

Strange Animals and Engineering

Summary:

A dumbo octopus. A boxer crab. A flying fox. Many of our planet's most unique animals have special abilities or features that are mimicked by engineers to solve our everyday problems. Educators will explore two picture books about unique animals and then use these animals for inspiration to design and improve a helmet for bicyclists and scooter riders.

Books Used:

- *Who Are You Calling Weird? A Celebration of Weird and Wonderful Animals* by Marilyn Singer
- *National Geographic Kids Readers: Animal Armor* by Laura Marsh

Setup and Preparation

Hard boil eggs in advance of the activity. Hard boiled eggs are safer to handle and permit easier cleanup than raw eggs. Make enough eggs so each group of 2 or 3 has one egg. Hard boil a few extra eggs if some break prematurely.

5E Model of Instruction – Outline:

- Engage – Read *Who Are You Calling Weird?*
- Explore – Animal Classifications
- Explain – Animal Armor
- Elaborate – Egg Helmet
- Evaluate – Egg Helmet Advertisement

Engage:

Read: *Who Are You Calling Weird?*

Common Core Connections: Reading: Informational Text, Craft and Structure K.5, 1.5, 2.5

Show the cover of *Who Are You Calling Weird?* and ask students:

Have you ever seen a seen a weird animal? What makes it weird?

Materials:

- Cotton pads and/or cotton balls
- Wooden coffee stirs, cut to approximately 2in in length
- Wooden craft sticks, cut to approximately 1/2in in length
- Souffle cups, 2oz and 3oz in size
- Play-dough, approximately 3oz per group
- A hard-boiled egg, one per group
- A marker to draw a face on the egg

How do students define the word weird? Remember the student's initial definition and use this as an assessment moving forward. By the end of this activity, students should recognize that all animals are "weird"—in their own special way.

Who Are You Calling Weird shares some of the planet's weirdest animals, and then ends by including a page on us humans!

Open the book and select two or three animals to learn about. Be selective in reading the text, some of the text is a reading level or two above K-2. You may choose to do a picture walk and summarize the text in your own words, depending on your audience.

Some of the suggested animals and their "weird" attributes to read include:

- Dumbo Octopus (Page 10)
 - o Gets around by flapping its fins that resemble the ears on Dumbo the Elephant. It can also suck in water and shoot it out through a funnel, called a siphon, for a fast escape.
- Platypus (Page 18)
 - o Has webbed feet so it can swim. It lays eggs and it has the bill of a duck, but it is a mammal.
- Boxer Crab (Page 24)
 - o Uses anemones, a type of venomous "ocean flower" as live boxing gloves. Boxer crabs use these stinging anemones to fight off predators.
- Narwhal (Page 32)
 - o Has a gigantic unicorn-like tooth full of sensitive nerve endings. Scientists aren't sure why narwhals have this tooth, although there is speculation that it is used to communicate.
- Humans (Page 46)
 - o Humans walk on two feet, are not covered in fur like most animals and have every smart brains!

After reading about a few weird animals, asks students:

Scientists use the things that some might consider weird to help classify animals. Today, we are going work like scientists to classify animals based on their features.

Explore:

Divide students into small groups of two or three and provide each group with a set of Animal Classification Cards and some blank index cards.

Ask students:

Sort and classify groups of animals by finding two things they have in common. For example (show the pictures of the fish) you could classify these images as *has fins and lives in the water*.



Circle around the room and ask guiding questions without providing answers. Ask students to think about where these animals live (based on the environment in the picture), what their skin is like (soft, scaly, furry, etc.) or what kind of food the animals eat (meat eater / omnivore or plant eater / herbivore).

Ask students to share out one or two of their animal classifications. Emphasize that there are many ways to classify animals. In *Who Are You Calling Weird*, the author classified animals by their weird but unique features. In this classroom, students used their own judgement and observations to classify.

To aid with communication, scientists set rules for some of the ways they classify animals. Hand out Worksheet – Animal Classifications to each of the groups. Read over each of the classification as a group:

- Amphibians: Have moist skin, cold blooded, young hatch from eggs and live on both land and water
- Birds: Have feathers, beaks and wings. Warm blooded and babies hatch from eggs.
- Mammals: Have fur or hair, are warm blooded, give birth to live young and babies drink their mother's milk.
- Reptiles: Have scales, cold blooded and young hatch from eggs.
- Fish: Have scales and fins, cold blooded, use gills to breathe underwater.

Based on these classifications, can students re-sort the animals the way a scientist classifies them? Ask:

- What part of the classification is easy to determine? *Physical attributes like fur, fins, beaks, feathers and scales. What type of environment each animal lives in like water or land.*
- What part is difficult? *Cold or warm blooded, how the babies are born.*

Read: Who Are You Calling Weird

Common Core Connections: Reading: Informational Text, Craft and Structure K.5, 1.5, 2.5

Tell students that you want to introduce one more animal from *Who Are You Calling Weird* that will introduce the class to a whole new type of classification. Go to Page 26 and read the first paragraph. Ask:

- What types of animals have “armor-like scales” and what makes the Pangolin unique? *Ask students to refer to their classifications for assistance. Students should answer with reptiles and fish.*

Finish reading the Pangolin page and ask:

- What is so unique about the pangolin? *It has armor and it can roll into a ball to protect itself.*

Pangolins are unique, but there are many animals like pangolins that have body armor. Learn more about animals and body armor in the next step.

Explain:

Hand Out: Worksheet – Animal Armor Cloze Paragraph

Read: National Geographic Kids Animal Armor

Common Core Connections: Reading: Informational Text K.1, 1.1, 2.1

Introduce students to the front cover of *Animal Amor*. On the front cover is a pangolin, which should now be recognizable from the reading in the first book.

Ask students to fill in the Cloze Paragraph prior to reading. Tell students they will have an opportunity to move their words around during and after the reading.

Read through *Animal Amor* up to Page 29, skipping over Pages 18-19 first and then revisiting those two pages at the very end.

Ask students what the main types of armor are. Allow students to substitute one of the animals for the armor type. The three main types highlighted in *Animal Amor* are scales, shells and spines. Ask students to explain these three types of armor in their own words:

- Shells are hard and are one continuous piece.
- Scales are small but hard. Scales sit over the skin and allow for easier movement when compared to an animal with a shell.
- Spines are pointy and stick out of the animal’s skin.

Elaborate:

Students should understand that there are different types of animal armor and that each type of armor serves a different purpose.

Ask students:

- Humans look to nature when designing and building new things. Can anyone think of a reason why we would use something like animal armor to protect ourselves from our environment?

Some ideas from students might include *knee and elbow pads, helmets, casts for a broken bone.*

In this step, students will design a helmet to protect an egg from cracking. Students will consider what type of armor is best for their helmet design and then justify their design through an advertisement.

Hand Out: Worksheet – Egg Helmet

Ask students to give their egg a name and to draw out their idea for an egg helmet. Some guiding questions to ask:

- Where should the egg helmet go on the egg?
- What type of armor will work best to protect the egg?
- Why do you think that armor is the best for the egg?

Once drawings are complete, provide each group with:

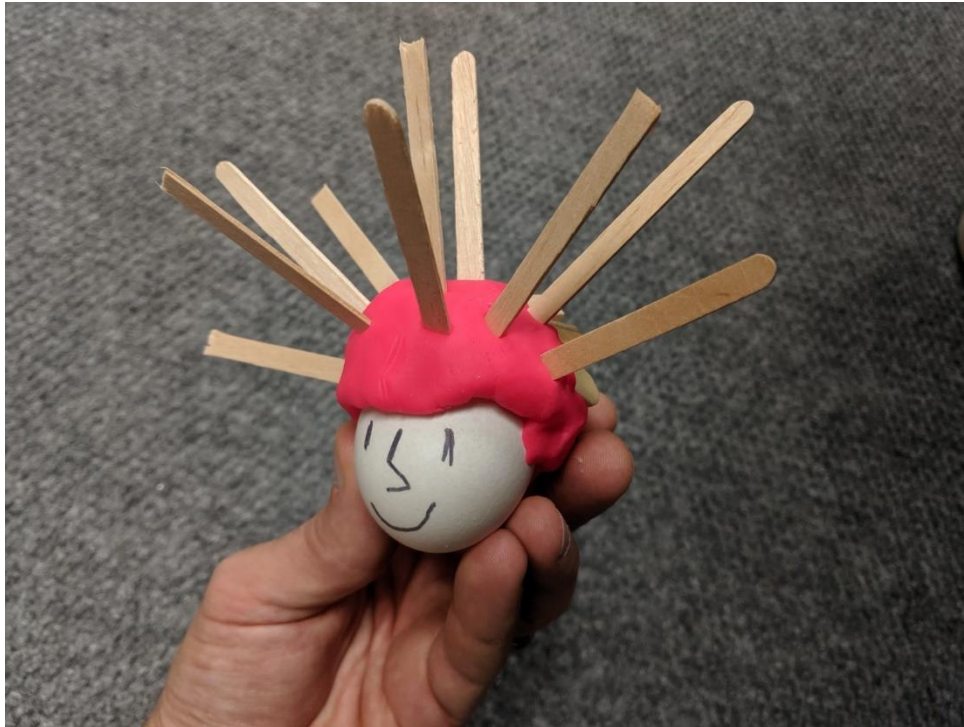
- Cotton pads and/or cotton balls (for padding)
- Wooden coffee stirrers, cut to approximately 2in in length (for spikes)
- Wooden craft sticks, cut to approximately 1/2in in length (for scales)
- Souffle cups, 2oz and 3oz in size (for shells)
- Play-dough, approximately 3oz per group
- A hard-boiled egg
- A marker to draw a face on the egg



Tell students that each group will receive an egg. Extra care should be taken when handling the egg because the shell is very thin!

Help students cover half of their egg with Playdough. Do this by flattening the Playdough on the table and gently wrapping one end of the egg in Playdough. Students will use the Playdough as the soft, pliable surface to add their armor.

Provide students the materials and explain what materials can serve as the scales, spikes and shells.



This egg helmet uses spikes for protection. Is this a good design?

Evaluate:

Students will have an opportunity to reflect on their learning by creating a product advertisement for their egg helmet.

Flip over Worksheet – Egg Helmet and ask students what they should name their egg helmet so that others will want to purchase it?

Ask students to create an advertisement, which can incorporate drawings and words, that tells others about the product and why they should use it.

In this final step, students are able to reflect on their understanding of animal armor, human's need to look to nature for inspiration, and the effectiveness of their helmet design.

NGSS Connections:

- **1-LS1-1** Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- **2-LS4-1** Make observations of plants and animals to compare the diversity of life in different habitats

5E Instructional Model

This workshop uses the 5E model. This model is a powerful way to support student understanding from experiences and new ideas.

Each of the five steps are often written in sequence: engage, explore, explain, elaborate and evaluate. However, the process is not linear.

In the **explore** stage, students establish connections between prior knowledge and a new concept. Facilitators do this by asking questions about prior knowledge, introducing a basic text or text selection, or sharing a phenomenon related to the content.

In the **explore** stage, students make observations and record their data.

In the **explain** stage, students share their findings. This is not an opportunity for facilitators to explain a concept, but instead it's a time to make sense of what was explored through additional texts and multimedia.

In the **elaborate** stage, students take their current understanding and expand it to other scenarios or to a larger context.

In the **evaluate** stage, student understanding is tracked. A successful assessment will gauge understanding from the very beginning and track it throughout the lesson.

