder*. With partners, have students describe what they notice and what they wonder about the images on the page. Ask volunteers to share and write their ideas in the table. Tell students that making observations and asking questions are important things that scientists and engineers do.
- **2.** Distribute the *Bones on Display* books to students. Read aloud the STEAM Challenge on pages 28–29.
 - Display the Interactiv-eBook for a more digitally enhanced introduction to the challenge.
- Distribute *Make a Plan* (page 9) to students. Have them summarize the STEAM Challenge. Summaries should include constraints and criteria.
 - **Support** students with the following sentence frame to help them summarize: *Design and build a bone display model that can _____ using _____*.

Note: You may wish to distribute all student activity sheets as one packet. They will be used throughout the STEAM Challenge.

Before Reading

- Write the vocabulary words on separate sheets of chart paper, and discuss their meanings. Post the chart paper around the room. Have groups of students rotate around the room to the posted sheets, drawing pictures and writing words that relate to each vocabulary word.
 Discuss the posters as a group, and keep them for students to reference throughout the lesson.
- 2. Tell students that, like scientists and engineers, good readers ask questions. Explain that readers ask questions before they read to activate prior knowledge and set a purpose for reading. Then, readers try to find and answer those questions.
 - **Support** students by reviewing questioning words (*who*, *what*, *when*, *where*, *how*, and *why*) and having them come up with examples of questions that start with each word.
- **3.** Model previewing the text and asking questions for pages 4–11 of *Bones on Display.* Point out how looking closely at images and other text features can help you generate questions.
- **4.** Distribute *I Want to Know* (page 10) to students, and review the directions. Ask students to preview the rest of the text and write questions on their activity sheets. Tell them they will get a chance to find answers to their questions when they read the book.
 - **Challenge** students to ask questions that start with *why* or *how*.

Unit I: Animals

Bones on Display (cont.)

During Reading

Research and Brainstorm

- L Distribute the *Bones on Display* books to students and refer them back to their *I Want to Know* activity sheets. Read the book aloud as students follow along. After each page, stop and ask students to share if any of their questions have been answered.
 - Display the Interactiv-eBook for a more digitally enhanced reading experience.
 You may wish to have students annotate the PDFs as you read.
 - Play the audio recording as students follow along to serve as a model of fluent reading. This may be done in small groups or at a listening station. The recording will help English language learners practice fluency and aid in comprehension.
- 2. Have students read the book a second time in small groups, taking turns reading each page. Ask students to stop after each chapter and record any answers they found for any of their questions.
 - Challenge students to find answers to any unanswered questions using another source.
- **3.** Have students discuss what animals would be good to use in their exhibits for the STEAM Challenge. Ask them to record ideas on their *Make a Plan* activity sheets.



After Reading

- I. Write the vocabulary words on the board and review their meanings. Prepare a sticky note or label for each student by writing one vocabulary word on it. Place one word on the back of each student. Have students walk around the room asking their classmates yes or no questions about the words on their backs. Tell them they cannot use any of the vocabulary words in their questions. Have students return to their seats once they guess their words correctly.
- 2. Tell students that making and recording detailed observations about events and experiences is an important writing skill for experts in STEAM fields. Explain that they sometimes turn their observations into narratives and share them with the public in books, magazines, or websites.
- 3. Distribute *Day at the Museum* (page 11) to students. Ask them to imagine that they spent the day visiting the Bone Hall at Smithsonian's National Museum of Natural History. Have students use their graphic organizers to record what they saw, heard, and felt as they explored the exhibit.
 - You may choose to have students explore the Skin and Bones app or Bone Hall, website at naturalhistory.si.edu/ exhibits/bone-hall/index.cfm for inspiration on planning their narratives and to gather ideas for the STEAM Challenge.
- **4.** Have students use their graphic organizers to write their narratives on separate sheets of paper.

Unit I: Animals

Bones on Display (cont.)

Prep

- Review all designs prior to building.
- Prepare all materials for STEAM Challenge.

STEAM Challenge

Design and Build

- **I.** As a group, discuss the following questions to connect the reading to the STEAM Challenge:
 - How do bone exhibits help others learn about animals from the past? Guide students to the idea that bone displays allow people to learn about what the specific animal looked like, what it ate, and what habitat it lived in.
 - What is the first thing people do when creating an exhibit? Have students recall that before people can begin building exhibits, they must first design them. Remind students that each design is purposeful and helps teach visitors about the animal. For example, if a skeleton is positioned to look like it is swimming, the animal probably spent most of its life in the water. Tell students they will also be designing their exhibit models before building.
- 2. Organize students into teams, and distribute previously completed activity sheets. Review the STEAM Challenge on pages 28–29 together. List materials on the board, and discuss with students what materials they will use to ensure that their models stand up securely. Show students different resources they may use to choose animals and learn about what they look like and where they live to make their model exhibits accurate.
 - You may choose to narrow animal options to a few choices, assign a different animal to each team, or allow teams to choose their animals.

- **3.** Ask students to independently sketch and label two designs on their *Make a Plan* activity sheets.
- **4.** Distribute one copy of *Team Designs* (page 12) to each team. Ask teams to have members share their designs. Then, have each team choose, sketch, and label a team design. (Team designs must be submitted for teacher approval before building begins.)
 - **Challenge** students by adding constraints or criteria (e.g., include length and width measurements in the design).
- **5.** Explain to students that when they build their models, they must follow their design plans. Reassure them they will have an opportunity to change and improve their designs after they present them. Review classroom expectations for working with materials. Then, give teams time to build models.
 - Digitally record students' processes to share at a later date with students and parents.
- **6.** Distribute *Think about It* (page 13) to each student. Explain that reflection is an important part of the engineering design process. Read aloud numbers 1 and 2 on the activity sheet, and have students write their responses. Ask volunteers to share.



Bones on Display (cont.)

Prep

- Review all designs prior to building.
- Prepare all materials for the STEAM challenge.

STEAM Challenge

Test and Improve

- **I.** As a group, discuss the following questions to connect the reading to the STEAM Challenge:
 - How have scientists and museum workers made bone displays come to life? Make sure students discuss how Smithsonian's National Museum of Natural History has created the Skin and Bones app to make bone displays interactive. Viewers can see animals move, "meet" scientists, and play games related to the current animal they are viewing.
 - How are bones held together in bone exhibits? Have students recall that people use metal frames and wires to hold bones in place.
- 2. Tell students they will be doing a gallery walk to view the model exhibits and that they will record information for each team as they do so. Explain that teams will offer feedback after the gallery walk. Use *Friendly Feedback* (page 14) to review best practices for giving feedback.
- **3.** Distribute *Bone Exhibit Test Results* (page 15) to students. Ask them to silently walk around the room, examining each model and filling out the table on the activity sheet. Then, gather students back together, and ask volunteers to give feedback for each model.

- **4.** Provide time for teams to brainstorm ways to improve their designs. Refer students back to the *Team Designs* activity sheets. Ask them to sketch their improved designs and explain any changes. Have students submit improved designs for approval before making changes.
 - Challenge successful teams with additional constraints or criteria for the second design (e.g., create a second model of a smaller animal to incorporate into your display to show the viewer a size comparison).
- **5.** Have teams gather materials to improve their designs. Then, have them make their improvements and retest their models.
- **6.** Have students complete numbers 3 and 4 on their *Think about It* activity sheets.

© Teacher Created Materials

Bones on Display

STEAM Challenge

Reflect and Share

- I. Ask students to think about how a team is similar to a skeleton. Guide them to the idea that bones make up a skeleton, each one supporting the whole, just like team members make up a team.
- 2. Distribute one note card to each student. Draw a simple bone outline on the board as an example. Ask students to draw one large bone on their note cards. Inside their bones, ask them to write one thing they did to support their teams. Invite volunteers to share what they wrote.
- **3.** As a group, try to create a skeleton with the bone drawings. Ask students to cut out their bones. Then, have one student at a time tape their bones on the board or a piece of chart paper. Challenge students to make all the bones look like a skeleton of an animal you choose together.
- **4.** Have students answer question 5 on their *Think about It* activity sheets.
- **5.** Distribute *Engineering Design Process* (page 16), and review how students used each step to complete the challenge. Have them annotate the infographic with details specific to this challenge.
- **6.** Read "Career Advice" on page 32 of the book. Ask students to brainstorm other tips for a career studying bones or creating exhibits.

Assessment Activities

- **I.** Have students complete a short posttest, *Bones on Display Quiz* (page 17), to assess this lesson's reading objective.
 - Students may use the Interactiv-eBook activities in the Digital Resources for assessment purposes (optional).
- 2. Have students complete *Teamwork Rubric* (page 18) and *Engineering Design Process Checklist* (page 19) to reflect on and evaluate their work and collaboration skills.
- **3.** Have students complete the Read and Respond questions from the book.
 - Possible answers to the questions can be found in the Digital Resources (bones_reproducibles.pdf).



Make a Plan

Directions: Summarize the challenge. Brainstorm ideas, and sketch two designs. Circle your favorite.



Name:

I Want to Know

Directions: Write at least two questions about how experts prepare bones. Write two questions about how they create exhibits. Then, read the book to find answers. Write the answers in your own words.



	©	Teacher	Created	Materials
--	---	---------	---------	-----------

Day at the Museum

Directions: Use the graphic organizer to plan a narrative about your visit to the Hall of Bones exhibit.

saw I heard l felt

Name:_____



Team Members:

Date:

Team Designs

Directions: Sketch your team's design in the first box. Sketch your team's improved design in the second box. Label each design with materials needed and the purpose of each part.



Ma	m	۵.
INA		с.



Think about It

I. It was (hard/easy) to create one team design because

2.	Thelped my team by
3.	Our design (failed/passed) the test because
	To improve our design, we
4.	Our improved design (worked/did not work). I know this because
5.	During this challenge, I learned
	My favorite part was

Name:

Friendly Feedback

Directions: Feedback from others can help people improve their work. Use these sentence stems to give feedback to your peers.





Bone Exhibit Test Results

Directions: Write the type of animal for each team's exhibit. Mark whether the skeletons stood up by circling *yes* or *no*. Then, answer the question.

Team	Type of Animal	Does the skeleton stand up?
		yes/no
Which ext	nibit do you think showed the animal's hab	vitat best? Why?





Date:

Bones on Display Quiz

Date:

Directions: Read each question. Fill in the bubble for the best answer. Answer the last question in complete sentences.





Date:

Name:



Directions: Think about how you worked in your team. Score each item on a scale of 4 to 1.

4 = Always 3 = Often 2 = Sometimes 1 = Never



Engineering Design Process Checklist

Directions: Check the boxes to show that you did each step.



Research and Brainstorm Why should museum workers know how to display bones? How do exhibits help people learn about animals? How do museums make learning fun?	Design and Build Sketch a model of your display. What purpose will each part serve? What materials will you use? Build the model. Test and Improve	Show your model to your friends. Can they tell what your animal is? Can your model stand on its own? How can you improve it? Improve your design, and try again.	Reflect and Share What was difficult about this challenge? What did you learn? How could you add technology to help people imagine what your animal looked or sounded like?
The second secon	Define the Problem Workers at a natural history museum near your home have found a new skeleton fossil. They want to put the bones on display. They have asked you to make a model of the exhibit.	Constraints: You may only use a shoebox, clay, pipe cleaners, glue, tape, paint, colored pencils, or markers to build your exhibit.	Criteria: Your exhibit must have a skeleton of an animal and its habitat. The skeleton must be standing. You must include a few sentences to teach people about your animal.

27

5,'