

# Building for Birdie

Grade Levels: K-2

Duration: 60 min

During this design challenge and ELA lesson, student teams will apply knowledge of shapes to build a bird home that is structurally sound. Students will compare and contrast how their designs solve the problem.



## Outline

Frame the Challenge	15 min total
Activate Prior Knowledge	5 min
Introduce the Scenario	10 min
Design Challenge	45 min total
Introduce the Design Challenge	5 min
Prototype (Build and Test)	20 min
Share Solutions	15 min
Debrief	5 min

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### Concepts/Skills

Compare and contrast, shapes, structure, engineering design, ornithology, habitats

### Objectives

Students will:


- Design and build a home for a displaced bird.
- Identify and explain how shapes are used for stability in a structure.
- Compare and contrast bird home examples and models.



## Materials and Preparation


### Materials

Choose a couple items from each category. Don't limit yourself to the items on this list. Use whatever you have on hand.

Per class of 32		
Structural Supplies (~100 total)	Cushion/Filler items (~100 total)	Connectors (~100 total)
<input type="checkbox"/> Cardboard pieces <input type="checkbox"/> Coffee stirrers <input type="checkbox"/> Craft sticks <input type="checkbox"/> Paper towel/cardboard rolls <input type="checkbox"/> Sticks 	<input type="checkbox"/> Cotton balls <input type="checkbox"/> Fabric (small scraps, socks etc) <input type="checkbox"/> Foam pieces <input type="checkbox"/> Grass, straw, leaves, feathers, etc. 	<input type="checkbox"/> Twist ties <input type="checkbox"/> Pipe cleaners (chenille stems) <input type="checkbox"/> Rubber bands <input type="checkbox"/> String <input type="checkbox"/> Clothes pins <input type="checkbox"/> Paper fasteners <input type="checkbox"/> Hair ties <input type="checkbox"/> Other natural materials (ex. mud, clay, grass) 

 **Tip:** Try to choose materials that challenge students to be creative (ex: avoid bowls or cups).

Test Area Supplies	Tools (1 per group as age appropriate)
<input type="checkbox"/> 1 table/desk <input type="checkbox"/> Item to represent the bird: golf ball, tennis ball, small toy/figurine etc (1 per team) 	<input type="checkbox"/> Scissors <input type="checkbox"/> Hole punch <input type="checkbox"/> Tape measure or ruler <input type="checkbox"/> Tape (4-6 inches per team) 

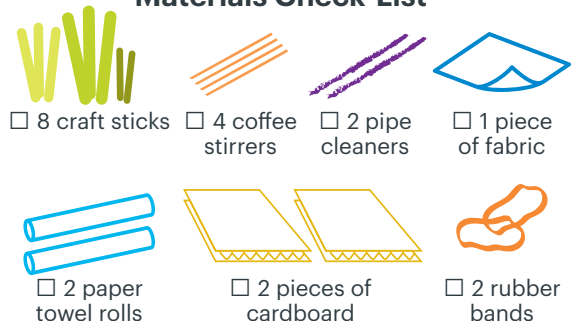
 **Tip:** Beginning engineers may benefit from the fine motor practice of using tape. However, challenge advanced engineers to build without tape as it allows for faster iteration.



### Adaptations for Beginning Engineers

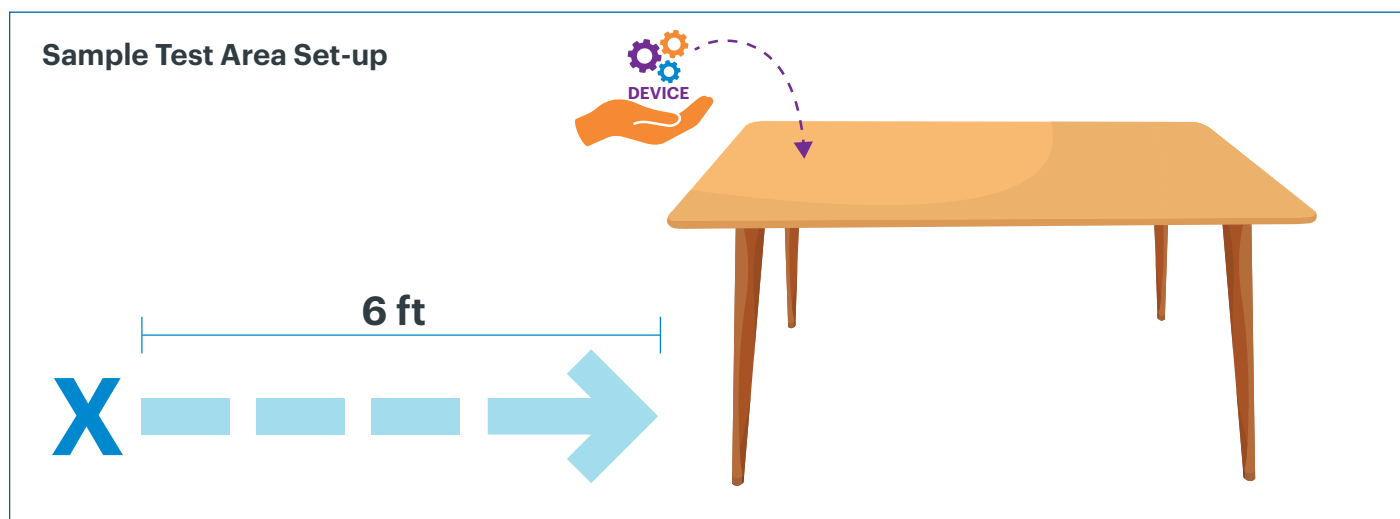
- Create and distribute kits of materials for each team.
- Create a visual check-list of the materials provided in each kit. This checklist can be used to practice vocabulary, counting, sorting and provide a tool for clean-up and recycling of materials at the end of the activity.
- Provide students with 2-3 minutes to just explore the materials before starting the build time.

### Materials Check-List



## Test Area Setup

1. Identify the area where students will need to transport their design during testing.
2. Choose a small surface (table/desk/chair) where teams will place their devices.
3. During testing, teams will carry their device approximately 6 ft to place it on this surface. Consider using tape to mark the starting point, and length of this path on the floor.
4. The testing site should be available throughout the build.
5. Each team will have their own “bird” to test with as they build.



## Lesson Preparation

1. Try the challenge yourself and/or with other educators and students. This will give you practice with the materials and testing plan and help you to anticipate student questions.
2. Collect, organize and set up materials.
3. Set up the Test Area.



### Adaptations for Distance Learning

When doing this lesson virtually, share the instructions with students and families ahead of time. Materials can be adapted to what students have around their home. For more tips on adapting Design Challenges to a virtual setting, see our [Educator Tips for Remote STEM Learning](#).



### Tech Tips

See our [educator guides and videos](#) for more design challenge facilitation techniques. For this lesson check out:

- What is Engineering?
- Materials Strategies for Engineering Design



### Frame the Activity

#### Activate Prior Knowledge (5 min)

- Lead a discussion to help students access prior knowledge about birds. For example:
  - *What kinds of homes do birds build? What are bird homes made out of?*
  - *How are bird homes like ours? How are they different?*
  - *What shapes do you notice in bird homes?*



#### Content Connections: Shapes

- If students are not familiar with 2D and 3D shapes, it may be useful to introduce these terms and definitions prior to this lesson.



#### Resources to Introduce and Frame the Challenge

- Picture books of birds and their homes:
  - “About Birds: A Guide for Children” by Cathryn Sill
  - “Mama Built a Little Nest” by Jennifer Ward (author) and Steve Jenkins (illustrator)
- Video example of building and iterating a bird home:
  - Peep and the Big Wide World, [Chirp Builds a Nest](#)
  - The first 4-5 minutes can introduce the problem of building a nest, while the remainder can be used to compare/contrast with their own designs later. In addition, have students look for examples of perseverance and collaboration.

#### Introduce the Scenario (10 min)

1. Read a book or show a video to engage students in the problem.
2. Next, explain that animals are sometimes **displaced**, or forced from their homes due to construction in growing communities. Ask:
  - *How else can animals be displaced?*
    - Responses may include: fire, flood, cutting down tree, another animal
  - *What could humans do to protect the animals living where humans want to build?*
3. Share the **design scenario/narrative** with students:

Today we will be acting as **Wildlife Veterinarians**, people who take care of wild animals when they are sick or are displaced from their home. Wildlife centers take care of animals until they are ready to be released back to the wild. We will practice engineering by designing a temporary home for a recently displaced bird. It will stay there until it is ready to be released. The home will need to be **stable**, strong and able to stand on its own. It also has to stay together even if it needs to be moved to make room for more birds.






#### Important!

Make sure students are aware that they should not move nests that they find on their own. In this challenge they are playing the role of professionals, but in their own lives, if they find a bird who has fallen out of a nest, or have a nest that is in an unsafe location, they should contact their local wildlife rescue group. See the [Wildlife Education Rehabilitation Center \(WERC\)](#) or [Humane Society](#) for more information.

## Design Challenge

### Introduce the Design Challenge (5 min)

1. Introduce the design problem, desired features and limitations.

<b>Design Problem</b>	Design and build a bird home that is strong enough to be moved.	
<b>Criteria</b>	<ul style="list-style-type: none"> <li>• Your home must stay together when it is moved.</li> <li>• Protects the bird from falling out while being moved.</li> <li>• You should be able to name/identify the shapes in your design.</li> </ul>	
<b>Constraints</b>	Time limit: 20 minutes	

2. Introduce students to the testing area. Have them consider: *The home needs to be moveable, so how will moving the home affect your design ideas?*
3. Explain the procedures students will follow for building, testing and sharing.
  - Encourage students to test throughout build time to help them iterate as they go.
4. If you have not already done so, group students into teams of 2-3.



### Adaptations for Advanced Engineers

- Have them research a specific bird and build or modify their nest to meet its needs (ex: wingspan, size, weather, location, building materials). When testing, students should use a test "bird" that is appropriately sized. During share outs they should use evidence from their research to justify the features they included in their design.
- Students can research local birds or compare and contrast birds from around the world.
- If available, students can even monitor an existing bird nest and record their data using a tool like [Nest Watch](#). Nest Watch is also an excellent resource for specifics on bird homes and habits and data collected by other citizen scientists.



## Prototype (Build and Test) (20 min)

1. Before beginning prototyping, make sure students understand how to test their homes.
2. Distribute materials kits to students.
3. Set a timer to track the time limit.
  - Give students occasional reminders on time and desired features to help them monitor their own progress.
4. During the prototyping time, walk around and support teams.
  - Help students focus on the process, rather than on the success of their designs. If their design fails, ask them how many things they have tried, what they notice about what isn't working and what they might try next.
5. Ask open-ended questions to encourage students to reflect on their process.

### Prototype Questions:

- How does your design solve the problem?
  - What parts of your design help the home to be strong and stable?
  - What do you think will happen when you test?
6. Encourage teams to test while they build.
  7. Encourage them to collaborate with each other.
  8. If teams feel like they are "done" use the [Challenge Cards](#) in the Appendix to keep them engaged.



## Share Solutions (15 min)




1. At the end of the time limit, learners stop building even if they haven't been able to complete a design.
2. Make sure all of the teams can see the testing area, taking turns testing/demonstrating their device before sharing their process.
3. Keep sharing simple and focused on what they did and why.

### Sharing Questions/Prompts:

- Tell us about your design.
  - Explain how the shapes in your design make it successful.
  - What changes would you make to your design based on your testing? What would you change if you had more time?
  - What inspired your design?
4. Encourage students to give each other positive feedback on their designs.
    - Select an observing team to tell the presenting team one thing they liked or noticed about the design.
    - They can use a simple sentence frame:
      - I liked that the design\_\_\_\_\_.
      - I wonder what would happen if\_\_\_\_\_.

## Class Data Chart

*Optional:* Use a Data Chart like this example to track each team's test results. After teams share, compare and contrast the results, focusing on the shapes used, and their stability rather than the success of each team's solutions.

Class Testing Data	
Group name	Puffin Rockstars
Shapes in design	
Did the home stay together?	
Did the bird fall out?	



## Content Connections: Compare and contrast with real bird homes

After students have built their designs, have them compare what they have built with real bird homes. Use some of the following resources to support this reflection.

- Refer back to any images OR photos, videos and books used to introduce the challenge.
- Use the [Bird Homes Student Handout](#): See this resource in the Appendix for some examples of bird homes.

### The Language of Compare and Contrast

Use sentence frames to help students compare and contrast their bird homes throughout the lesson. For example:

#### • Compare:

- Both \_\_\_\_\_ and \_\_\_\_\_ have \_\_\_\_\_.
- \_\_\_\_\_ are similar/alike because they both \_\_\_\_\_.

#### • Contrast

- \_\_\_\_\_ has/is \_\_\_\_\_, but \_\_\_\_\_/is \_\_\_\_\_.
- \_\_\_\_\_ and \_\_\_\_\_ are different because \_\_\_\_\_.



## Debrief (5 min)

1. After students share their solutions, bring the conversation back to the engineering concepts and what they learned.
2. Lead a short discussion with some of these **Debrief Questions**:
  - *How were our designs similar? How were they different from each other?*
  - *What shapes are the same in many designs? Are there any shapes that no one used in their design?*
  - *How would our designs help keep real birds safe?*
  - *How do our designs compare to/contrast from real bird homes?*



## Wind Iteration Extension

Iteration is an important part of the design process. With additional time, challenge students to build and test a home with a new desired feature: They must make it stable against the wind.

For more details on this extension as well as assessment tools, see the [Building for Birdie Unit Plan](#).

### Next Generation Science Standards

Grades	Standard	Description	
K-2	Performance Expectation	ETS1-2	<b>Engineering Design:</b> Develop a simple sketch drawing, or physical design to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2	Disciplinary Core Idea	DCI: ETS1.B	<b>Developing Possible Solutions:</b> Designs can be conveyed through sketches, drawings, or physical designs. These representations are useful in communicating ideas for a problem's solutions to other people.
K-2	Science and Engineering Practice	SEP	<b>Developing and Using Models:</b> Develop a simple design based on evidence to represent a proposed object or tool.
K-2	Cross Cutting Concept	CCC6	<b>Structure and Function:</b> The shape and stability of structures of natural and designed objects are related to their function(s).

### Common Core State Standards

Grade	Standard	Description
1	RL1.9	Compare and contrast the experiences and adventures of characters.

### Vocabulary

For more tips on vocabulary and common engineering terms, see our [Tech Tip: The Language of Engineering](#).

- **Displace:** To force out of a home territory or particular place.
- **Iteration:** Remaking the object many times in different ways or remaking with a new part.
- **Rehabilitation:** To restore to good health.
- **Stable:** An object is stable when it can stand on its own and not be easily pushed over or fall apart.
- **Wildlife Center:** A place where sick, injured or orphaned wild animals are cared for before they are released back into the wild.
- **Wildlife veterinarian:** Someone who takes care of sick or injured wild animals.

### Resources and References

1. [Educator Tips for Remote STEM Learning](#), The Tech Interactive
2. "About Birds: A Guide for Children" by Cathryn Sill (author) and John Sills (illustrator), 2013
3. "Mama Built a Little Nest" by Jennifer Ward (author) and Steve Jenkins (illustrator), 2014
4. Video: [Peep and the Big Wide World ep.17: chirp-builds-a-nest/](#)
5. [Wildlife Education Rehabilitation Center \(WERC\)](#)
6. [Humane Society](#)
7. Nest Watch: <https://nestwatch.org/>
8. Cornell Lab of Ornithology: <https://www.birds.cornell.edu/home>

### Student Handouts

Title	Page
<a href="#">Bird Homes</a>	9
<a href="#">Building with Birdie Challenge Cards</a>	10





# Building for Birdie Bird Homes

**Gila Woodpecker Nest**



**Bowerbird Home**



**Cliff Swallow Home**



**Bald Eagle Home**



**Baya Weaver Home**



**Sociable Weaver Home**



**Asian Paradise-flycatcher Home**



**Puffin Home**



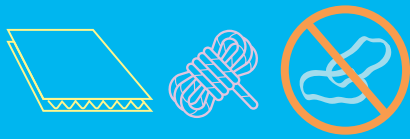
**Baya Weaver Home**



# Building for Birdie Challenge Cards

## Fewer Materials

Can you build your bird home with fewer materials?



## Many Moves

Your bird home needs to move at least 5 times! Will it stay together?



## Big Bird

Your bird has grown! Change your design for a bird that is larger.



## Clean Up

Sometimes baby birds make a mess. Change your design to be easily cleaned.



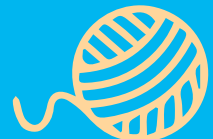
## Peek-a-Boo

Make sure that the bird can be seen inside from across the room.



## Bored Bird

Add something fun to your nest that the bird might play with or enjoy.



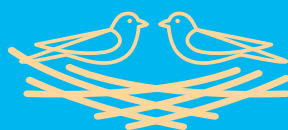
## Rainy Day

Your bird home is being moved outside. Protect it from getting wet in the rain.



## Two Birds

The wildlife veterinarian has more birds. Change your design to hold two birds.



## Teacher's Choice

