Endeavor STEM Teaching Certificate Project
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July 2021

Lesson Title: *Function Construction*

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Topic: *Structure and Function of living organisms*

Targeted Grade Level: *4th grade, but it could be adapted for 3-5*

Time Needed: *2-3 days*

Subject Integration: Science, Engineering, Reading & Writing

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence, data, and/or a model.	**LS1.A: Structure and Function** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	**Systems and System Models** • A system can be described in terms of its components and their interactions.

Common Core State Standards:

Life Science:	Math:	ELA:
GLE 1: Organisms have both internal and external structures that serve various functions. EO a: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. (4-LS1-1) (Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lungs, brain and skin.) (Boundary Statement: Stress at this level is on understanding the macroscale systems and their functions, not the microscopic scale.)	4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. (4-LS1-1)	Oral Expression and Listening GLE 1: Pose thoughtful questions after actively listening to others. Reading for All Purposes GLE 2: Apply strategies to comprehend and interpret informational texts GLE 3: Apply knowledge of spelling patterns (orthography) and word meanings (morphology) to decode multisyllable words and determine the meaning of unknown words Writing and Composition GLE 2: Write informative/explanatory texts using text structures appropriate for the purpose and developed through facts, definitions, concrete details, precise language, and domain-specific vocabulary.

Other Standards

Ocean Literacy Core Principle 5: The ocean supports a great diversity of life and ecosystems.

A Ocean life ranges in size from the smallest living things, microbes, to the largest animal on Earth, blue whales.

B Most of the organisms and biomass in the ocean are microbes, which are the basis of all ocean food webs. Microbes are the most important primary producers in the ocean. They have extremely fast growth rates and life cycles, and produce a huge amount of the carbon and oxygen on Earth.

C Most of the major groups that exist on Earth are found exclusively in the ocean and the diversity of major groups of organisms is much greater in the ocean than on land.

D Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (symbiosis, predator-prey dynamics, and energy transfer) that do not occur on land.

E The ocean provides a vast living space with diverse and unique ecosystems from the surface through the water column and down to, and below, the seafloor. Most of the living space on Earth is in the ocean.

F Ocean ecosystems are defined by environmental factors and the community of organisms living there. Ocean life is not evenly distributed through time or space due to differences in abiotic factors such as oxygen, salinity, temperature, pH, light, nutrients, pressure, substrate, and circulation. A few regions of the ocean support the most abundant life on Earth, while most of the ocean does not support much life.

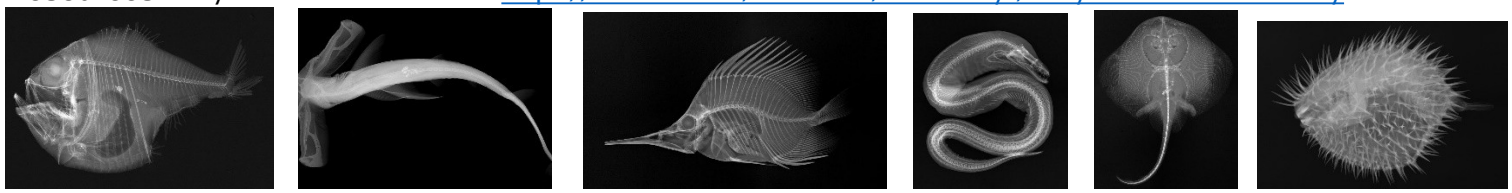
G There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms. Hydrothermal vents, submarine hot springs, and methane cold seeps, rely only on chemical energy and chemosynthetic organisms to support life.

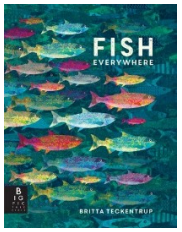
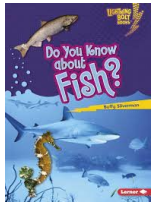
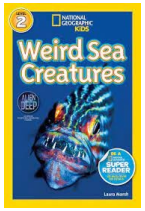
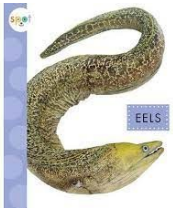
H Tides, waves, predation, substrate, and/or other factors cause vertical zonation patterns along the coast; density, pressure, and light levels cause vertical zonation patterns in the open ocean. Zonation patterns influence organisms' distribution and diversity.

I Estuaries provide important and productive nursery areas for many marine and aquatic species.

5E Model	5E Objectives

Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.*	**Procedure:** The teacher should set up expectations for discussion beforehand. In my classroom we use speaking roles like "instigator, prober, challenger, and summarizer" as well as sentence frames for students to use such as "I hear what you are saying, but have you considered…" This engage phase could be done as a whole class, or in small groups depending on the group of kids and the age. As a whole class: each photograph from the exhibit "x-ray vision: fish inside-out" should be put up one by one (in either transparency form or as a large picture projected on the screen). Without speaking, students should first be asked to write their initial thoughts, questions, wonderings, noticings… on a sticky note and bring it up to the teacher (This same feat can be achieved through a digital platform like pear deck). The teacher can start spreading the post-its out on an anchor chart, or around the picture and read each of them out loud. This keeps initial answers anonymous, which will hopefully encourage students to be risk takers with their thinking. Additionally, when students hear the other ideas out loud, it may spark some deeper thinking. If many notes are the same, they can be grouped in the same area. Using the classrooms pre-established discussion expectations, we may enter into a conversation about one of the themes. An example could be "I think this is a fish" and we could challenge that idea, or ask for more information. As more questions arise, we can add more sticky notes to the board. Some student may say "I think that is his stomach." This is a perfect misunderstanding to write down as later students will discover how a fish bladder works. In small groups: each table could have their own picture that they discuss together and challenge each other's thinking. Ideas can be written down in the same way before the groups come back to a whole group discussion. IT IS VERY IMPORTANT THAT THE TEACHER DOES NOT AGREE OR DISAGREE WITH ANY OF THE ASSUMPTIONS. The teacher can encourage lines of questioning that lead to stated assumptions like "I think that is its tail for steering," or "I think that one lives deep in the ocean." Teachers can add their own questions like "**Why is it shaped like that?"** **Modifications** Vocabulary words that will help ELL students describe what they see should be present. Prepositions like "under" or "behind" as well as frames like "I see a _____" or "I wonder if _____?" **Standards Addressed** Standard 1: Oral Expression and Listening *GLE 1: Pose thoughtful questions after actively listening to others.*

	Beginning to address Life Science *GLE1: "Organisms have both internal and external structures…"* **Formative/Summative Assessments** Formative assessment of student understandings and knowledge will be collected via the sticky notes, or through the digital pear-deck file. **Resources** X-ray vision: Fish Inside out https://ocean.si.edu/ocean-life/sharks-rays/x-rays-fish-reveal-diversity 
Explore *Plan for students to engage in hands-on activities that are designed to facilitate*	**Procedure:** Students will be asked to find the truth about these structures. "How do we know that x-ray isn't of a plant? How do you know that x-ray eats meat? Find three facts from one of these books that PROVE what the structure is for." Students should have a dedicated page in their notebook to "jot" down any facts that stand out to them. All four resources provided contain information about adaptations of different sea creatures and exactly what they are for. After the jot phase, students should be encouraged to challenge each other's thinking. The teacher may probe saying "How do you know that fish lives in the deep ocean? What does life need to survive there? And how do you know that is an eel and not a snake?" This phase should become noisy toward the end ☺ **Modifications** Students who cannot yet read in English will have three of these four books available as audio "read to me" books

conceptual change.	on EPIC. Students who may struggle with recording their thoughts could be given sentence frames to finish "I was surprised to learn _____" "The _____ of a _____ is used for _____." The teacher can support with vocabulary they may be missing. **Standards Addressed** Life Science GLE 1: Organisms have both internal and external structures that serve various functions. Reading for All Purposes GLE 2: Apply strategies to comprehend and interpret informational texts GLE 3: Apply knowledge of spelling patterns (orthography) and word meanings (morphology) to decode multisyllable words and determine the meaning of unknown words **Formative/Summative Assessments** Jots in notebooks will be the artifact that shows growth of understanding. The teacher should move around the room, to see if students are challenging their own thinking as well as the thinking of others. Are students jotting down the FUNCTION of something, or just what it looks like? **Resources**  Fish Everywhere by Britta Teckentrup  Do you Know about Fish by Buffy Silverman (Level M readers)  Weird Sea Creatures by Laura Marsh (Level N readers)  Ocean Animals: Eels by Mari Schuh (Level D readers)
Explain *Facilitate opportunities for students to explain their understanding*	**Procedure:** The goal of this section is for students to explain their understanding by constructing an argument. Now that students have had plenty of time to jot their supporting facts down, and collaborate with peers, they should have enough confidence to make a claim for an argument. The majority of students will be required to write a paragraph with 4-5 sentences that states exactly what the functions of the structures are. Some may choose to write about more than one structure, and some may

of concepts and processes and make sense of new concepts.	choose to write about more than one creature. The teacher should roam, supporting with sentence frames and feedback for the argument. **Modifications** Lower readers should be placed in charge of explaining the structure of an Eel. The Level D text goes over many of an eel's adaptations, and will provide many supporting facts for their argument. Students may choose to use an organizer for their writing, or use the class model for informational writing. The paragraphs on the anchor model for the class include sentence frames. Students who finish early may start sketching a design for the elaborate phase. **Standards Addressed** Life Science Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. Writing and Composition GLE 2: Write informative/explanatory texts using text structures appropriate for the purpose and developed through facts, definitions, concrete details, precise language, and domain-specific vocabulary. **Formative** Student writing will be judged for their effort at their current level. Did they find evidence in a text that supported their claim? Was their claim clear? Did they provide a counter argument? Did they use the terms "structure" and "function?" (or other relevant academic vocabulary) **Resources** Sentence frames and Success Criteria – If the class does not already have an anchor that they follow

Name: _____ Date: _____

Argument Writing: Sentence Frames

When you make an **argument**, you are making a claim that you believe is true. For example, you might argue that you should be allowed to have a pet dog. To make an effective argument and convince your reader you are right, you will need to provide examples or evidence that support your claim.

A **counter-argument** is a statement that opposes your claim. For example, your parents might argue that you are not responsible enough for a pet dog. Addressing a counter-argument in your writing will make your claim stronger!

Here are some sentence frames to help you get started with your own argument writing!

Claim What do you believe?	• I strongly believe... • (topic) is important for many reasons... • Everyone should... • In my opinion...
Evidence Give examples that support your claim.	• For example... • Another reason why... • You would agree if you knew... • Not many people know that...
Counter-Argument What might someone say if they disagreed with you?	• Some people say... • It may be true that... • It's easy to think... • You might argue that...
Rebuttal What would you say to the person who disagreed with you to change their mind?	• ...but I argue that... • However, the truth is... • ...but when you look at the facts... • But, the evidence shows...
Conclusion Restate your claim in a powerful way!	• In conclusion... • Now you can see why... • It is clear that... • Therefore...

Argument Writing: Parts of an Argument

When you write an **argument**, you are trying to convince your reader that your opinion is correct. A strong argument has five key parts.

Claim	A statement of opinion. This is the topic of your argument.
Evidence	Proof or facts that support your claim.
Counter-Argument	An argument that your reader would make if they disagreed with your claim.
Rebuttal	Your response to the counter-argument.
Conclusion	A strong restatement of the original claim.

Underline each part of the following argument using the colors listed above.

Dear Mom,

I think we should get a pet dog. Dogs make great pets because they are loyal. They help deter criminals, like thieves. They also help boost people's moods because they are friendly and playful. Doctors have even found that owning a dog can improve a person's health. They reduce the risk of cardiovascular disease and they help prevent allergies, asthma, and eczema in children! You might think that I am not responsible enough to have a pet dog. But, I have demonstrated responsibility by making my bed every morning and doing my homework every afternoon. I know that I would be responsible for walking our pet dog and cleaning up after it. Getting a pet dog would be good for our whole family!

Love, Natalie

Elaborate

Provide applications of concepts and

Procedure: *Can students replicate the structure as a model to prove that it functions the way they claim?*

Did students choose the Eel? Can they create a model of its teeth, or vertebrae?

opportunities to challenge and deep ideas; build on or extend understanding and skills.	Did students choose either of the fish? Can they create a model of its swim bladder to show how it works? Did students choose the porcupine fish? Can they create a model that functions in the same way? Students should be given recycled materials (bins of tinkering supplies-wire, balloons, cardboard, toothpicks, etc.) to try to build a working model of the structure. **Modifications** Some students will need guidance with tools or materials. Explain that it can't just look like the structure, it has to work. If the free for all nature of this is intimidating, teachers could choose one structure to model (rib cage, swim bladder, vertebrae). That way there could be fewer materials, and clear expectations. **Standards Addressed** *Engineering Practice:* Construct an argument with evidence, data, and/or a model. **Formative** Does the model show that the student understands the function of the structure? Can they show others how it works? **Resources** Tubs of tinkering supplies, OR supplies for one structure  Bladder: cardboard tube, coins, tape, bowl of water, balloon Vertebrae: Empty Egg Carton, Pipe Cleaners, Colored Foam Sheets (other materials could work) Teeth: Air dry clay and cardboard for a mouth base (students could try making different kinds of teeth to see how they function)
Evaluate *Assess students knowledge,*	**Procedure:** Can students take these new skills and apply them to different creatures? Can they make a claim about a new sea creature, or a new creature on land? Can they discover evidence that supports their thinking? Students should now pick a creature from one of the resources below, or outside resources, to write an

skills and abilities.	argument paragraph about the structures and their functions. The same sentence frames and success criteria should be used. **Modifications** Students may choose to use an organizer for their writing, or use the class model for informational writing. The paragraphs on the anchor model for the class include sentence frames. Students with low English Reading skills may be provided with audio materials for finding evidence. **Standards Addressed** Life Science Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. Writing and Composition GLE 2: Write informative/explanatory texts using text structures appropriate for the purpose and developed through facts, definitions, concrete details, precise language, and domain-specific vocabulary. **Summative Assessments** Student writing will be judged for their effort at their current level. Did they find evidence in a text that supported their claim? Was their claim clear? Did they provide a counter argument? Did they use the terms “structure” and “function?” (or other relevant academic vocabulary) **Resources** https://www.youtube.com/watch?v=gtj_JSlKXgY Video of other deep sea structures working “pulsing and jetting” https://www.youtube.com/watch?v=woTi--GCzwM&ab_channel=EVNautilus Nautilus Video

- **Teacher Background:** *What background information does the teacher need to effectively teach this lesson? If you can provide links to resources, please do so.*

  “Over the last 2,000 million years, plant and animal life on earth has continuously evolved from its simple

beginnings in the oceans to the complex existence lived today.” - https://www.marinebio.org/conservation/marine-ecology/structures-adaptations/

https://www.youtube.com/watch?v=MbVk0tQBMz0 How a swim bladder works

https://kidskonnect.com/animals/eels/ Eel structure information
Even though the eel looks like a snake it is really a fish. They have long, narrow bodies with long dorsal and anal fins. Most eels have no scales. The eel’s backbone is made up of over 100 vertebrae which makes it very flexible. Most eels hide and live in caves and rock crevices. They also burrow in the sand. These behaviors allow them to surprise and attack their prey. Some eels will actually chase their prey. The rocks also provide protection for the eel.