Grades K-5
Mini-Lesson + Activity: “How do scientists know so much?”

VIDEO TRANSCRIPT

MINI-LESSON VIDEO 1

Hi, it's Doug! Have you ever been walking, like in a park or a forest, and you found something that really got your attention? Well, that happened to me recently. I was in a forest and I found this—it's a pine cone. But I'd never seen a pine cone like this before. I was so curious. I had all kinds of questions. So I came home and I got out some of my books that I have about trees. These books were written by scientists who studied things like pine trees. Now sometimes when I have a question, I find out that nobody knows the answer. And that's always exciting, too. But a lot of times, there are answers to things that I'm curious about. And it's scientists who figured them out. Someone named Barina has a question about scientists. Let's give her a call now.

[Video Call]

- Hi, Doug!

- Hi, Barina!

- I have a question for you. How do scientists know so much?

- That's a great question.

To answer this question, it might be helpful to think about what scientists do when they work. Let me tell you a story about two scientists, whose discoveries changed the way people think about the world. You see this thing right here? You might know what it is—it's a telescope. And you

know what a telescope is used for? To look up at the night sky. But it wasn't always used for that. In fact, when the telescope was first invented, one of the main ways people would use it, was to watch for enemy ships coming from far away. No one had thought to point a telescope up at the sky. No one until this person—this was Galileo. He was a scientist. Galileo was curious and he wondered what you might see if he pointed the telescope up at the sky. One of the first things he decided to look at, was the Moon. Night after night, he looked at the Moon through his telescope. He wrote notes, and he made drawings of what he saw. He was amazed by all the details that he noticed. You see, before Galileo, most people thought that the Moon was this round perfectly smooth ball, more like a beautiful nightlight, rather than some actual place. But by carefully looking at the Moon, Galileo noticed lots of pointy bumps and shadows. He compared his drawings to things that he noticed here on Earth. And he realized what he was seeing on the Moon, were mountains, valleys, and hills. The Moon wasn't some perfectly smooth light. It was an actual place with mountains and hills, just like the Earth. Galileo realized maybe we could even go walk around on the Moon someday. Galileo gave us new ideas about what the Moon was really like. Now here's another famous scientist—her name was Mary Anning. She's known for being one of the greatest fossil hunters in all of history. Mary spent almost every day of her life, ever since she was a young girl, searching along the beach for interesting fossils. One day, there was a landslide. A huge piece of the cliff near the seashore had fallen down. Mary wondered, “What if I go look over there? If I look carefully, will I find anything new?” Digging through the rubble, Mary noticed some really strange markings in the rock. It was the fossil of a large skull with lots of sharp teeth. As she unearthed the entire fossil and put its bones together, Mary realized that it was the fossil of a giant reptile that had once lived in the ocean. This was unlike any creature alive today. It was an animal that had gone extinct. All her life Mary kept looking carefully, finding more and more fossils of extinct animals.

Mary Anning gave us new ideas about what animals on Earth had been like, a long time ago. Mary Anning and Galileo were looking at very different things. But take a moment to think about what their stories have in common. What did both of these scientists do that was similar?

MINI-LESSON VIDEO 2

One thing you might have noticed is that both Galileo and Mary Anning started out being really curious about things around them. When they noticed something interesting or surprising, they didn't just say, "Oh, that's neat," and then move on. They noticed things and then paid really close attention. And here's the thing, when you start paying close attention to something, you start wondering a lot more questions. Galileo started wondering things like what are little bumps and shadows? What is the surface of the moon like? Mary wondered, what kind of animals did these fossils belong to? What does that mean about life a long time ago? You don't have to be a scientist to think like this. This is a drawing made by a young girl named Fiona, who decided to purposely take something plain and ordinary—these leaves—and look really carefully at them. As soon as she started paying close attention, she realized she had all these interesting questions. Drawing and paying careful attention to something is kind of like training your brain to discover interesting new things and ask questions. You should try it yourself. You can train your brain too. After this video is done playing, we have a special activity where you'll practice noticing something and asking questions like a scientist. See how many questions you can come up with. I think you'll find it's a lot of fun. Even if you don't figure out the answers to the questions right away, that's totally okay. Scientists sometimes spend years figuring out the answers to questions they come up with. Even when you do figure out the answer to a question, you'll find it always leads to new questions. That's actually one of the fun things about noticing something interesting and asking questions. It just gets more and more interesting. And you

start having more and more questions. That's why at the end of each video I always say, "Stay curious." There are so many interesting things out there to notice and wonder about. There are so many questions worth asking. So in summary, the reason scientists know so much is because they pay close attention to lots of things, and they ask lots of questions. By doing this, sometimes they discover things no one has noticed before. That's all for this week's question. Thanks, Barina, for asking it. Now, I hope you'll try the activity. Have fun and stay curious!

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to train your brain to observe, wonder, and ask questions, just like a scientist does. Galileo and Mary Anning made drawings of their discoveries, not just because drawing is fun, but also because it helps focus your brain. So, today you'll be drawing and observing something that you see every day to find out if you can discover something new or surprising about that thing. As you draw, your challenge is to come up with as many questions as you can. I'll show you how to get started, step by step.

ACTIVITY STEP 1

Find a partner. If you're working alone, that's okay too. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies. Depending if you're in a younger grade or an older grade you'll use a different handout.

ACTIVITY STEP 3

You can do today's activity using any object. We chose to use something that you're likely to have around, a hand. We chose a hand because even though you see your hand every day, you might not have looked at it really closely before. So if you're going to use a hand too, hold up the hand that you don't normally use to write with. That's the one you'll observe today. You'll use your other hand to draw.

ACTIVITY STEP 4

Look at your hand closely. Carefully look at the top and bottom, then bend your fingers and watch how they move.

ACTIVITY STEP 5

Now, help your brain focus by drawing. It's tempting to make your drawing really perfect or pretty. But don't worry about that. The goal is to observe your hand closely and think of questions you might have. Everyone put your hand down in the middle of your Wonder Page. Then trace the outline of your hand like this.

ACTIVITY STEP 6

You'll draw more details in a minute. But first, think of at least one question that you wonder about your hand. Older students: write this question on your Wonder Page. Younger students: share your questions with your teacher. They'll write these questions on the board. In case it's helpful, questions usually start with words like why, how, or what.

ACTIVITY STEP 7

You're going to be coming up with lots more questions, so here's a little tip: to help keep track of all the questions that you come up with, use an arrow to connect your question to the part of your drawing that it has to do with. For example, if you have a question about your thumb, draw an arrow between your thumb and your question. Now for younger students, since you're not writing out the whole question, you can just draw an arrow between your question mark and the part of your drawing that it has to do with.

ACTIVITY STEP 8

Now here's the really fun part. Look at all of your fingers really closely. Notice all those lines, bumps, circles, dots—any little details you can see. You're going to add those details now to your drawing. As you notice more details, you're going to start thinking of more questions. So older students: write those questions down and use arrows. Younger students: you can just put a question mark.

ACTIVITY STEP 9

Sharing what you notice with other people can give you new ideas. Scientists do that all the time. So share your drawing with your partner. Then discuss these questions.

ACTIVITY STEP 10

If you and your partner thought of even more questions. Older students: write down the most interesting questions that you discussed. If you run out of space, you can use the back of your paper. Younger students: share your favorite questions with your teacher. They can write these

questions on the board. You can add another question mark to your Wonder Page for each new question that you come up with.

ACTIVITY STEP 11

Younger students: you can skip to Step 13. Older students: now try zooming in even closer. Circle the part of your drawing that includes one fingernail. Connect a line from that circle to the magnifying glass. Then, go to the next step.

ACTIVITY STEP 12

Look even more closely at this fingernail on your own hand, then draw your fingernail and fingertip in the magnifying glass. When you think of any questions, write them down, and use arrows to connect your drawing to the question.

ACTIVITY STEP 13

How many questions have you been able to come up with? Count up all the questions on your page. Then, write this number down in your Curiosity Counter.

ACTIVITY STEP 14

Now that you've come up with all these questions, it's time to think about which one are you most curious about. Choose one question that you think would be interesting to investigate in the future. Younger students: your teacher will give you another sheet of paper so that you can write down your favorite question. Older students: look at all the questions you already wrote and circle the one that you're most curious about.

ACTIVITY STEP 15

Today, you drew something ordinary to help you observe closely and think of questions. I know that when I try the same thing, no matter what object I choose to draw, I'm always surprised by just how many questions I start having about that object. Thinking of questions is the first step to learning new things, the way a scientist does. Keep it up this year. Keep drawing and noticing interesting things. Check out the Curiosity Wheel that we linked to in the Extras. We think you'll find it's a good way to think of new things to explore and wonder about. Have fun and stay curious!