



STEAM Biomimicry Workshop Lesson Plan Resource

The following includes lesson plan resources based off today's workshop activities.

Engaging Activity to Introduce the Concept of Biomimicry

(These procedures are the write up of the workshop notes for the initial activity that began the workshop.)

1. Participants/students enter the room and take a seat. There are mystery containers at each table containing 5 each of either burdock seeds or Velcro strips (2 tables will have 5 seeds, 2 tables will have 5 Velcro strips, 1 table will have a mix). Each container has a sign, or table that has a sign instructing participants not to touch or open the boxes. "No touchy!"
2. Teacher/Instructor welcomes participants and says (however you want to say this), "Welcome to your challenge. Your voices are now gone. You will see a mystery box on your table. When I give the signal, open your boxes and investigate your object. Your goal is to pair with someone who has a different object and work together to figure out the connection between your objects. You may use body language, you may draw, but you may not speak or write words or letters. Tell participants that once they think and agreed upon the solution of the connection to take a seat with their partner in the room.
3. Teacher/Instructor gives the signal and the activity begins!
4. Once most students/participants are sitting down, stop the activity. Only take about 5 minutes. Ask partner pairs to discuss with other pairs at their table what they thought the connection was/observations made, questions/ideas.
5. Ask groups to share out what they thought the connections were. Use procedures for productive group discussion.

Exploring Biomimicry Sorting Cards (Students)

(Activity to be done either as an explore leading into biomimicry, or as an activity to check for understanding after introducing biomimicry concepts. The following procedures represent steps for the latter.)

1. Tell students you have some great examples of biomimicry, inventions that humans made to solve a problem. Show the class the Biomimicry Image Sorting Cards. They will be getting these pictures and will need to match them with a nature picture that they think the invention was copied from.
2. Hold up the picture of the burdock seed. Ask the class to recall the function of the hooks. Ask them if they remember the invention that was made that mimicked or copied the seed's hooks? Velcro. Discuss the similarities of the two and show the students how these two cards would be a great match since they both have hooks and one is an



3. invention and one is from nature (reference the activity from the workshop between the connection of Velcro to Burdock seeds).
4. Tell them that there are lots of ways that humans have copied, or mimicked, nature to solve their own problems. Hold up each card and explain what is happening in the picture. Make sure students can identify the nature cards and which ones are inventions. Pass them out to the students. Ask students to try and match their cards – which pictures of nature inspired human inventions to solve problems?
5. As students are looking at the cards you can walk around and have the them think about the inventions that they thought were:
 - a. The most useful
 - b. The least useful
 - c. The most interesting
 - d. The most surprising
 - e. What problem are we trying to solve?

Also ask students about the shapes they see. Can they use shapes to help them make their matches?

Exploring Biomimicry Sorting Cards (Teachers)

(Procedures below were those written out for the purpose of the workshop sequence)

1. Make sure participants are in groups of 4-5. Pass out Nature/Invention Cards. Tell participants they will work together in teams to match the human invention with the nature that inspired it (just like the Velcro and burdock seed). Give them a few minutes to do this, walk around and check in with groups, asking what decisions/observations they are making as they sort their cards. Note if any groups mention shapes (to plug later into a debrief).
2. Ask groups to share out what their matches were and why. Note any answers that mention shapes. Go through all matches using good discussion format (how did you know? Why do you think that? Would anyone like to build on that? What do you think about so and so's idea?)
3. Finish by asking the group:
 - a. **How did you know the fish was a match for the car?**
 - b. **The bird for the train?**
 - c. **The tortoise for the helmet?**

Tell the group that objects in nature are shaped in particular ways that help them survive. These structures and shapes play key roles in engineering, and inventions to help humans solve problems and to improve quality of life. Humans have observed



those patterns in nature and we continue to notice and use those patterns everyday. Next, we're going use our observation skills to identify more shapes in nature and explore how they help humans.

Station Procedures from Workshop

1. Tell participants that they will be working in groups and rotating through 3 different stations about shapes in nature, and using multiple perspectives to observe patterns. Pass out booklets and give a quick explanation for each station:
 - a. **Nature Scene Investigators**
(Please see attached document for this activity. This activity originates from BEETLES lesson plan procedures. Please visit beetlesproject.org for more information and giving credit to the amazing educators and facilitators that create activities like this. They also have a ton of free resources and lesson plans for teachers! Check it out!)
In this station one of our presenters will be running an activity that involves making close observations, asking questions, and using the ideas of others to investigate a mysterious natural object. Use the perspectives of your peers to solve the mystery!
 - b. **Objects in nature - Microscopes & Hand lenses**
In this station participants will get to use digital microscopes to obtain a different perspective of objects from nature. While getting a closer look at the objects, participants will be encouraged to see what shapes, structures, and patterns they notice. Can you sketch or draw what you see on the screen? What structures, shapes and patterns do you see? Using hand lenses, get a close look and try and see what details you can capture by journaling in your notebook. Try a nature journaling activity such as Zoom in Zoom Out!
 - c. **Finding Shapes in Nature ART**
Participants will examine photos and paintings of nature looking for patterns and shapes. How many and what different shapes can you find in these works of art?
2. Have participants evenly split up into 3 groups, find a station, and get started. After about 5 minutes have groups stop and rotate to a new station. Repeat until each group has participated at each station.
3. Have participants return to tables for a group discussion. Show the following questions on the PowerPoint and ask participants to think pair share about some/all of the questions, then call on participants to share. Use Appropriate discussion practices and follow ups to answers. Only call on a few for time-sake.

Questions:

1. *What surprised you about your observations?*
2. *How can different perspectives change how you observe structures in nature?*



4. Now that we've seen different shapes in nature (and nature does a good job of selecting shapes for a reason!) can we select a shape from nature to help us solve a problem?

The Marker Case Challenge

(Procedures below were those written out for the purpose of the workshop sequence)

1. Tell participants that they will have a chance to design a solution to a human problem by mimicking nature and using shapes. Explain the problem to participants.
2. Have participants work in table groups (5 per group). Hand out the Biomimicry Problem/Solution Cards. Have participants reread the problem. Then read about the four examples from nature that they can use to help design a solution to the problem.
 - a. A circle or cylinder, where do we see these? TREE TRUNKS!
 - b. A hexagon? BEEHIVES!
 - c. A square? PYRITE!
 - d. Or a triangle? EVERGREEN TREES!
3. Ask participants to think pair share: "Which shapes do they think will work the best and hold the most markers? Will different shapes hold different amounts?" Direct groups to the 4 pieces of paper on their tables (or hand them out). Each group will be building a marker box with each shape and testing out how many markers each shape holds. (If time is short, give each group a different shape).
4. Direct participants to the data sheets in their notebooks. Ask them to record how many markers each shape holds, including any notes or observations of the process for each shape. For example, "What's working? What's not working?" Hand out supplies and allow groups to get started. Show participants the chart paper in the front of the room. As they collect data on the number of markers each shape holds have a group member independently keep recording those numbers on the chart paper.
5. When most groups are finished, or almost finished, bring them to attention and ask participants to look at the chart paper, now full of data. What do you notice about the results? Have a discussion about the results. Which shapes held the most, which shapes held the least, the process, thoughts, etc.
6. Ask participants to think back to the patterns in nature and common shapes they saw in the previous activity. Are there any connections you observed in nature and the shapes that held the most markers? Why do you think that is? In having this discussion, you might find it helpful to bring up the following points:



- a. Bees use hexagons to store honey because the shape lets them fit a lot of honey without using more beeswax to make the honeycomb.
 - b. Spheres & cylinders are probably the most common shape we see in nature because they can have a lot of space inside with the least amount of material (surface area) on the outside.
 - c. Squares and triangles are a lot less common. Tree trunks are not square because if they were they would be more likely to break in the wind, and triangles cannot hold as much as the other shapes.
7. Tell participants nature is great at solving problems. Designers copy this shape all the time when they want to store and build things. Participants may have noticed the cylinder held a lot of markers. Why don't we use that shape more for storage? Then ask to reflect and think pair share - How can this idea help humans?