

Modeling Flower Pollination or Seed Dispersal by Animals

Second Grade Guam STEM Design Challenge

Anchor Question: How can you create models to teach others about how an animal helps a plant disperse seeds or how an animal pollinates island flowers?

Overview

Guam Connection

Some native plants on Guam rely on specific animals to help with flower pollination and/or seed dispersal. However, many pollinators and seed eaters no longer exist on the island, and some plant populations are decreasing.

Engineering Design Challenge

Create a model (physical or picture) that mimics how pollination or seed dispersal by animals happens on Guam. Choose between a model of the flower and structure of the animal that helps pollinate the flower OR a model of the seed and how the animals disperse it. Examples: Pollinators could be butterflies or moths. Several seed dispersers could be seed-eating birds (very few left).

NGSS Performance Expectation

2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

STEM Concepts (NGSS Disciplinary Core Ideas)

LS2.A: Interdependent relationships in ecosystems. Some plants depend on animals for pollination or to move their seeds around.

LS4.D: Biodiversity and Humans. There are many different kinds of living things in any area, and they exist in different places on land and in water.

Time: Estimated Number of Classes

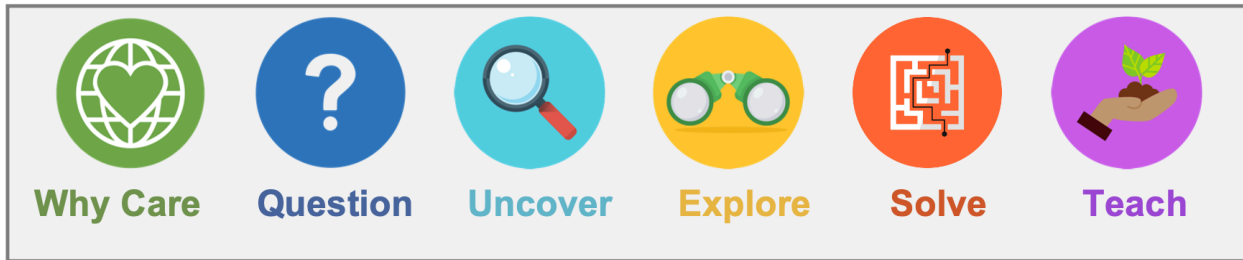
3-5 classes (45-minute class)

Materials for the Design Challenge

Depending on which design you choose, seeds, twist ties, paper clips, paper or cardstock, craft sticks, pipe cleaners, cotton balls, rubber bands, toothpicks, string, glue, masking tape /duct tape, basin / water, a colored powder (powdered mac-cheese, drink or jello).

[Seed Dispersal Action Cards Handout](#), Seed-Go Handout, Collect seeds or flowers that have fallen from plants

The Q-U-E-S-T Experience



Why Care?

What is the problem, anchor question, and design challenge? How is this relevant and interesting to us and where we live?

Question

Begin by asking QUESTIONS about the problem and ways to solve it. Figure out what you already know, and brainstorm what you could do.

Uncover

Learn the science ideas needed to understand the problem and design a project to solve the problem.

Explore

Apply what you've learned in Uncover to EXPLORE the problem in your community and consider project ideas to solve the problem.

Solve

Use the engineering design process to design and do a project that helps SOLVE the problem.

Teach

Share your project with others to help others understand the problem and how your project helped solve it.



Why Care?

What is the problem, anchor question, and design challenge? How is this relevant and interesting to us and where we live?

Introduce the Quest

1. **Post and read the anchor question:** How can we teach others about how an animal helps a plant disperse seeds or pollinates a flower by using a model we create?
2. **Read, describe, and post the design challenge:** Create a model (physical or picture) that mimics how pollination or seed dispersal by animals happens on Guam. You can do one or both: A model of the flower and structure of the animal that helps pollinate the flower, and/or a model of the seed and how the animals disperse it. Examples: Pollinators could be butterflies or moths. Several seed dispersers could be a seed-eating bird or non-native rats.
3. **Share and talk about the Driving Question for why we should care:** Why should I care about how our native animals help disperse seeds and pollinate flowers? How do these animals affect my island, my community, my family, and/or me? What is the role of invasive species and how do these animals affect the pollination and seed dispersal around Guam?

4. **Guam connection:** Discuss with students that some native plants on Guam rely on specific animals to help with pollination and/or seed dispersal. However, many pollinators and seed eaters no longer exist on the island, and some plant populations are decreasing. What can be done to reverse this situation?
5. **Do this:**
 - a. Video for kids: [Flowers and their pollinators](#), Sci Show for Kids, and/or [Pollinators for kids, Ranger Zak](#)
 - b. Ask: What animal pollinators and seed eaters do we have on Guam? Butterflies, bees, birds. What happens if pollinators and seed dispersers disappear?
 - c. Video: [Nihi! Native bird songs](#) (song of native bird names) Video: [Ko'ko' bird near extinct](#)
 - d. [Nihi Kids! channel](#) with other videos: Nihi! amplifies indigenous voices, knowledge, issues and stories in Guåhan (Guam), the Marianas and across Micronesia — to affirm identity; to inspire a deep love for our land, ocean and communities; and to equip the next generation of protectors.
 - e. Article: [Birds key to reproduction, survival of Guam trees](#)
 - f. Write or draw your “why I care” and why others on Guam care, before and after learning about the loss of pollinators and seed dispersers on Guam.

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Write or draw your “why I care” and why others on Guam care.



Question

Begin by asking QUESTIONS about the problem and ways to solve it. Figure out what you already know, and brainstorm what you could do.

Ask Questions

1. **Create a KND Chart (Know, Need to know, Do)** with the three driving questions below. Save the questions and responses to look at during the QUEST; writing them on chart paper, butcher paper, in student design notebooks, or use a digital organization chart, like Jamboard. KND Questions:
 - a. What do we KNOW already about seeds, pollination, flowers, and dispersal of seeds by animals?
 - b. What do we NEED TO KNOW to design a model of a seed that is pollinated or dispersed by an animal? Here are a few examples of questions students might ask:
 - i. How do seeds spread if humans don't touch them or the wind is not involved?
 - ii. What animals can pollinate flowers around Guam (or have in the past)?
 - iii. Which flowering plants do these animals pollinate? Are these plants our vegetables, fruits, trees, flowers we wear or decorate with?
 - iv. What animals disperse seeds around Guam (or have in the past)?
 - v. How are seeds alike and different?
 - vi. What body structures on animals help them disperse seeds? What behaviors help?
 - vii. How do seeds get dispersed from their parent plant by animals on Guam?
 - c. What could we DO to learn about how animals help disperse seeds or pollinate flowers? How could we create a model that shows this relationship?

2. **Gather responses from students.** Have students think and write responses: 1. First, silently and individually, 2. Then, in small groups, 3. And finally, with the full class. The end result is a class KND chart to refer to, add to, and reorganize throughout the QUEST. Students could sort the responses that are similar. This information will help guide the UNCOVER and EXPLORE.

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Write KND lists. Organize the questions (Need to Know) from class. Record the categories, or themes, of the questions and ones you are most interested in.



Uncover

Learn the science ideas needed to understand the problem and design a project to solve the problem.

Uncover Key Ideas

1. **Driving Question:** (Share with students) How are seeds the same and different? Where do seeds come from and what is their purpose? Then do this:
 - a. Read aloud video book: [A Fruit is a Suitcase for Seeds](#)
 - b. Students watch a video and listen to a read aloud to see how seeds get dispersed.
 - i. [Seed Dispersal for Kids](#) video
 - ii. [Seeds move! - a read out loud story book](#)
 - c. SciShow video: [How do plant seeds travel](#)
 - d. Fun Science Demos video: [Seeds and the life cycle of plants](#)
 - e. Lesson plan: [Plant life cycles](#) (PBS Learning Media)
2. **Driving Question:** (Give to students) How and why are plant seeds dispersed by animals? What structures are available that would allow my seed to be carried by an animal? What fruits are available that would allow my seed to be eaten by an animal?
 - a. Collect a bag or box of seeds. Have students organize the seeds by the different methods of dispersal. You can also have them do math (measure, weigh, describe shapes)
 - b. How do you think seeds are dispersed from the parent plant? Create a labeled picture of how different seeds are dispersed.
3. **Driving Question:** (Give to students) What's a pollinator? How and why are flowers pollinated by animals? What animals eat pollen or nectar that result in flower pollination?
 - a. Lesson plan: [Flowers seeking pollinators](#)
 - b. Beekeeping recently began on island to help with pollination. Video: [What the buzz is all about – beekeeping on Guam is a thing](#), 2021, KUAM News. Search internet “beekeeping around Guam” for many other videos about the start-up of beekeeping on island.
 - c. [Teach Engineering: To Pollinate or Not to Pollinate](#)
 - d. [Pollinator QUEST](#) (Captain Planet Foundation)
 - i. [What's a pollinator?](#) Page
 - ii. [How do animals pollinate?](#) Page

4. **Driving Question:** What happens on Guam when we don't have animals to help disperse seeds or pollinate flowers?
 - a. [Why are pollinators important?](#) (Page from Pollinator QUEST)
 - b. Guam has lost many of our native bird and insect pollinators. Why is this a problem we should try to solve? For more information, go to [Guide to Habitat Planting for Pollinators in the Pacific Islands Area](#)

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Write the driving question and summarize what you did and learned. (blank page)

Students will understand these NGSS Disciplinary Core Ideas:

LS2.A: Interdependent Relationships in Ecosystems. Plants depend on animals for pollination or to move their seeds around.

LS4.D: Biodiversity and Humans. There are many different kinds of living things in any area, and they exist in different places on land and in water.



Explore

Apply what you've learned in Uncover to EXPLORE the problem in your community and consider project ideas to solve the problem.

Apply Your Learning

1. **Share the Driving Question with students:** How can we apply what we learned in UNCOVER to understand how animals disperse seeds and pollinate flowers on Guam, and then decide how to create a model?
2. **Revisit the KND lists** you wrote at the beginning of your Quest. Add and edit them to include new understandings and experiences from UNCOVER.
 - a. KNOW - What have you confirmed as accurate? Correct any inaccurate information.
 - b. NEED to know - Mark any questions that you have answered, and ones you still need and want to answer. Add new questions.
 - c. DO - Add any new project ideas you could do to help solve the problem. What animals living on Guam, other islands, or places near Guam, help disperse seeds or pollinate flowers? Why are there so few animal pollinators and seed dispersers left living around Guam?
3. **Return to the anchor question:** How can we teach others about how an animal helps a plant disperse seeds or pollinates a flower by using a model we create? Do you want to focus on pollinators, seed dispersers, or both?
 - a. Choose a plant (on Guam) that is pollinated or whose seeds are dispersed by animals.
 - b. What seeds can we gather from the island? What do we know about these seeds? Which seeds would we like to create models of? What do we need to know about them?
 - c. Choose a Guam or Pacific island animal that helps a native plant on Guam.
4. **Read and talk about the design challenge:** Create a model (physical or picture) that mimics how pollination or seed dispersal by animals happens on Guam. You can do one or both: A model of the

flower and structure of the animal that helps pollinate the flower, and a model of the seed and how the animals disperse it. Examples: Pollinators could be butterflies or moths. Several seed dispersers could be a seed-eating bird or non-native rats.

- a. Seed dispersal model ideas:
 - i. [Seed-Dispersal Action Cards](#), [Seed-Go Card](#) - select card and create model
 - ii. Another [Plant Seed Design Challenge](#), Science Buddies. (modify from grade 6-8)
 - b. Pollinator model ideas to spark student creativity:
 - i. [Pollination STEM activity](#), Around the Kampfire, (craft sticks mac & cheese or other powder)
 - ii. [Create a Model of Pollination](#), hand2mind.
 - iii. [Models of pollination](#) (video instructions), Nagwa
 - iv. Pollinator simulation: [How many pollinators do you see outside?](#), U of California
5. **Choose materials to use** to create your pollinator model and your seed dispersal model.

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- Design Challenge Map- Complete as much as you can. Then add to and edit it throughout SOLVE.
- Design Requirements and Limitations (criteria and constraints)



Solve

Use the engineering design process to design and do a project that helps SOLVE the problem.

Design & Do Your Project!

1. **Driving Question:** (Share with students.) How can I design and test models illustrating how an animal disperses seeds or pollinates a flower to see which model works the best?
2. **Do this:**
 - a. Students build and test their models. Follow these [Engineering design process \(poster\)](#) steps to determine the most effective design to solve the problem.
 - i. Decide what you want you want your model to do and to look like.
 - ii. Get the materials you need to build your model.
 - iii. Build your models.
 - iv. Test your model to see if it works to demonstrate how an animal disperses seeds or pollinates flowers.
 - v. How well did it work and what could you do to make it work better?
 - b. Students can revise their model based on their test(s) and their answer to the questions about their model.
 - i. What worked well to show how animals disperse seeds or pollinate flowers?
 - ii. What did not work well? Why do I think it did not work well?
 - iii. How could I improve my models?

- c. Students modify their model or make a new model. Then they test their model and compare how well it worked compared to their first model. Encourage students to make 2-3 different models and be able to explain why one model works better than another.

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- Edit and complete the Design Challenge Map.
- Edit and complete the Design Requirements and Limitations (criteria and constraints)
- Action Plan: List steps to complete the project, and who will do what.
- Team Self-Review: Review your project design to make sure it is focused on the design challenge, anchor question, and Guam.
- Gathering Feedback from Others: Get input from others to help strengthen your project.
- Claim-Evidence-Reasoning (CER): Give evidence for the most effective project design.

Students will understand these NGSS Disciplinary Core Ideas:

ETS1.B: Developing Possible Solutions. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.



Teach

Share your project with others to help others understand the problem and how your project helped solve it.

Share & Reflect on What You Learned

1. **Return to the anchor question:** How can we teach others about how an animal helps a plant disperse seeds or pollinates a flower by using the model we create?
2. **Do this first:**
 - a. Prepare a creative way to share your project and how it helped solve the problem.
 - b. Build your presentation around the anchor question. How can we teach others about how an animal helps a plant disperse seeds or pollinates a native island flower by using a model we create?
 - c. Who's your audience? Who will benefit from hearing about and seeing your project?
 - d. How will you share this information?
 - e. What do you want them to know and understand about the problem and your solution?
 - f. When and where will you share?
3. **Students will** use their models to teach others about how some of Guam's flowers are pollinated or seeds are dispersed. They can also teach about seeds, pollinators and flowers.
 - a. Who will you teach?
 - b. What will you say as you demonstrate with your model?
 - i. Why do plants need seeds dispersed or flowers pollinated?
 - ii. How do animals help plants survive?
 - iii. What are seeds, pollinators, pollination, and/or flowers?

- iv. What happens on Guam when we don't have the necessary animals to help disperse seeds or pollinate flowers? (optional)
4. **Student reflection:** Students can reflect on their experience with this design challenge while preparing their presentation or afterwards. Here is one reflection idea: 4-3-2-1: Looking back, planning forward. Respond to:
- a. FOUR of the most important things I learned doing this design challenge.
 - b. THREE of the most important things I learned about myself doing this design challenge.
 - c. TWO things I will do differently in my next problem-solving experience.
 - d. ONE thing I now want to learn more about.

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- TEACH. Make a plan for sharing your project with others.
- Looking back, planning forward. Reflect on what you did and what you might do next time.



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