 

**ELEMENTARY SCHOOL**

**Sustainable Science**

**The Secrets of Sharks’ Skin**

**Lesson 1: Grammar Sharks**

**Teacher Background and Overview:**

Sharks seem to be a favorite source of inspiration for those who practice biomimicry—the science of taking inspiration from nature in the design of new technology. The unique features of sharks allow them to swim fast and efficiently, thereby helping sharks stay at the top of the food chain. Biomimicry and sustainable science often go hand-in-hand, as nature has been making amazing materials and performing complex tasks for millions of years without the need for high temperatures and pressure, and without making persistent waste.

Many scientists look at sharks’ dermal denticles—their tooth-like scales made of cartilage—which give them a competitive edge while swimming and hunting prey. Denticles are more efficient than scales in moving through water because they reduce both drag and turbulence. Scientists and engineers interested in sustainability have used the structure of the denticles on the surfaces of boats and submarines to increase their speed and efficiency.

This lesson sets the stage for talking about both sharks and biomimicry by introducing fun shark facts through a grammar-correcting challenge, then by considering examples of technologies modeled after sharks’ dermal denticles. In the upcoming lessons, dermal denticles will be discussed as the inspiration for Sharklet film, a micro-texture that prevents the growth of bacteria without the use of chemical or antibiotic methods.

**Time Required:**

30 minutes

**Learning Objectives:** Students will…

* Determine the main idea of a text and summarize it.
* Use correct capitalization, correctly identify run-ons, and use word analysis skills to decode words.

**Standards:**

***NGSS***

**4-LS1-1** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

***Massachusetts Standards***

*STE*

**4-LS1-1:** Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior, and reproduction.

*ELA & Literacy*

**RSIT.4.2:** Determine the main idea of a text and explain how it is supported by key details; summarize the text.

**RSFS.4.3:** Know and apply grade-level phonics and word analysis skills in decoding words.

**RSFS.4.4** Read with sufficient accuracy and fluency to support comprehension.

1. Read grade-level text with purpose and understanding.

**SL.4.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others’ ideas and expressing their own clearly.

**LS.4.1** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

**d:** Order adjectives within sentences according to conventional patterns (e.g., *a small red bag* rather than *a red small bag*).

**f:** Produce complete sentences, recognizing and correcting inappropriate fragments and run-ons.

**g:** Correctly use frequently confused words (e.g., *to, too, two; there, their, they’re*).

**h:** Write legibly by hand, using either printing or cursive handwriting.

**LS.4.2** Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

**a:** Use correct capitalization.

**Materials (per student group):**

* Copies of Student Worksheets 1 and 2

**Procedure:**

Part 1 – Grammar Sharks:

1. Pass out Worksheet 1 to half of the class and Worksheet 2 to the other half of the class.
2. Go over the instructions on the worksheets with the class.
3. Have students read through the paragraph on their worksheet and correct for grammar (e.g., reorder adjectives to conventional patterns, recognize and correct sentence fragments and run-on sentences, change incorrectly used commonly confused words, correct capitalization).
4. Read the corrected paragraphs as a class so that all students can hear the facts from both worksheets.
5. Make a KWL chart on the board. Fill out the K section as a class with what the students know about sharks.
   * If students do not mention that sharks are fast swimmers, guide them to this point.
6. Fill out the W section as a class with what the students wonder about sharks.
   * If students do not wonder why sharks can swim fast, guide them to this question.

Part 2 – Shark Skin Secrets Revealed:

1. Introduce the word *biomimicry*. Decode the word together. *Bio* means life, *mimicry* means to imitate or copy.
   * Biomimicry is the science of studying nature’s best ideas and then adapting them to solve human problems.
2. Explain that scientists have been inspired by the sharks’ ability to swim fast.
3. Show a picture of a submarine. Ask the class how sharks may have inspired scientists to make a better submarine.
4. Show a picture of a Speedo Fastskin swimsuit and ask the same question: <http://www.speedousa.com/fastskin>
5. Explain to the class that scientists have made faster submarines and swimsuits based off of the same unique property of sharks: their teeth-like scales called *dermal denticles*.
   * Show this picture of shark denticles:

Image by: [**Pascal Deynat/Odontobase**](https://en.wikipedia.org/wiki/Fish_scale#/media/File:Denticules_cutan%C3%A9s_du_requin_citron_Negaprion_brevirostris_vus_au_microscope_%C3%A9lectronique_%C3%A0_balayage.jpg), Creative Commons <https://asknature.org/strategy/skin-prevents-biofouling/#jp-carousel-8084>

1. The sharks’ shape helps them move through the water very efficiently, but it is really the unique pattern and structure of their denticles that enable sharks to swim so quickly.

**Wrap-Up/Assessment:**

1. Wrap up by filling out the L section of the class KWL chart with what the students have learned about sharks.

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***Grammar Sharks: Lesson 1 Worksheet 1***

Directions:

Read the following paragraph about sharks. Identify the grammatical errors by either circling or underlining the mistakes. Then rewrite the paragraph in the space provided to show how you would fix the mistakes.

***Tons of Teeth***

Sharks have very sharp teeth. Both there upper and lower jaws can move. Different than most animals. This lets them bite very hard and hold onto their prey. Then, they shake their heads strongly until a piece of meat comes loose and they swallow it. Sometimes a tooth can fall out but this is not a problem for the Shark, sharks have backup teeth, which spin into place when they’re teeth fall out. Throughout its life, a shark can grow and use over 20,000 different teeth.

Rewrite the paragraph to show how you would fix the mistakes.

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Write 1–2 sentences to summarize the paragraph you just read.

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***Grammar Sharks: Lesson 1 Worksheet 2***

Directions:

Read the following paragraph about sharks. Identify the grammatical errors by either circling or underlining the mistakes. Then rewrite the paragraph in the space provided to show how you would fix the mistakes.

***Got Gills?***

There are about 350 different types of sharks in the ocean. some sharks can grow really big and other sharks stay very small, all sharks breathe the same way. They use there gills too take oxygen from the seawater as it passes around them. Some sharks need two be moving at all times so that they are able to breathe while others can rest at the bottom of the ocean and push the water through their gills.

Rewrite the paragraph to show how you would fix the mistakes.

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Write 1–2 sentences to summarize the paragraph you just read.

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***Grammar Sharks: Lesson 1 Worksheet 1***

***Teacher Key***

Directions:

Read the paragraph below about sharks. Identify the grammatical errors by either circling or underlining the mistakes. Then rewrite the paragraph in the space provided to show how you would fix the mistakes.

***Tons of Teeth***

Sharks have very sharp teeth. Both there upper and lower jaws can move. Different than most animals. This lets them bite very hard and hold onto their prey. Then, they shake their heads strongly until a piece of meat comes loose and they swallow it. Sometimes a tooth can fall out but this is not a problem for the **S**hark, sharks have backup teeth, which spin into place when they’re teeth fall out. Throughout its life, a shark can grow and use over 20,000 different teeth.

Rewrite the paragraph to show how you would fix the mistakes.

Sharks have very sharp teeth. Both their upper and lower jaws can move, which is different than most animals. This lets them bite very hard and hold onto their prey. Then, they strongly shake their heads until a piece of meat comes loose and they swallow it. Sometimes a tooth can fall out, but this is not a problem for the shark. Sharks have backup teeth, which spin into place when their teeth fall out. Throughout its life, a shark can grow and use over 20,000 different teeth.

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***Grammar Sharks: Lesson 1 Worksheet 2***

***Teacher Key***

Directions:

Read the paragraph below about sharks. Identify the grammatical errors by either circling or underlining the mistakes. Then rewrite the paragraph in the space provided to show how you would fix the mistakes.

***Got Gills?***

There are about 350 different types of sharks in the ocean. some sharks can grow really big and other sharks stay very small, all sharks breathe the same way. They use there gills too take oxygen from the seawater as it passes around them. Some sharks need two be moving at all times so that they are able to breathe while others can rest at the bottom of the ocean and push the water through their gills.

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