Engage: Islands of Change: How New Species Are Born

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Learning Objectives: By the end of this activity, you will be able to:

- Explain how a species can evolve into a new species through speciation.
- Identify the steps in speciation, including isolation, adaptation, genetic variation, and reproductive isolation.
- Create a storyboard that shows the process of speciation using pictures and words.

Background Information

Speciation is the process by which new species form from a common ancestor. It happens over a long

period of time when a group of organisms (like animals, plants, or insects) gets separated from the rest of the population. When this happens, the separated group is no longer able to **interbreed** with the original group, and over time, the isolated group can develop into a new species.

Isolation occurs when a **geographic barrier**—like a river, mountain, or desert—separates part of the population from the rest. This means the two groups of the same species can no longer meet and mate. Isolation can also happen if the species are separated by other factors like different climates or food sources. This separation is very important because, without contact between the two groups, they can start to change in different ways.

Once the groups are separated, they begin to **adapt** to their new environments. **Adaptation** is the process in which organisms change in order to survive better in their environment. These changes can be physical, like the shape of a bird's beak, or behavioral, like when animals change the way they search for food. For example, a population of birds on one side of a mountain might develop longer beaks to eat bigger seeds, while birds on the other side might develop shorter beaks to eat smaller seeds.

As the groups continue to live in their different environments, **genetic variation** occurs. This means that individual organisms within each group will have small differences in their traits, like size, color, or shape. These differences happen because of random changes in their **DNA**, which is passed from parents to offspring. Some of these differences might help the organisms survive better in their environment, and others might not.

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Natural selection is the process where certain traits become more common in a population because they help the organisms survive and reproduce. For example, if birds with larger beaks can crack bigger seeds more easily, they may survive better and have more offspring, passing on their large beaks to the next generation.

After many generations, the two isolated groups may become so different that they can no longer **interbreed**, or mate with each other, even if they are brought back together. This is called **reproductive isolation**. When this happens, the two groups have become separate species. Over time, they are no longer able to produce offspring that can grow up and have babies of their own. Now, each group is a new, distinct species, different from the original population.

Materials Needed:

- Pre-drawn storyboard template (you will draw in the panels)
- Markers or colored pencils
- Word bank (provided below)
- Pencils
- Rubric for evaluation (provided after the activity)

Instructions:

- 1. Create Your Storyboard:
 - Use the storyboard template provided to draw and write about the different steps of **speciation**.
 - Each panel of the storyboard represents a different step. Be sure to:
 - Label each step with the correct vocabulary word (from the word bank).
 - Draw a picture that shows what is happening at each step.
 - Use **short phrases** or **sentences** to explain each step.

2. Follow the Order of Speciation:

- Panel 1: Initial Population on the Island
 - Description: A group of the same species (e.g., finches or lizards) live together in one area.
 - Instructions: Draw the original species before any changes happen. Write a short phrase about how they all look the same and live in the same environment.
 - Key Term: "Initial Population"

• Panel 2: Geographic Isolation

- Description: A natural barrier (like water, mountains, or a desert) separates part of the population, isolating them from the rest.
- Instructions: Draw two groups of the species on either side of the barrier. One side can be forested, and the other can be rocky.
- Key Term: "Isolation"

• Panel 3: Adaptation to New Environment

- Description: Over time, the isolated group adapts to its new environment.
 Changes in food sources or climate lead to physical or behavioral changes.
- Instructions: Draw how the species on each side of the barrier might start to look or behave differently. You can show changes like beak size, color, or body structure.
- Key Term: "Adaptation"

• Panel 4: Genetic Variation

- Description: Random mutations and genetic variation begin to appear in each group, giving them the potential for further differences.
- Instructions: Illustrate the small differences that may begin to appear between the two populations. For example, you might draw different-colored lizards or different types of beaks.
- Key Term: "Genetic Variation"

• Panel 5: Natural Selection

- Description: Certain traits become more common in one group due to survival advantages in the new environment.
- Instructions: Show which traits are better for survival. For example, stronger, larger beaks for cracking nuts, or longer legs for running faster.
- Key Term: "Natural Selection"

• Panel 6: Reproductive Isolation

- Description: Over time, the groups become so different that they no longer interbreed, leading to the formation of two distinct species.
- Instructions: Draw the two groups and show that they can no longer mate. You
 might show them living in the same area but acting differently or avoiding each
 other.
- Key Term: "Reproductive Isolation"

• Panel 7: New Species Formed

Name: ____

- Description: After many generations, the isolated groups are considered separate species.
- Instructions: Draw the final form of the two species. They should look different enough that they are easily recognizable as separate species.
- Key Term: "New Species"

Pre-Activity Questions (Think About It):

Use the sentence stems below to help you think about the process of speciation. Answer the questions on your own paper:

1. What does it mean for a population to be isolated?

• An isolated population means that _____.

2. How do adaptations help a species survive?

Adaptations help a species survive because ______.

3. Why is genetic variation important for evolution?

Genetic variation is important because _____.

4. What happens when two populations can no longer mate and have offspring?

When two populations can no longer mate, _____.

Name: _____

Date: _____

Word Bank:

- Speciation
- Isolation
- Adaptation
- Genetic Variation

- Natural Selection
- Reproductive Isolation
- Initial Population
- New Species

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Graphic Organizer: Speciation Storyboard Template

Original Populatio	on	G	eographic Isolation
Adaptation			Variation
Selection	Reproductive Isolation	New Species	

Date: _____

Post-Activity Reflection:

After completing your storyboard and discussing it with your peers, answer the following questions. Use the sentence stems to help guide your thinking:

1. What was the most interesting part of the speciation process to you?

• The most interesting part was _____ because _____.

2. How do the changes in a species help it survive in its environment?

• The changes help a species survive because _____.

3. What did you learn from your classmate's storyboard?

• I learned from my classmate's storyboard that _____.

4. How would you explain speciation to someone who has never heard of it?

- Speciation is the process when _____. It happens when
- ° _____.

Evaluation Criteria (Rubric):

You will be graded on the following:

Criteria	Excellent (4)	Good (3)	Needs Improvement (2)	Incomplete (1)	Points Earned
Accurate Representation	All steps of speciation are accurately represented with correct terms and clear drawings.	Most steps are represented accurately but may have a few minor mistakes.	Some steps are incorrect or missing.	Steps are incomplete or unclear.	
Clarity of Explanation	All explanations are clear, correct, and easy to understand.	Most explanations are clear with a few unclear points.	Explanations are somewhat unclear or incomplete.	Explanations are unclear or missing.	
Creativity and Effort	The storyboard is very creative, well-detailed, and shows a lot of effort.	The storyboard is clear and shows some creativity.	The storyboard is basic with little detail.	The storyboard is incomplete or lacks effort.	
				Total Points	

Conclusion:

By completing this activity, you will have a better understanding of how species change and form new species over time. The **speciation** process is key to understanding how life on Earth has evolved and continues to evolve. Use your storyboard to share what you learned and to help explain speciation to others.

Instructions for Teaching the Activity:

1. Introduction (10 minutes):

- Begin by explaining the concept of **speciation** to the class. Use visual aids (diagrams or a video) to reinforce your explanation.
- Introduce the vocabulary words: Isolation, Adaptation, Genetic Variation, Natural Selection, and Reproductive Isolation. Make sure to define each term clearly and check for understanding.
- Ask students to think about animals or plants they know of that might have changed in different environments (e.g., how lizards or birds change on islands).

2. Modeling the Activity (5 minutes):

- Show a completed example of the storyboard on the board (or a printed version).
 Describe each panel, pointing out how the illustrations and explanations match the key events in speciation.
- Walk through the key terms for each step, explaining how these concepts work together over time to create new species.

3. Student Work Time (30-40 minutes):

- Distribute the storyboard templates, word bank, and colored pencils/markers.
- Allow students to begin working on their storyboards, providing support as needed.
 Encourage students to use the **word bank** and **sentence stems** to guide their written explanations.
- Walk around the room and check for understanding. Offer support to students who may need help with specific steps or drawing.

4. **Group Discussion (10-15 minutes):**

- After students have completed their storyboards, arrange them into small groups or pairs.
- Have students share their storyboards and explain the speciation process to each other.
- Encourage them to ask questions and offer feedback. Remind them that different species may have different adaptations depending on their environment.

5. **Post-Activity Reflection (10-15 minutes):**

- Have students write a short reflection based on the sentence stems provided. Ask them to consider:
 - What they learned from the activity
 - The most interesting part of the speciation process
 - How the changes in the species help them survive in their environment
- Allow students to share their reflections with the class or in small groups.

Differentiation and Modifications:

To ensure all students, including those with learning gaps, special needs, or English Language Learners (ELL), can successfully complete the activity, consider these modifications:

1. For Students with Learning Gaps or Special Education Needs:

• **Graphic Organizer:** Provide a graphic organizer with simplified definitions and more space for drawings and writing. This will help students who struggle with written language.

Name:

- Sentence Stems: Use additional sentence stems and simpler vocabulary for students who have difficulty writing or understanding the key concepts.
- **Pre-teach Key Vocabulary:** Review the vocabulary words before the activity and provide visual aids for each term. For example, use pictures of animals that demonstrate **adaptation** or **genetic variation**.
- **Peer Support:** Pair students who need extra support with a peer who can help explain concepts or guide them through the storyboard.

2. For English Language Learners (ELL):

- **Simplify Language:** Use simpler language and shorter sentences in the background information and instructions. Speak slowly and clearly, checking for understanding.
- **Provide Visuals:** Make use of charts, diagrams, or pictures that show how speciation happens. This visual support can help reinforce the concepts for ELL students.
- Word Bank and Glossary: Offer a bilingual glossary if possible. Allow students to use their native language to help understand the concepts if they are more comfortable with it.
- **Modeling and Guided Practice:** Demonstrate each step of the storyboard process with clear verbal and visual instructions. Allow ELL students to ask questions as needed.

3. For Advanced Students:

- **Expand the Project:** Ask advanced students to create a more detailed version of the storyboard, including additional information about the **genetic mechanisms** behind speciation (such as mutations or gene flow).
- **Research Option:** Allow advanced students to research a specific example of speciation (such as Darwin's finches) and include that information in their storyboard.
- **Critical Thinking Questions:** Encourage advanced students to explore how human activities (like habitat destruction or climate change) can impact the process of speciation.

4. For Visual and Kinesthetic Learners:

- **Interactive Elements:** Encourage visual and kinesthetic learners to incorporate interactive elements in their storyboard, such as movable parts (e.g., drawing species on separate pieces of paper that can be rearranged to show isolation or interaction).
- Hands-On Materials: Provide materials like colored paper or clay to represent different traits or species, allowing students to physically manipulate the components of their storyboards.

Assessment and Evaluation:

Use the rubric provided to assess each student's storyboard. Focus on the following areas:

- Accuracy: Does the storyboard correctly represent the steps of speciation, including accurate vocabulary usage?
- Creativity: Is the storyboard visually engaging and creative? Does it show effort?
- Clarity: Are the explanations clear, concise, and easy to understand?
- **Reflection:** Does the student demonstrate understanding of the speciation process in their written reflection?

Date: _____

Closing:

- **Class Discussion:** End the lesson by asking a few students to share their storyboards and reflections with the class. Highlight the diversity in their ideas and reinforce the key concepts of **speciation**.
- Homework/Extension (optional): For homework, students can research another example of speciation in nature (e.g., peppered moths, Galápagos tortoises) and write a short paragraph explaining how it relates to what they learned in class.

This structured, flexible approach ensures that all students, regardless of their learning needs, can engage with and understand the process of **speciation**.