



**EVOLUTION, NATURAL SELECTION & ADAPTATIONS** 

# Creature Feature Design Challenge

## **Summary**

In this hands-on design challenge, participants will create a unique "creature" and tell the story of how it evolved through various environmental changes including natural disasters and shifts in predator and prey populations.



#### **MATERIALS** | HERE'S WHAT YOU NEED FOR THIS ACTIVITY!

- Paper (index cards, constructions, etc.)
- Markers, crayons, colored pencils, etc.
- <u>Design Challenge Worksheets</u> (1 per participant)
- *Evolution Cards* (1 stack/animal per group)

# MATERIALS | HERE'S WHAT YOU NEED FOR THIS ACTIVITY!

- Modeling clay (playdough, clay mold, etc.)
- <u>Change in Environment Cards</u> (1 deck per group)

• VOCABULARY WORDS	
ADAPTATION	A change or the process of change by which a population becomes better suited to its environment.
TRAIT	A distinguishing quality or characteristic (this can include physical traits and behaviors)
EVOLVE	To gradually change overtime
PREDATOR	An animal that hunts other animals
PREY	An animal that is hunted by other animals
NATURAL DISASTER	A natural event such as a flood, earthquake, or hurricane that causes great disruption within an environment
INDUSTRIALIZATION	The development of manufacturing in an environment

#### **i** VOCABULARY WORDS

CLIMATE CHANGE

A change in climate patterns in an environment

## **Preparation Before the Lesson**

- 1. Copy, print & cut the *Evolution cards*. Cards should be cut and shuffled so that the animal's evolution is not in the correct order.
- 2. Copy, print & cut the <u>"Change in Environment" cards</u>. Cards should be cut and stacked like a playing deck. Each group or table should receive one facedown deck that they will draw from each round. The event description on each card will serve as a turning point in the evolution of the animal that each participant has created.

## **Delivering the Lesson**

#### **1. HOOK THE YOUTH:**

Think about how you're going to "hook" the youth, or get them excited about this activity. Can you think of a creative way to motivate youth, relate the activity to their lives, or pique their interest? If you're stuck, we've included a suggested activity below:

- Start a discussion on traits by asking participants to brainstorm some physical traits they have in common with their classmates (ex: two legs, two arms, hands with five fingers, teeth, two eyes, one nose, one mouth, etc.).
- Ask participants how those common traits might help humans survive in our current environment. Also consider asking what alternative physical traits might be useful for survival if the environment changed drastically (ex: What if the city became covered in water and we had to live underwater?)

- Ask participants to brainstorm some physical traits that vary among their classmates (ex: eye color, skin color, height, hair color, etc.)
- Ask participants where they think their traits come from? (traits are expressions of genes, which can be passed on from parents to offspring).
- Close by stating that in this activity participants will explore how species can evolve over time by expressing and passing on traits that help them survive in their environment.

#### 2. INTRODUCE THE CONTENT:

Begin by giving each group of participants one stack of Evolution cards (see above). Have the participants analyze and discuss the photos with their partner(s) and then sequence them in order from the first version of that animal up to today's version of that animal.

Have groups share out their animal, any observations they have made and how it has evolved over time. As the discussion continues, create a running list of adaptations that participants are observing or that simply come up in conversation.

Adaptations · taller/shorter · new/different fur/skin colors · new/different/additional limbs or features

To wrap up, engage participants in a discussion that highlights how some animals have experienced major evolutions over time while others have stayed relatively the same. Other discussion topics can include: common ancestors, similar traits, and similar experiences that may have caused the evolutions.

#### **POSSIBLE REFLECTION/DISCUSSION QUESTIONS:**

- How did you recognize the animal that you were given?
- What traits or characteristics describe/distinguish/characterize your animal as we know it today?
- Why did you choose the card you chose for the original version of your animal?
- What do you think happened between versions 2-3?
- Did you notice any traits that stayed with your animal throughout its evolution?
- Did you notice any traits that your animal lost while it was evolving?
- How much or how little do you think your animal has evolved? Why do you think this is?

#### **3. ISSUE THE DESIGN CHALLENGE:**

A popular board game company is prototyping a new game focusing on population evolutions on an alien planet. Players will begin with a creature and explore how its features could adapt and evolve to help them survive in their planets ever changing conditions. Can you help this company prototype this new game by designing your own creature and exploring its evolution through whatever life throws its way?

#### 4. PROVIDE TIME FOR PLANNING, BUILDING, AND TESTING:

As a group revisit the list of adaptations that you made in the first activity and engage participants in a discussion on how or why those adaptations came to be. These driving forces can be listed next to each adaptation. Tell participants that these adaptations can serve as inspiration for their creatures' evolutions.

Adaptations What could drive this? taller/shorter - Change in food source location new/different fur/skin colors
new/different/additional
new/different/additional
new/different/additional
new/different/additional
new/different/additional
new/prey

Introduce the Change in Environment cards and explain that after they create the initial version of their creature, they will be drawing one card and then determining an appropriate adaptation that could help their creature's population survive this change.

Have participants start designing their creature - at your discretion participants can draw, sculpt with modeling clay, or build with any appropriate and accessible materials. Remind participants that their creature will be evolving so they will have only 10 or so minutes to create their first version.

Participants can use the design challenge worksheet to sketch designs throughout the activity. (If participants are having a difficult time creating a creature - they can use one that they are already familiar with)

#### **POSSIBLE QUESTIONS TO ASK WHILE BUILDING:**

- What type of creature do you want to start with?
- Do you want to create a land, air or sea creature?
- How many legs do you want your creature to utilize?
- Will your creature have a tail/ears/spots/stripes/scales/fur/etc.?

Once a majority of participants have completed their initial creature, come back together and have everyone draw a Change in Environment card from their table stack. Give participants a few minutes to share their card with their group/table and allow them to brainstorm how their creature's population could adapt to survive this Change in Environment.

For the first adaptation you may want to engage participants in a whole group discussion about their change and proposed adaptation so that you can be sure that everyone understands the goal of this design project and that they are following the "rules" of the game.

When a majority of participants have decided on their adaptation they can begin drawing or sculpting their second design. (Just as a reminder participants will be making three versions of their creature: the initial version, the first adaptation, and the second adaptation).

**?** POSSIBLE QUESTIONS TO ASK WHILE REDESIGNING (ADDING ADAPTATIONS):

- How do you think this change will impact the environment that your creature's population lives in?
- What would you do if this happened to your neighborhood?

**O** POSSIBLE QUESTIONS TO ASK WHILE REDESIGNING (ADDING ADAPTATIONS):

- Do you think your creature's population has the physical capacity to survive this without adapting? Why or why not?
- What trait(s) would be advantageous for this population to survive this change?

As participants are wrapping up their second design, come back together as a group - time permitting some participants can share any troubleshooting or tips for success that they've encountered. Have participants draw a new card and repeat the process for brainstorming how their creature's population could adapt for survival. (This will be the second and final adaptation.)

#### 5. LEAD THE GROUP IN A REFLECTION ACTIVITY:

After at least 2 rounds of adaptations, have your participants organize their creatures and Change in Environment cards in one progression from beginning to end - much like a timeline. In order to tell the evolutionary story of their creature have participants create a few captions for their designs that would allow a visitor to learn about the progression of their creature.

**VISTA** can be a helpful acronym to guide this conversation and to remind participants the process by which traits become advantageous and passed on.

- **V** = Variation
- I = Inheritance
- **S** = Selection
- **T** = Time
- **A** = Adaptation



After a long period of drought, this creature's population was having difficulty moving around in it's water environment. Luckily, some of this population already had limbs so

After their primary prey moved out of its habitat, this creature's population was having difficulty find a new food source. Luckily, some of this population already



After new predators were introduced to its environment, this creature's population was in need of a defense mechanism. Luckily, some of this population already had

Participants can share with a partner, with their table or you may wish to bring everyone together for a whole group discussion. As participants are sharing, be sure to ask them about the connection between each environmental event and how the adaptation is crucial for the survival of their creature's population.

If participants are sharing with a partner or a small group - you can post the following questions on the board for easy referencing during their conversations:

- What change occurred in the environment?
- What adaptation was necessary for the survival/continuation of your creature's population?

# **Additional Background Information:**

**Evolution** is the process by which an entire population gradually adapts more advantageous and beneficial **traits** over a period of time. When the environment changes, some animals already have features that help them survive due to the population's variation - features like color, size, strength or limb characteristics. These features are already present within the population and may become newly beneficial based on a disruption that occurs for an extended period of time within their environment.

Throughout this activity, we're using the term population to reinforce the idea that it is not one individual within a generation that is evolving- It's a collective change in population over time. An individual retains its same genes throughout their life but the ratio of genes can change in a population. In other words, some organisms in the population might happen to have a beneficial trait, and they survive long enough to reproduce and pass the beneficial traits on - hence a change in the population's gene pool expressing the beneficial traits.

Some examples of a populations' evolution overtime include the evolution of butterfly and bird's wing colors to better suit their environment, Galapagos finches' beaks evolving to better suit their primary food source, and insects evolving to become resistant to the pesticides being used in their environment. Please note: Unlike the awareness of the environmental changes that participants will have within this activity - the changes in nature are not consciously part of the adaptation and evolution process.

### **Scope and Sequence Major Understandings**

Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring. (3.1f )

# **NGSS Science and Engineering Practices**

**Constructing Explanations and Designing Solutions:** Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)

# **NGSS Science Crosscutting Concepts**

**Cause and Effect:** Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-6)