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

- Common Cartridge (attached)
- Evolution Research Notes handout (attached)
- Evolution Presentation Rubric (attached)
- Evolution Cornell Notes handout (attached)
- LMS Account

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

Students will begin the lesson by watching a brief video from BBC Ideas about the life and work of paleontologist Mary Anning titled The True Story of Mary Anning.

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 viewing the video, students will pretend they work at a museum where an exhibit of Mary Anning will be opening and create an advertisement that celebrates Anning's work. For the advertisement, they will craft a Six-Word Memoir to attract others to this exhibit by drawing attention to her contribution to evolution. Students will then add their memoirs to a **discussion board** within your class learning management system (LMS).

After all students have posted their memoirs, you can ask them to each vote for their favorite.

Voting for a Favorite

- If you are completing the memoirs synchronously as a class, once all students have added their memoir then have them vote by liking the memoir that most attracts them to the exhibit.
- If students are completing the memoirs on their own, give them at least 24 hours to add a memoir, and then ask them to vote the following day.

15 minutes

Explore

Procedure 1: Students will watch National Geographic's Ancient Whale Bones video and respond to an accompanying set of questions posted in the Quizzes section of your LMS. Be aware that question 6 asks students to identify their own questions. Compile these students-generated questions into a Driving Questions Board using a Google Doc, or have students add their questions to a Padlet board. Inform students that you will revisit these questions later in the lesson.

Optional Modifications

- Consider replacing the quiz with an activity based on the video: EdPuzzle's Ancient Whale Bones | National Geographic. To learn more about EdPuzzle, visit the K20 Center's EdPuzzle Tutorials page.
- If you use Padlet for this activity, be sure to monitor the board and remove editing permissions from students after you have gathered their questions. To learn more about how to create a Padlet board and share it in your LMS, visit the K20 Center's Padlet Tutorials page.

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: Students will next complete a Card Sort activity to connect evolution-related terms with images. Explain the Card Sort process you plan on students using.

Teacher's Note: Group or Individual Considerations

- **Teacher's Note: Group or Individual Considerations**
  - If you are completing this activity synchronously as a class, break students into groups of 2-4 using breakout rooms.
  - If students are completing this activity on their own, give them at least 24 hours to complete the Card Sort.

90 minutes

Explain

Introduce the seven concepts that have helped scientists reconstruct an organism's evolutionary history and three types of selection. These are the ways that scientists have graphically depicted evolutionary change over time.

1. Split students into groups of three and ask them to create a slide about one of the seven principles or three selection types. Their slide should explain how this principle has helped scientists reconstruct evolutionary history and provide examples.
2. Assign one of the 10 topics to each group:
    1. *Evolutionary Principles*: Fossil Records, Homologous Structures, Vestigial Structures, Analogous Structures, Embryology, Biochemistry, and DNA Technology
    2. *Types of Selection*: Directional, Disruptive, and Stabilizing
3. Provide students with copies of the **Evolution Research Draft** and **Evolution Presentation Rubric** handouts.
4. Each group member will need to submit the **Evolution Research Draft** for feedback.
5. After their drafts are approved, students will create and submit their group's slide to be compiled for the class presentation. You can either create this presentation from the submitted slides or ask students to add their slides to a class Google Slides presentation.

Teacher's Note: Formative Assessment

The research draft is a formative assessment, so rather than assigning a grade, use the opportunity to provide feedback that will help students as they create their slide. However, if you need it for a grade, we recommend checking it off as a completion grade.

Set a virtual presentation day for students. Make sure to emphasize that each person must present their own portion of the slide. As students are presenting, have them take notes and write down any questions they have on the **Evolution Cornell Notes** handout. Inform them they will need to submit the notes for review after the presentations are complete. Consider pausing after each presentation and opening the floor for questions students might have before moving to the next presentation.

40 minutes

Extend

Procedure 1: Students 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.

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 Learning Management System, LMS.

Log in to the Blooket account that you created, select the teacher option, and select She Sells Seashells by the Seashore game from your Favorite list. Click the Host button to select the game mode.

To play the game, students will need to go to https://play.blooket.com/play, enter the game ID, and join the game. Copy the game ID and share the code in the assignment description in your LMS. Students’ goal is to get as many questions correct as fast as they can to outscore their peers and win the race.

After playing the game, inform students to return to their LMS and answer the following prompt:

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.

20 minutes

Evaluate

Revisit the Driving Questions Board that you compiled during the Ancient Whale video activity. Create a discussion board where you post the questions or a link to the Google Doc or Padlet board containing the questions. Instruct students to choose one question from the list and reply to the post by specifying which question they chose and providing a 2-3 sentence answer based on what they have learned about the principles of evolution and the types of selection. In addition, ask students to respond to at least two of their classmates' posts.

Optional Differentiation

If you are completing this activity synchronously as a class, give students about 15 minutes to write their responses, and then use breakout rooms for them to discuss their responses with a small group. Ask groups to create a summary of their discussion, and when the whole class comes back together have each group share its summary. You could even open up the discussion for other groups to respond to the explanations that they have heard.

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