Grandma's Learning to Text

Evolution: Cladogram

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Published by *K20 Center*

Grade Level	9th – 12th Grade	**Time Frame**	2-3 class period(s)
Course	Biology I, Biology II	**Duration**	150 minutes

Essential Question

What are the evolutionary relationships between organisms and how do we illustrate those relationships?

Summary

Students will apply the idea of generational change to the living world and to the inventive/technological world. Students need to have prior knowledge of the concept of speciation and factors that influence speciation.

Snapshot

Engage

Students will document observations they make from pictures of different species.

Explore

Students will arrange the Cladogram Cards to determine evolution path and organism relationships and to create both a data table and a cladogram.

Explain

Students will discuss and learn about the parameters of a cladogram.

Extend

Students will use a blog post about the evolution of cell phones as inspiration to do research and harvest data to construct a cladogram of the cell phone, computer, music player, etc.

Evaluate

Students will give feedback via a Gallery Walk of all the cladograms

Standards

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-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.

Oklahoma Academic Standards (Biology)

B.LS3.2 : Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
B.LS4.1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
B.LS4.2.1: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2)variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

Attachments

- CellPhoneEvolution - Spanish.docx
- CellPhoneEvolution - Spanish.pdf
- CellPhoneEvolution.docx
- CellPhoneEvolution.pdf
- Cladogram Cards - Spanish.docx
- Cladogram Cards - Spanish.pdf
- Cladogram Cards.docx
- Cladogram Cards.pdf
- Cladogram Teacher PP.pptx
- Gallery Walk Rubric - Spanish.docx
- Gallery Walk Rubric - Spanish.pdf
- Gallery Walk Rubric.docx
- Gallery Walk Rubric.pdf

Materials

- History and Evolution of Cell Phones blog post (for Extend)
- Cladogram Cards (for Explain)
- Arrow Cards (for Explain)
- Poster paper and poster-making supplies (for Extend)
- Post-it Notes (Evaluate)
- Copies of Rubric (Evaluate)

Engage

Display the second slide of the PowerPoint with the pictures of the zebras. Give students 2-3 minutes to brainstorm on their own the similarities and differences of the different pictures.

Giving You Some Background

It will be revealed on the third slide--these are all zebras but different species. All four of them have diverged from a common ancestor because of geographical barriers. There's more information about the different species in the notes section of the third slide.

After the individual brainstorm, have a few students who are willing to share give some of their observations. Then, show the third slide of the different species names and the fourth slide of the phylogenic tree (of not only zebras but horses and donkeys, as well). There are questions on the slide that are intended to prompt student thinking.

Keep It Casual

Try to keep it a short sharing experience, including as much of the background information as is needed for the group of students. This Engage shouldn't last more than 7 minutes total, otherwise the rest of the lesson will get lost.

Explore

Gather students into small groups using your preferred grouping method, then pass out set of the Cladogram Cards to these small groups of students. Using the strategy Sociogram, have students create a flowchart or trait relationship chart. Switch to slide 5 on the PowerPoint and leave this up as students work on their Sociograms.

- First, students will draw (or place) arrows between cards that share traits.
- Then, students will use the information on the cards to fill in a data table to determine the sequence of trait acquisition.
- Finally, students will construct a cladogram based on the data that illustrates the progression of speciation.

Streamlining

For the arrows, having students write and erase arrows can be cumbersome. Printing out arrow cards that can be dragged around and rotated, just like the Cladogram Cards, would be recommended. Another idea, have the sociogram flow chart arranged on a dry-erase board, so arrows can still be drawn but would be easier to erase or modify.

As students work, pull out the core ideas of change over time, homologous structures, increasing complexity, mutation influence, and any pertinent academic language from the small groups as they stumble across them and post them on the board for the whole class to see.

Want More Of A Challenge?

Set A of the Cladogram Cards consist of just animals, which is typical of basic cladogram/evolution lessons. Set B has organisms from all three domains, so it's a little harder and more abstract for the students. Set B is also useful to extend into how taxonomy is constructed and how taxonomy is related to cladograms.

Explain

Keep following your lesson by clicking through the included PowerPoint. The solution for both Set A and Set B of the cladogram cards is included (slides 6 and 7, respectively). Post the essential question: "What are the evolutionary relationships between organisms and how do we illustrate those relationships?" Engage in a Think, Pair, Share activity, where students think about their answers individually, share with a partner, then tell the whole class what was discussed. The prompt for this activity is included on slide 8 of the PowerPoint.

Extend

Have students read the blog post "The History and Evolution of Cell Phones" individually (instructions that can be posted are on slide 9), and then discuss informally together what they've read and how it relates to cladograms. Have small groups (2-3 students) each pick a subject to research. It could be anything, since everything experiences change if it sticks around long enough. The groups will do research on the subject, deciding on a beginning point and a progress of change, the parts that changed, and what it has become. Groups will then make a cladogram for their topic on a poster board or butcher paper, incorporating images, time references, and changes to shape each "generation."

Runaway Train

This is a great opportunity to connect the idea of gradual change to their everyday life. However, it can be easy for students to lose focus or to turn in a product that doesn't achieve the intended outcome. Yes, images are super fun, but the real learning happens in connecting the data points together in the correct sequence. Be sure to put an emphasis on the data points that connect each of their "generations" with the others and with the changes that occurred to create each unique generation.

Don't Just Read, Be Critical!

Incorporating a critical reading strategy with with the article, such as CUS and Discuss, would be fine. It's not included in the original lesson because the article is used as inspiration and a thought-provoker, but there's never a bad time to incorporate critical reading work.

Evaluate

Students will hang their finished cladograms around the classroom. Then, groups will do a Gallery Walk of the cladogram posters (instructions for which are on slide 10 of the PowerPoint), leaving Post-it notes of data gaps that need to be filled, needed details for clarification, or praise for parts that were well done. Groups then go back to their original posters, process the feedback, and make changes, as needed, to their posters.

Putting A Grade On It

A rubric for the poster is included, but don't feel pressured to use it. If you take a grade over the poster, a rubric is highly recommended, though. Otherwise, students won't know what's expected of their final product.

Show It Off

This would be a great opportunity to hang the finished posters outside of your classroom for the entire school to see the awesome work that's happening in your classroom.

Resources

- K20 Center. (n.d.). CUS and discuss. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5073969
- K20 Center. (n.d.). Gallery walk / carousel. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505a54d
- K20 Center. (n.d.). Sociograms. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5061dbd
- K20 Center. (n.d.). Think-pair-share. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5064b49
- Ray, A. (2014). The history and evolution of cell phones. The Art Institutes. Retrieved from https://www.artinstitutes.edu/about/blog/the-history-and-evolution-of-cell-phones