Lesson: “Why do seeds have so many different shapes?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther from the Mystery Science team. I want to show you this plant. It has these curvy green pods, which look kind of like chili peppers. But watch what happens when you touch one. It's like a mini explosion. Even a gentle tap can make a pod pop. It happens so fast. Let's slow it down and get a better look. Ready? The green pod splits open and curls up. And see those round things that burst out? Those are the plant's seeds. They go flying in all directions. Now, exploding is a pretty unusual way for seeds to move. Just think, if seeds came exploding out when you tapped a watermelon or an apple, the grocery store would be a messy place. But many other seeds move, too. They just have other ways of getting around. Maybe you've even seen some before, like these. Have you ever watched seeds drift away from a dandelion plant? They're definitely on the move. Or maybe you've watched seeds twirling down from a maple tree. They're on the move too. Or imagine you're at the beach and see this round thing bobbing on the waves. That's a coconut. It's a seed from a palm tree, and it's on the move too. All of these seeds are on the move. That's something they have in common, but I'm guessing you can notice lots of things that make them different. How are these seeds different from each other?

EXPLORATION VIDEO 2

These seeds are all different shapes and sizes. Take those dandelion seeds. They're so tiny compared to a big coconut, Maybe you also notice some of the unique parts that go with these seeds. For instance, each dandelion seed is attached to a fluffy tuft that's shaped a bit like a parachute. It catches the wind to help the seed drift away. That tuft has a totally different shape from this pod. It has pieces that can burst apart. That popping pod gives the seeds inside the push they need to get moving. And that big coconut? You're looking at a thick husk outside that keeps salty ocean water from reaching the seed on the inside. Different plants have their own unique parts with unique shapes. You can call this the plant's structure. Fluffy tufts, exploding pods, and waterproof husks are all special structures that help seeds move. And seeds that move in other ways have their own unique structures. For example, see that spiky pom-pom-shaped thing on this plant? They have seeds inside. These structures have seeds inside too. At first, they look a bit like tiny pea pods. But up close, check out all those fuzzy prickles. Other seeds are surrounded by structures with sharp spikes and curved hooks. These structures are all different, but you may notice some things that they have in common. And it turns out all of these structures help these seeds move in a similar way. But how do they move? Maybe the structures can give us a clue. Take a closer look at their shapes. I'm curious if they remind you of any objects you use.

EXPLORATION VIDEO 3

I'm not sure how you answered, but something I noticed was that all these structures have parts that look prickly and poke out. The shape of this one with two big spikes sticking out really reminds me of a fork. Think about how you use the spikes on a fork. They can poke into a piece

of food and grip onto it so you lift it to your mouth. The fuzziness of this one makes me think of Velcro. You've probably seen how well the fuzzy, prickly parts of Velcro can stick together, like holding the strap of a shoe in place, or playing catch with a Velcro mitt. Maybe you thought of other spiky or fuzzy things you use. Like a spiky pin that can poke through fabric to hold a button on your backpack. It seems like these spiky, fuzzy structures are really good at helping us poke, grip, and hold things in place. So what about these spiky, fuzzy structures? Could they also be good at gripping onto things? Well, check out this bison. See those brown specks on his fur? Those are spiky seeds. They're even dangling from his fluffy beard. This fox is trying to nibble fuzzy seeds off her leg, and this sheep's wool is polka-dotted with seeds. It seems like those spiky, fuzzy structures are really good at gripping onto things. But wait. This tortoise and this toad are hanging out in the same field as the sheep. Even though there are lots of plants with spiky, fuzzy seeds around them, they are seed-free. Nothing is sticking to them. Why might that be? Do you notice anything about the tortoise and the toad that's different from these other animals? Why might spiky, fuzzy seeds stick to some animals and not others?

EXPLORATION VIDEO 4

Maybe you noticed that all these animals have fur, but the tortoise and the toad don't. The tortoise’s hard shell and the toad's bumpy skin are really different from the fluffy bison or the curly sheep. So what is it about fur that makes spiky seeds stick to it? What might be going on here? Having seeds stuck in your fur looks pretty annoying for an animal, but maybe it helps the seeds. You saw before that many seeds have structures that help them move. If spiky, fuzzy structures are good at gripping onto fur, could that help these seeds move? Like when this bison goes off to graze, maybe those seeds will go with him. Maybe a spiky seed can stay stuck long enough to take a ride on an animal. Let's say we want to test out this idea that spiky, fuzzy

seeds stick to fur and then travel. We just need a bison in our classroom, right? Okay, maybe not. Instead, we can use a model. Models are what scientists use to study things that might be hard to get their hands on, like a bison in your classroom. A model isn't the real thing, but it has similarities. So if we want to make a model of a furry animal, we'll need a material that's similar to fur. We could try things like shredded paper or cotton balls or crumpled-up foil. Each of these materials has a different structure. We could see which one the seeds stick to. Then we could test how far a seed can actually travel that way. I'm curious which material you think is the most similar to fur. Which material would you choose as a model for an animal's fur?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you and a partner are going to use models to explore how far different types of seeds move with the help of an animal. We know that seeds have different structures that help them move in the wind and on the water, but do they really have structures that would help them move around on animals too? That's what you'll be testing today. First, you'll make a model of an animal with thick fur. There are many materials you could use for a model, but today we're going to use cotton balls to make a fluffy creature. We'll call it a fluffadoo. Then you'll get two different seed models, Seed A and Seed B. You'll test those seeds to see how far they travel on your fluffadoo fur. Can a seed really travel this way? Does one type of seed travel further than the other? There's only one way to find out: through testing. We'll get you started, step by step.

ACTIVITY STEP 1

Get your supplies for the activity. You'll get more later.

ACTIVITY STEP 2

First, you're going to build your own fluffadoo. Pay close attention and watch this whole step before trying it yourself. Here's what a fluffadoo's fur looks like. It's got six cotton balls on its back, all right next to each other. To put on the fur, first hold your cup on its side with your fingers inside, like this—keep your plate under your cup, this next part might get a little messy. Then, with your other hand, squeeze a few lines of glue on the top of your cup, like this. Five or six should be enough. You want to try and get most of the top of your cup covered. When you're done with that, keep your hand inside your cup so it doesn't roll over. Use your other hand to press six cotton balls onto the glue. Make sure the cotton balls are touching, like this. Now it's your turn. Hold your cup on its side. Squeeze your glue on and add your cotton balls.

ACTIVITY STEP 3

Once all of your cotton balls are on, gently press them together, like this. Try your best to make the cotton balls touch with no gaps so that it looks like an animal's fur. When you're done, you should have something that looks like this.

ACTIVITY STEP 4

Your fluffadoo needs one final touch: a face. Draw your fluffadoo’s face here. It can be a smiley face, an excited face, a goofy face, or whatever you want. I'll set a timer for one minute in case that's helpful. Time's up. Click the arrow to move on.

ACTIVITY STEP 5

Let's learn how to move like a fluffadoo. Fluffadoo's move by gently hopping. When you test your seeds, you'll want to move just like they do. But you'll be hopping in place. First, stand and hold your fluffadoo in front of you with both hands so that its face is pointing forward, like this. Fluffidoos are graceful animals, so you want to be graceful too. When you hop in place, try to keep your elbows by your side and hold your fluffadoo steady, like this. This is how you want to hop with your fluffadoo every time. Now it's your turn. Practice moving like a fluffadoo. Once you feel like you've got the hang of it, click the arrow to move on.

ACTIVITY STEP 6

You'll work with a partner for this next part. Choose who will be Hopper and who will be Counter. Don't worry, both partners will have a chance to do both jobs.

ACTIVITY STEP 7

Get your supplies. This is the first seed model you'll test with your fluffadoo. We'll call it Seed A. Discuss with your partner: What do you notice about Seed A? How does it look and feel?

ACTIVITY STEP 8

Now it's time to test your fluffadoo and Seed A. Watch this whole step before trying it yourself. Imagine your fluffadoo brushes up against the plant and Seed A ends up on its fur.
Hopper: Pick up your fluffadoo and put your seed in between where the cotton balls touch, like this. Then hold your fluffadoo in front of you with both hands and tuck your elbows by your side. Don't start hopping yet, though. Counter: Your job is to count how many hops it takes for the

seed to fall off of your partner's fluffadoo. If the seed is still on the fluffadoo after fifteen hops, you can stop counting. And Hopper can stop hopping. Then take the seed off of your fluffadoo. Get ready to do your first test now. Counter: make sure to remember that number—you'll need it in the next step. When you're done, click the arrow to move on.

ACTIVITY STEP 9

You can imagine that each hop you counted in your test is another big leap your fluffadoo made away from the plant it came from. If your seed stayed on for only one hop, that means that it fell off right next to the plant. If your seed stayed on for fifteen hops, that means it traveled really far away from the plant. Counter: Tell your partner how many hops it took for the seed to fall off of their fluffadoo. Hopper: Look at the section for Seed A on your worksheet. Find the row that says Test 1. Then circle the number of hops it took for the seed to fall off of your fluffadoo. For example, I counted that the seed stayed on my partner's fluffadoo for ten hops. So they're going to circle ten here on their worksheet.

ACTIVITY STEP 10

You're going to switch jobs and do the same test again. Hopper, you're now going to be Counter. Counter, you're now Hopper. Counter, remember to count the number of hops it takes for the seed to fall off of your partner's fluffadoo. Hopper: Remember to circle that number in the Test 1 section for Seed A on your worksheet. I'll set a timer for two minutes if that's helpful. Time's up. Click the arrow to move on.

ACTIVITY STEP 11

Now do the rest of your Seed A test. After each test, switch jobs. Remember to circle how many hops your seeds stayed on your fluffadoo for after each test. When you're done, each partner should have results for 3 Seed A tests on their worksheet. I'll set a time for five minutes in case that's helpful. Time's up, click the arrow to move on.

ACTIVITY STEP 12

Discuss as a class. How many hops did it take for Seed A to fall off of your fluffadoo? What was the lowest number of hops? What was the highest number of hops?

ACTIVITY STEP 13

Here's what we noticed. When we looked back at both of our worksheets, we noticed that our seeds only fell off near the plant a few times. The fewest number of hops Seed A stayed on our fluffadoo for was three hops. But usually, we noticed that our seed stayed on our fluffadoo for a lot longer. The highest number of hops Seed A stayed on our fluffadoo for was fifteen hops before we stopped the test. If we kept hopping until our seed fell off on its own, it would have traveled even further away. You probably got different numbers on your test than we did, and that's okay. You still might have noticed the same pattern we did. Overall, we found that Seed A traveled pretty far from the plant it came from with the help of a fluffadoo. As you've seen, though, not all seeds have the same structure. Will a different type of seed travel as far on a fluffadoo as Seed A did? Let's find out. Click the arrow to move on.

ACTIVITY STEP 14

Get the rest of your supplies. This is your second seed model. We'll call it Seed B. Discuss with your partner, What do you notice about Seed B? How does it look and feel compared to Seed A?

ACTIVITY STEP 15

Now you're going to test how far Seed B can travel on your fluffadoo. Let's do the first test together. You'll test Seed B just like you tested Seed A. Hopper: You'll put Seed B in between where the cotton balls touch on your fluffadoo, like this. Then hop in place. Counter: You'll count how many hops it takes for Seed B to fall off of your partner's fluffadoo. Hopper: Circle that number in the Test 1 space for Seed B. I'll set a timer for one minute in case that's helpful. Time's up. Click the arrow to move on.

ACTIVITY STEP 16

Now do the rest of your Seed B tests. After each test, switch jobs. Remember to circle how many hops your seed stayed on your fluffadoo for after each test. When you're done, each partner should have results for 3 Seed B tests on their worksheet. I'll set a timer for five minutes in case that's helpful. Time's up, click the arrow to move on.

ACTIVITY STEP 17

Discuss with the class. How many hops did it take for Seed B to fall off of your fluffadoo? What was the lowest number of hops? What was the highest number of hops?

ACTIVITY STEP 18

Discuss with the class. Did Seed A or Seed B travel farther on your fluffadoo? Why do you think that happened? After you discuss, watch the next video, but don't put your fluffadoos away just yet. You'll need them again soon.

WRAP-UP VIDEO 1

In our tests, Seed A usually stayed stuck for more hops than Seed B did. It looks like Seed A could have traveled pretty far on a fluffadoo. So why did Seed A stay stuck for so much longer? We think it had to do with differences in the two seed models. Seed A has fuzz sticking out all over, while Seed B is smooth. We noticed that Seed A's fuzz was really good at sticking to the fluffy cotton of our fluffadoo’s fur. Sometimes, strands of cotton were still tangled in its fuzz even after Seed A came off. It seems like Seed A stayed on for as long as it did because its fuzz and the cotton fluff were so good at gripping onto each other. Because Seed B was smooth, it didn't have anything to grip onto the cotton fluff, and it quickly slipped off. Seed A is a lot like these real seeds that are surrounded by fuzzy, spiky parts. We saw earlier that plants have their own unique parts with unique shapes, things we call structures. Animals also have unique parts with unique shapes. They have structures too, like fur. Fur’s structure is made up of lots of soft, flexible hairs. When a furry animal brushes up against a seed's spiky, fuzzy structure, some of those hairs get tangled around the spikes. Then, when the animal travels on, the seed moves with it. Of course, the fluffy thread of a sock can also work. After a hike, I always check if any spiky seeds are traveling on me. Maybe that's happened to you too. Now what about our other seed model? We just saw that Seed B doesn't travel very far on fur. But here's a surprise. This model is similar to real seeds that also move with the help of animals. They just don't travel on

fur. I wonder if you can come up with some other ways that animals can help seeds move. In a moment, you'll get to experiment with your fluffadoo again. Instead of traveling on its fur, what other ways could your fluffadoo help Seed B move? I'm curious what you come up with.

WRAP-UP DISCUSSION

Your challenge is to explore other ways that your fluffadoo could help Seed B move. Play around with your fluffadoo and Seed B to try out all sorts of different ideas. you can move your fluffadoo any way you want, it doesn't have to hop. If you need ideas to get started, check in with your partner. I'll set a timer for 4 minutes in case that's helpful. All right, time's up! Click the arrow to move on.

WRAP-UP VIDEO 2

You probably came up with lots of creative ways that a fluffadoo can move a seed. Maybe you tried having the fluffadoo push it along, like this. Or maybe you tried giving it a hip bump, like this. Or maybe you tried putting it inside your fluffadoo, like this. It looks like there are different ways that a fluffadoo could help Seed B travel away from the plant. And it turns out animals really do help seeds move in similar ways. See if you can spot how this bird helps a seed move. The bird swallows a berry, then flies away. If you guess that the berry has a seed inside, you're right. While some seeds have fluffy structures or spiky structures, other seeds are surrounded by soft, juicy structures that are food for lots of animals. The bird gobbled down the berry's soft, juicy parts and its seed. Now the seed is inside the bird's stomach. Wherever the bird goes, the seed goes too, until it eventually gets dropped in a new place. It's like a fluffadoo carrying Seed B inside. And have you ever seen a squirrel doing this? She's holding an acorn. That's a seed from an oak tree. Then she dashes away with it. That seed is on the move. Later, the squirrel

buries the acorn. When she needs a snack, she can come back and dig it up. Until then, this acorn will be fine underground. The hard, smooth structure on its outside keeps the seed inside safe. And if the squirrel doesn't come back to eat it, that seed can grow right where it's buried. We've seen different ways animals help seeds move. Some travel outside on an animal's fur; others travel inside in an animal's stomach; and some get carried off, stashed, and forgotten. We've also seen seeds move by exploding, drifting in the wind, and floating on the water. All these seeds are on the move. But why? Are seeds just super excited to explore the world? Probably not. So maybe moving helps a seed in some way. To get some ideas, let's think about what would happen if seeds didn't move. Like these acorns. Let's say they all stayed right here where they landed under the oak tree they came from. Once they start to grow, each one will get bigger, and bigger, and…wait. Maybe you noticed some problems here. What problems might there be if all these seeds try to grow in one place?

WRAP-UP VIDEO 3

There are at least five acorns in this little patch. Can you picture five new oak trees growing there? It would be so crowded. There's probably not enough space, water, and sunlight for all these growing plants. Plus, the big tree is already growing there. It also needs lots of space, water, and sunlight. There could be other problems, too—like, what if caterpillars that love oak leaves are munching on the big tree? When the little sprouts grow, the caterpillars might eat up their leaves too. But if some acorns had moved away, they could avoid the caterpillars and grow big and healthy. Moving away could also help the acorns in other situations. Like, let's say someone bulldozes the big oak and builds a house right on that spot. But luckily, squirrels already moved away some of its acorns. A beautiful new oak tree could grow here or here. It seems like there are lots of reasons why it could be good for seeds to move. When seeds

spread out away from the plant they came from, we say they disperse. Dispersing can help seeds survive and grow in new places. While some seeds disperse by exploding, most seeds need help to get moving. Spiky, fuzzy structures and soft, juicy structures are two ways seeds get help from animals to move. We call that animal dispersal. It turns out there's a reason seeds have so many different shapes and sizes, things we call structures. Different structures do different things, and the things they do help seeds survive. Try looking for other kinds of structures in the plants and animals around you. You might spot structures that are strong and flexible, twisty and curvy, rough and bumpy, or smooth and sharp. Think for a moment about how that structure might help that plant or animal. You may discover something new about how they survive or even work together. Keep discovering, and stay curious.