MYSTERIES AND EXPLANATIONS

Students explore nature while digging deep into curiosity. They propose and refine questions and pose possible explanations for what they see, without the need to be right.

Asking questions, finding mysteries, and making explanations are fun and dynamic ways to be creative in nature. Once we start to think of nature as a world of endless small mysteries, we can become fascinated wherever we go. What's causing the pattern of flowers on the hillside? Why are the clouds moving so quickly today? Who is making holes in the stump at the edge of the schoolyard? This activity sets students up to start making explanations about their questions and observations, and gives them a mindset and skills for interacting with nature mysteries wherever they go. Teaching students to be curious, ask questions, and make explanations gives them basic scientific inquiry skills. Wonder also adds to the delight of being alive.

Time

Activity: 15–20 minutes
Discussion: 10 minutes

Materials

optional

- ☐ Hand lenses

Teaching Notes

Experience with *I Notice, I Wonder, It Reminds Me Of (INIWIRMO)* is a prerequisite for this activity. Once students have some experience using *INIWIRMO* in a few different sessions, they will be ready deepen their inquiry skills through *Mysteries and Explanations.*

This activity introduces students to some basic ideas about how scientists gather information, but it isn't a complete course on inquiry or investigation. See the chapter Teaching Science and Inquiry: A Deeper Dive for some ideas about a deeper dive into scientific processes for coming up with and testing scientific explanations.

This activity takes place without journals. Giving students the opportunity to practice making explanations without writing them down at first allows them to focus on one skill at a time. Then, once they are familiar with making explanations, they can transfer the practice to the page. A short follow-up activity offers a structure for students to do just that.

NATURAL PHENOMENA

For the first part of the activity, you can focus students' attention on a small part of nature they can hold in their hand, such as a leaf, a pinecone, an acorn, or a seed pod. Or, if there is an intriguing nature mystery the whole group can interact with—for example, a series of holes in the ground or an animal carcass—focus the group's attention on this. When students get time to practice using the prompts on their own, any natural area that is safe for them to explore will work.

PROCEDURE SUMMARY

1. Make observations.
2. Ask questions and look for mysteries.
3. Make multiple possible explanations about your observations or mysteries; support explanations with evidence.

Note: No demonstration is required because this is a discussion-based activity.

PROCEDURE STEP-BY-STEP

After students have had experience with the activity *I Notice, I Wonder, It Reminds Me Of,* offer these steps:

1. **Gather students, then explain that they'll start by focusing on asking questions.**
   a. "We've had some practice using observation skills to learn, ask questions, and make discoveries."
   b. "Now, let's focus on asking questions."
2. **Explain that students will make observations of a leaf (or other small part of nature you've chosen, or the phenomenon the whole group is focused on), and then will ask questions based on their observations.**
   a. "Start by taking a couple moments with a partner to make observations of a leaf, or statements about what it reminds you of."
   b. "Then ask questions based on your observations or 'It reminds me ofs.'"
   c. "For example, you might notice holes in a leaf, and wonder how they got there. Or you might see a bird's beak that reminds you of a tool, and wonder whether it works in a similar way."

3. **Explain that asking questions based on what we observe is a way of finding nature's mysteries.**
   a. "There are mysteries everywhere in nature. Why is one half of a pond covered in ice in the morning, but not the other? What animal is burrowing and leaving these tunnels? What is causing the patterns and colors on a decomposing leaf? Why are there so many ladybugs on one side of the plant, but not the other?"
   b. "Making observations and asking questions is a way to discover mysteries other people might never notice."
   c. "How many questions can you ask and mysteries can you find?"
4. **Give students a few more minutes to work with a partner finding mysteries on their leaf (or other small part of nature you've chosen, or the phenomenon the whole group is focused on).**
5. **Ask a few pairs to share interesting questions or mysteries they came up with.**
6. **Explain how students can try to answer questions by making more observations.**
   a. "What do we do with the questions and mysteries we find?"
   b. "We might be able to answer some of our questions right away by making more observations, like 'I wonder if other leaves on this tree have this same spotted pattern.'"
   c. "If you ask questions that you can answer through making more observations, go for it."
7. **Tell students that it can be fun and interesting to come up with explanations for the observations, questions, and mysteries they find in nature.**
   a. "There are going to be lots of mysteries you find in nature that you likely won't be able to answer right away."
   b. "There's a chance you will find mysteries that no one may have thought about before."
   c. "It can be fun and interesting to make explanations and try to figure out nature mysteries."
8. **Offer some examples of explanations based on evidence.**
   a. "For example, if we noticed that two halves of a puddle had very different freezing patterns, we could come up with some explanations, like 'Maybe it's shallower in the frozen part, so there's less water and it froze differently there.' Or 'Maybe that part with the lines all in the center was disturbed in the freezing process, so it looks different than the other part."
   b. "Or if you found scratch marks on a tree, you might try to figure out where they came from, saying, 'Maybe it was from a deer's antlers! Or maybe it was a squirrel scratching up the bark to use in a nest!'"
   c. "You could then try to make more observations and see whether there is evidence that supports or contradicts either of your explanations."
9. **Tell students to base their explanations on evidence.**
   a. "We can't just make up explanations. We need to base our explanations on evidence."
   b. "So we wouldn't just say, 'I think these holes were made a long time ago' and leave it at that."
   c. "We would need to share the evidence and reasoning that make us think that, such as, 'I think the holes were made a long time ago, and my evidence is that the dirt is falling down in them and there are plants grown over them.'"
10. **Tell students to use the language of uncertainty and to come up with many possible explanations.**
   a. "When we make explanations, we're coming up with some possible ideas about what *could* be happening and making more than one explanation."
   b. "We don't know for sure what's going on, so we should come up with lots of different possible explanations for our mysteries."
   c. "We also want to remind ourselves to stay open minded to different possible explanations by using what scientists call 'the language of uncertainty.'"
   d. "This means using words like 'Maybe' and 'Possibly' as we say our explanation."
11. **Pick a mystery that a student came up with earlier in the session, then give students about 2 minutes in pairs to make two or more explanations about it.**
   a. "Take a moment and make explanations about the leaf [or the phenomenon the group is focused on]."
   b. "Make sure you use the language of uncertainty, and base your explanations on evidence."
12. **Ask students to share a few of their explanations with the group. Listen to what they say, and coach students to use the language of uncertainty and base their explanations on evidence.**
13. **Tell students that they'll have a few minutes to find nature mysteries and try to explain what they see.**
   a. "In a moment, you'll get to spread out, find nature mysteries, and try to explain them."
   b. "You will get to go wherever you want to within these boundaries [state the boundaries], trying to find cool mysteries and figure them out."
   c. "You can go back and forth between making observations, asking questions, and coming up with explanations. If you're able to answer a question through observation right away, go for it! Then ask another question."

d. "You don't need to be rigid about it, or always go in that same order. You might ask a bunch of questions, then come up with many different explanations. Your explanations might lead you to make more observations, then come up with another question."

e. "You do not need to be right, but do think carefully and be sure to support your explanations with evidence. Be creative and have fun with it!"

14. **As students work, take time to circulate, support, and troubleshoot, and coach students to use the language of uncertainty and make more than one explanation for a phenomenon.**

15. **If a group of students finds an especially interesting or cool nature mystery, consider bringing the class together and facilitating a whole-group discussion focused on trying to explain the mystery.**

16. **Offer time for students to share interesting or exciting explanations they came up with, then discuss in pairs which explanation seems the most likely based on the evidence.**

a. "Scientists try to come up with the best possible explanation based on all the available evidence."

b. "Pick a question or mystery you explored and that you came up with multiple explanations for. Which explanation has the most evidence that you can see to support it?"

c. "Share your reasoning and thinking with a partner."

17. **Explain that scientists go through this process on a much longer time scale.**

a. "Scientists come up with questions, explore mysteries, and make explanations, too. It's part of how they learn about the world."

b. "Science is about trying to find the best explanation based on all the available evidence, so scientists spend a lot longer, usually months or years, doing research and testing and considering different explanations."

c. "When scientists come upon evidence that contradicts their explanation, they stay open minded and are willing to change their thinking and listen to ideas."

DISCUSSION

Lead a discussion with a few of the general discussion questions. Intersperse pair talk with group discussion.

General Discussion

a. "What was it like to observe, explore nature mysteries, and come up with explanations?"

b. "What helped you learn during this activity? What skills do you feel like you got better at?"

c. "You can find nature mysteries and come up with explanations wherever you go. It is a fun way of learning about the world around you. What are some other places you'd want to explore using this mindset?"

d. "What are some reasons it might be important for scientists to use language of uncertainty, such as saying 'Maybe' or 'Perhaps,' when they come up with explanations, and to come up with multiple possible explanations?"

e. "A good scientist should always be ready to change their mind if there is strong evidence against an old idea and in support of a new one. We accept an idea in proportion to the strength of evidence that supports it. How do you think we can get better at changing our minds in the face of evidence?"

FOLLOW-UP ACTIVITIES

Making Explanations, Testing Predictions

Use the information in the chapter Teaching Science and Inquiry: A Deeper Dive to guide students into scientific inquiry, through which they come up with alternate explanations, predict what they'd expect to see if the explanation were true, and test those predictions against what they observe. This more rigorous approach to asking questions and making explanations will strengthen students' understanding of scientific processes and methods.

Learning to Evaluate Evidence

To strengthen students' skills in using evidence to support explanations, do the BEETLES Project classroom activities *Evaluating Sources* and *Evaluating Evidence* (http://beetlesproject.org/resources/for-classroom-teachers-2/).

Making a "Why Web"

Some answers cannot be directly observed but may be inferred from evidence. "Why" questions are a good example of questions that can only be inferred. Inference starts by thinking of possible alternate explanations for a phenomenon. A "Why web" is a useful way to visualize this. Choose a question for which you can think of more than one explanation (ideally a question from one of your students) and write it in the middle of a whiteboard. Then build on students' skills in making explanations by encouraging them to make a "Why web" in their journal.

a. "'Why' questions are challenging and fun to explore. The trick is not to get stuck with the first possible explanation that comes to you. What are some possible answers to this question?"

b. "Take a few minutes to write down possible explanations in your journal. You do not have to be right. Be creative." (Students generate answers.)

c. Listen to students' explanations.

d. "All of these are possible. There may be other possibilities that we have not thought of, so I am going to add "something else" to remind us of that possibility. From here we would look for ways to test explanations for evidence against them so that we could cross ones that do not work off the list."