She Sells Seashells by the Seashore

The Principals of Evolution

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Grade Level	9th – 10th Grade	**Time Frame**	185 Minutes
Subject	Science	**Duration**	4-5 Periods
Course	Biology		

Essential Question

Which principles help provide evidence of evolution among organisms?

Summary

In this lesson, students will learn about paleontologists who have helped shape our understanding of organisms' evolutionary history. They will research and evaluate evidence that scientists have used to construct and continually use to reconstruct evolutionary history and environmental pressures that cause evolutionary shifts. This lesson is part two of a three-part series. Lesson 1, Ch-Ch-Ch-Ch-Changes, is intended to help students define evolution. This is a multimodality lesson, which means it includes face-to-face, online, and hybrid versions of the lesson. The attachments also include a downloadable Common Cartridge file, which can be imported into a Learning Management System (LMS) such as Canvas or eKadence. The cartridge includes interactive student activities and teacher's notes.

Snapshot

Engage

Students answer guiding questions while watching a video about the life of paleontologist Mary Anning and then create an advertisement that celebrates her work.

Explore

Students view scientific evidence of a prehistoric whale.

Explain

Students research and present an evolutionary principle or type of selection and take notes as other students present.

Extend

Students play a game to assess their knowledge of the principles of evolution and types of selection.

Evaluate

Students identify and reflect on their own learning related to evolutionary principles.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD302: Understand basic scientific terminology
EMI501: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text

Oklahoma Academic Standards (Biology)

B.LS4.5 : Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
B.LS4.5.1: Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.
B.LS4.5.2: Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' adaptation over time is lost.

Attachments

- Ancient Whale Bones Questions - She Sells Seashells - Spanish.docx
- Ancient Whale Bones Questions - She Sells Seashells - Spanish.pdf
- Ancient Whale Bones Questions - She Sells Seashells.docx
- Ancient Whale Bones Questions - She Sells Seashells.pdf
- Ancient Whale Bones Questions Answer Key - She Sell Seashells.docx
- Ancient Whale Bones Questions Answer Key - She Sell Seashells.pdf
- Common Cartridge - She-Sells-Seashells-by-the-Seashore.zip
- Evolution Card Sort - She Sells Seashells - Spanish.docx
- Evolution Card Sort - She Sells Seashells - Spanish.pdf
- Evolution Card Sort - She Sells Seashells.docx
- Evolution Card Sort - She Sells Seashells.pdf
- Evolution Card Sort Answer Key—She Sells Seashells.docx
- Evolution Card Sort Answer Key—She Sells Seashells.pdf
- Evolution Cornell Notes - She Sells Seashells - Spanish.docx
- Evolution Cornell Notes - She Sells Seashells - Spanish.pdf
- Evolution Cornell Notes - She Sells Seashells.docx
- Evolution Cornell Notes - She Sells Seashells.pdf
- Evolution Presentation Instructions - She Sells Seashells - Spanish.docx
- Evolution Presentation Instructions - She Sells Seashells - Spanish.pdf
- Evolution Presentation Instructions - She Sells Seashells.docx
- Evolution Presentation Instructions - She Sells Seashells.pdf
- Evolution Presentation Rubric - She Sells Seashells - Spanish.docx
- Evolution Presentation Rubric - She Sells Seashells - Spanish.pdf
- Evolution Presentation Rubric - She Sells Seashells.docx
- Evolution Presentation Rubric - She Sells Seashells.pdf
- Evolution Research Draft - She Sells Seashells - Spanish.docx
- Evolution Research Draft - She Sells Seashells - Spanish.pdf
- Evolution Research Draft - She Sells Seashells.docx
- Evolution Research Draft - She Sells Seashells.pdf
- Lesson Slides - She Sells Seashells by the Seashore.pptx

Materials

- Lesson Slides (attached)
- Evolution Card Sort (attached, one per group of 3-4 students)
- Ancient Whale Bones Questions handout (attached, one per student)
- Evolution Presentation Instructions (attached, one per group of three students)
- Evolution Research Draft handout (attached, one per group of three students)
- Evolution Presentation Rubric (attached, one per student)
- Evolution Cornell Notes handout (attached, one per student)
- Sticky notes (one per student)
- Paper clips or envelopes (for organizing the Card Sort cards)

30 minutes

Preparation Notes

Lesson Series

This lesson is part two of a three-part series. You can find the first lesson in the series, Ch-Ch-Ch-Ch-Changes.

F2F Lesson Set up:

Prior to the lesson, print and cut out copies of the **Evolution Card Sort**. You'll need one set for each group of 3-4 students. Use envelopes or paper clips to keep the sets together.

Create a Driving Question Board to document the students' questions. Consider butcher paper, giant sticky notes, or a Google Doc.

Extend Preparation:

Create a free Blooket account. Students will use Blooket to assess their knowledge of the evolutionary principles and types of evolutionary selection. Find and favorite the game She Sells Seashells by the Seashore by selecting the star.

Online/Hybrid Set Up:

Adding Content to LMS

Download the Common Cartridge-She Sells Seashells and import it into your Learning Management System account (ie. eKadence or Canvas).

Explore Preparation:

Use the card sort attached to create an activity for your students. You can create an online process, quick quiz, or other method for your students to complete the activity.

20 minutes

Engage

Use the attached **Lesson Slides** to follow along with the lesson. Begin with **slide 3.** Read aloud the essential question and then move to **slide 4** and share the objectives.

Go to **slide 5**. Inform students that they will be watching a video about paleontologist Mary Anning from BBC Ideas called The True Story of Mary Anning. As they watch the video, students should note any words that come to mind that help describe Anning's life and work.

Embedded video

https://youtube.com/watch?v=BEbgTpdwRgI

Teacher's Note: Alternative Video

The tension between Christianity and the scientific discovery of extinction is mentioned briefly at the 1:25 mark. If you prefer not to bring religion into the discussion, you could consider using the video Mary Anning's Story from the Lyme Regis Museum as a possible alternative.

After the end of the video, go to **slide 6**. Provide students with the following prompt:

> Imagine that you work at a museum and want to let people know about your new Mary Anning exhibit. Compose a Six-Word Memoir about Anning and her contribution to evolution that will help attract visitors to this exhibit. Pass out a sticky note to each student and provide them time to create their Six-Word Memoir.

Teacher's Note: Voting Directions

Unhide **slide 7** to provide students with directions on the voting process.

After students are done writing, inform them that they will be voting on which memoir they believe is the most intriguing and would best attract people to the exhibit. Divide students into groups of four to read their memoirs and vote on the one they like the best. Have those with the most votes read their memoirs to the whole class and have the class vote on the best memoir for the Mary Anning exhibit.

Teacher's Note: Monitoring Student Progress

Circulate around the room to observe as students create their Six-Word Memoirs and share them within their groups.

Optional Modifications and Extensions

Voting can be done in an online virtual platform, such as RCV123 or Poll Everywhere, to give students the opportunity to read all submissions and choose the one they think best meets the criteria.

After the activity, consider displaying an image of Mary Anning in the classroom or outside the door along with the winning memoir.

15 minutes

Explore

Procedure 1: Pass out copies of the **Ancient Whale Video Questions** handout. Go to **slide 8** and let students know that they will watch another paleontologist, Professor Philip Gingerich, report his findings about an ancient whale. Students should consider the questions as they watch the Ancient Whale Bones video.

Embedded video
https://youtube.com/watch?v=WK8i8_qsWjo

After playing the video, give students time to complete their responses.

When they're finished, have students share out the questions that they identified for item 6 in their handouts and record them on the Driving Question Board. Save these questions and inform students that you will revisit them later (during the **Extend** portion of the lesson).

Possible Questions

Questions that students identify might include:

- How did the changes occur in the whale?
- How long does it take for a drastic change like this to occur?
- Can the whale evolve to be back on land?
- Are whales closely related to land animals, fish, or both?
- Are there land animals related to the whale?

Procedure 2: Organize students into groups of 3-4 and pass out the **Evolution Card Sort** cards. Instruct students not to open their cards until after you've finished giving the instructions. Go to **slide 9**. Tell students that they will complete a Card Sort related to the principles of evolution and the types of evolutionary shifts that take place over time. They should take a few minutes to match each definition with the image or graph they believe it is best associated with. When they are finished, instruct them to put the matching cards to the side. They will return to them later in the lesson.

Teacher's Note: Resist the Urge to Help

Walk around the room and monitor students as they arrange the cards, but don't assist them with the Card Sort beyond sharing the basic instructions.

90 minutes

Explain

Go to **slide 10**. Review the seven principles that have helped scientists reconstruct an organism's evolutionary history and three types of evolutionary selection, which represent the different ways that scientists graphically depict evolutionary change over time.

Inform students that they will be creating a slide related to one of the seven principles or three types of selection. On their slide, they should explain how the principle has reconstructed evolutionary history and provide examples. Students will add their slide to a class slideshow and present it to the class.

Split students into groups of three. Pass out the **Evolution Presentation Instructions, Evolution Research Draft,** and **Evolution Presentation Rubric** handouts. Go to **slide 11** and inform students that they will start by compiling and constructing a rough draft of their assigned topic on the Evolution Research Draft handout. Have students review the instructions and the specific requirements detailed on the rubric and spend the class period researching the information for their slide for you to review. After you approve the content, groups should create and submit their slides. Remind students to double-check the rubric again before they finish.

Set a presentation date for students. Make sure to emphasize that each group member must present their own portion of the slide content. On presentation day, pass out copies of the **Evolution Cornell Notes** sheet and have students take notes as their peers are presenting. They should also write a short synopsis of their own topic on their note sheet.

40 minutes

Extend

After presentations, place students back their groups of 3-4 to revisit their card sort from the Explore. Allow a few minutes for students to re-sort their cards based on their newly gained knowledge from the presentations. Review the correct pairings. Complete the 8-Up strategy by asking students to take out a sheet of paper and write a paragraph in response to the following question:

Based on what you have learned, determine where you believe the evolution of the whale from the Ancient Whale video falls in accordance with which principles of evolution and the types of selection.

Once time is up, ask students to return to their group, share their response, and compose a single revised response. After they have created their new response, have students group with another group to share their new responses and revise it to a new collective response. Repeat the process until you have two large groups. Have the two groups share their responses and narrow it down as a class to a final group response.

Optional Activity:

Inform students they will use Blooket to assess their knowledge of the evolutionary principles and types of evolutionary selection by playing the She Sells Seashells by the Seashore game.

Log in to the Blooket account that you created, select the teacher option, and select She Sells Seashells by the Seashore game. It should be in your favorites tab. Click the Host button to select the game mode.

Go to slide 12. Have students go to https://play.blooket.com/play or use the QR code provided on the slide and enter the game code and name. Tell students that their goal is to get as many questions correct as quickly as they can to outscore their peers and win the race.

Teacher's Note: About Blooket

If you are familiar with Kahoot!, Blooket is similar. However, Blooket offers multiple options for games and can be played synchronously with the class or asynchronously with students playing on their own.

For synchronous play, we recommend the "Racing" game option. You can control how many times questions are asked for students to improve and lengthen the game. For asynchronous play, we recommend "Factory" and “Tower Defense” set for 10 minutes for solo gaming. At the end of the game, you can have students take a screenshot of their score to upload into your LMS.

Go to **slide 12**. Have students go to https://play.blooket.com/play or use the QR code provided on the slide and enter the game code and name. Tell students that their goal is to get as many questions correct as quickly as they can to outscore their peers and win the race.

20 minutes

Evaluate

Revisit the Driving Questions Board that you compiled from question 6 of the Ancient Whale video. Share the questions again and ask students to choose one question from the list.

Go to **slide 14.** On a piece of paper, have students indicate which one of the questions they chose and provide a 2-3 sentence answer based on what they have learned about the principles of evolution and the types of selection.

When they are finished writing their answers, have students discuss what they wrote with a small group and come up with a group summary. Have one student from each group share the summary with the class.

20 minutes

Research Rationale

Learners learn best when they can contextualize what they learn for immediate application, and they acquire personal meaning by reflecting on experiences while participating in a social-dialogical process (Piaget, 1950).

Approach to learning with technology: The aim of learning with technology is "knowledge construction, not reproduction, conversation, not reception; articulation, not repetition, collaboration, not competition; and reflection, not prescription" (Jonassen, Howland, Moore, & Marra, 2003).

Resources

- BBC Ideas. (2019, March 27). The true story of Mary Anning: The girl who helped discover dinosaurs. | BBC ideas [Video]. YouTube. https://www.youtube.com/watch?v=BEbgTpdwRgI
- K20 Center. (n.d.). Blooket. Tech Tools. https://learn.k20center.ou.edu/tech-tool/2386
- K20 Center. (n.d.). EdPuzzle. Tech Tools. https://learn.k20center.ou.edu/tech-tool/622
- K20 Center. (n.d.). Kahoot! Tech Tools. https://learn.k20center.ou.edu/tech-tool/637
- K20 Center. (n.d.). Mentimeter. Tech Tools. https://learn.k20center.ou.edu/tech-tool/645
- K20 Center. (n.d.). Padlet. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1077
- K20 Center. (n.d.). Parking lot. Strategies. https://learn.k20center.ou.edu/strategy/131
- K20 Center. (n.d.). Six-Word memoirs. Strategies. https://learn.k20center.ou.edu/strategy/75
- K20 Center. (n.d.). Spend a buck. Strategies. https://learn.k20center.ou.edu/strategy/154
- Lyme Regis Museum (2020, June 23). Mary Anning's story [Video]. YouTube. https://www.youtube.com/watch?v=5YBiYQXtdM8
- National Geographic. (2009, February 4). Ancient whale bones | National Geographic [Video]. YouTube. https://www.youtube.com/watch?v=WK8i8_qsWjo