QUESTIONING QUESTIONS

Students observe a natural phenomenon and explore a process for asking varied and interesting questions.

When students are told to ask questions in nature, they often resort to fact-based inquiries, such as "How long does it live?" "How much does it weigh?" or "How fast can it go?" With practice and support, students can develop the tools for more intentional inquiry, asking deeper questions that they can then explore through observation or critical thinking. This activity takes a group of students through a "curiosity crash course," beginning with asking questions from observations, then using a question generator to ask more varied questions. Students put their skills into practice by asking questions about any part of nature that is interesting to them. Students can apply the frameworks they learn in future journal entries, outdoor explorations, science experiences, and learning in other disciplines.

NATURAL PHENOMENA

Students can practice questioning with any part of nature. To find a subject for this activity, try to find a phenomenon that you are curious about or that your students are curious about, or something that makes you think, "Huh, that's weird." Your authentic curiosity will rub off on your students. Make sure you are in a rich area with different natural features, so that in the second part of the activity, students have the opportunity to practice their questioning skills while looking at something interesting to them. If you have specific learning goals or want to use this activity to design an investigation around a specific phenomenon, then use one that is appropriate.

PROCEDURE SUMMARY

1. Use words, pictures, and numbers to record observations, leaving space around the page.
2. Use the question generator "Who, What, When, Where, How, and Why" to ask as many questions as possible, and do not worry about answering them.
3. Start by asking questions about the phenomenon you sketched. Then, if you get curious about something else, you can shift your attention there.

DEMONSTRATION

When the whiteboard icon appears in the procedure description: Make a few quick drawings in the center of the whiteboard and sets of parallel lines to represent blocks of written notes. After the first observation period, write, "Who What When Where How Why" (or whatever scaffold you are using) down the side of the page, then make question mark icons with straight lines next to them to indicate questions. Where appropriate, draw lines to the part of an illustration or note that relates to the question.

Time

Introduction: 10 minutes
Activity: 30–50 minutes
Discussion: 10–15 minutes

Materials

- ☐ Journals and pencils

optional

- ☐ Cut-and-Paste Journal Strategies (p. 273)

Teaching Notes

The procedure introduces the curiosity scaffold "Who, What, Where, When, How, and Why" as a tool for generating questions. The follow-up section explains how you could substitute one or more of the Crosscutting Concepts or question scaffolds from the International Baccalaureate Key Concepts p. 92 into the activity. It's important to get to the questioning part of the activity before students "run out of steam," so if your students are only able to focus on journaling for a short amount of time, make their initial observational sketching time shorter.

Consider printing out copies of the Cut-and-Paste Nature Journal Essentials on p. 273 and having students paste thm to the back page of their journals. This will help them remember the list of "Who, What, When, Where, Why, and How" questions.

PROCEDURE STEP-BY-STEP

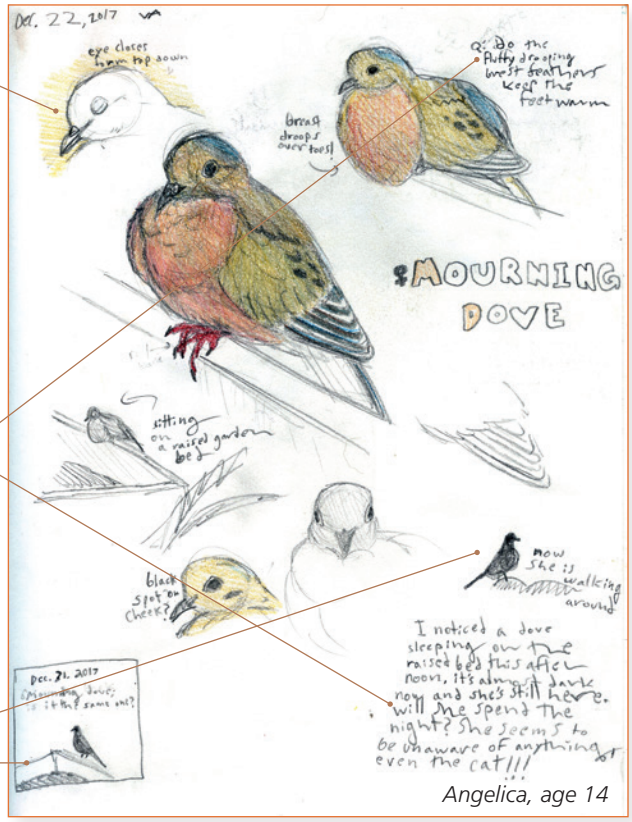
1. **Focus the group's attention on your chosen phenomenon and ask them to share some observations out loud.**
   - a. "Look at this. What do you notice?"
   - b. "What else do you see? Can anyone add to these observations?"
   - c. "What does it remind you of? What have you seen before that is similar to this?"
2. **Tell students to record observations of the phenomenon using words, pictures, and numbers in the center of their journal.**
   - a. "We're going to observe this in more detail."
   - b. "First, observe this and sketch it in the center of a new page. Use numbers and words to show your observations, too."
   - c. "Leave a border of blank space around the outside of your notes."
   - d. "You will have seven minutes to record your observations."
3. **After 7 minutes have passed, call for the group's attention, then explain how to generate questions from observations.**
   - a. "Being curious and asking questions are important parts of what scientists do and how they think. We can use strategies to help us think of questions."
   - b. "We can always ask questions based on our observations. For example, if you observed a hole in a leaf, you could wonder how it got there, ask a question about its shape, or ask a question about whether other nearby leaves also have holes."
4. **Explain that "Who, What, Where, When, How, and Why" is a question generator that can help us come up with lots of questions.**
   - a. "You can also use thinking tools to help you think of questions, and you will learn about one right now."
   - b. "First, write 'Who What Where When How Why' down the side of your page."
   - c. "You can use these words to help you ask more varied and interesting questions."
5. **Explain that "Who" and "What" can focus us on identifying things and describing a process, then ask students to brainstorm some example questions.**
   - a. "'Who' and 'What' can remind us to ask questions to determine what kind of species or process we see, like 'Who left these tracks?' or to think generally, 'What happened here?' using questions to try to get at a process that is happening."
   - b. "Take thirty seconds to come up with some 'Who' and 'What' questions out loud with a partner about the phenomenon we're looking at."
6. **Explain that "When" and "Where" get us thinking about space, location, and timing, then ask students to brainstorm some example questions.**
   - a. "'When' and 'Where' can remind you to wonder about time, space, and location: when things have happened or will happen, where things have happened or will happen, or the significance of where things are in relation to one another."
   - b. "Share some 'When' and 'Where' questions out loud with a partner about the phenomenon we're looking at." (If necessary, add examples such as "When did this sapling sprout?" or "Where did this seed come from?")
7. **Explain that "How" and "Why" questions focus on figuring out how things work or looking at cause and effect, then ask students to brainstorm some example questions.**

Start with observations. These are the backbone of nature study.

When students are new to journaling, it is easier to separate observation and questioning into discrete steps.

As students become more advanced, questions will occur to them as they observe. They can integrate observations and questions as they work.

The level of detail of observation depends on how close and cooperative the subject is. A resting bird gets a close-up. A bird on the move gets a silhouette.



Angelica, age 14

a. "'How' and 'Why' can help us ask questions about how things work, or why they might be happening."

b. "Share some 'How ' and 'Why' questions out loud with a partner about the phenomenon we're looking at." (If necessary, add examples, such as "Why are there holes on only one side of the leaf?" or "How do the spikes on the leaf help it survive?")

8. **Tell students that they will practice using the question generator to come up with as many questions as possible.**

   a. "In a moment, your job will be to ask as many questions as possible. Use your observations and the thinking tools we just talked about to come up with questions."

9. **Tell students that they should start by asking questions about the subject they sketched earlier, but can shift their attention if their interest changes.**

   a. "Start by focusing on the sketch you did earlier. Write your questions around your observations, near a part of the drawing that relates to the question. You may also draw a line from the question to the part of the drawing that you are wondering about."

   b. "If you start wondering about other things in nature that aren't what you drew originally, you can write down those questions, too. You could shift your attention entirely and focus on a different subject if you would like."

   c. "If you are stuck, and feel as though you can't come up with any more questions, you can just say 'I wonder…' to yourself, and see what pops out."

10. **Tell students that they don't need to be rigid with the words that start their questions; the goal is just to get the questions out the door.**

    a. "You don't need to be rigid with these words. Sometimes a question that starts with 'What' can accomplish the same goal as a 'Who' question, like 'What animal made this mark?'"

    b. "Don't worry about the first word of the question, or 'doing it right.' The goal is just to get the questions out there."

11. **Tell students that they will not need to worry about answering the questions at the moment—their goal is to be curious and to get the questions out there.**

    a. "You will not need to answer these questions. Right now, it is just about putting them out there. See if you can catch yourself getting curious about what you see."

12. **As students work, take time to circulate and support those who might be struggling to use the scaffold to ask questions.**

DISCUSSION

Lead a discussion with the general discussion questions, and the topic from the Science and Engineering Practices category. Intersperse pair talk with group discussion.

General Discussion

a. "Let's hear a few of the interesting questions you came up with."

b. As students share, ask follow-up questions, such as "What did you find interesting about that question?" or point out patterns in the group's questioning, such as "Isn't that interesting—many of our questions started with the words 'How' and 'Why.'"

c. After a little while, shift the discussion to reflecting on the question prompts, using questions such as "How did having the 'Who What When Where How Why' reminders impact your questioning?" or "What helped you ask questions?

Asking Questions and Defining Problems

a. "You just practiced an approach for asking varied and interesting questions. You can use these strategies to help ask questions anywhere and to help you become more curious in other settings. Talk with another person about how you might be able to use these question prompts in another setting, like in a different subject in school or in another situation."

EXTENSION

Sorting Questions

1. **Lead students through the process of briefly categorizing questions based on how they could be answered or investigated.**

   a. "Let's look back at our questions now."

   b. "Draw bold question marks next to your most interesting questions."

   c. "Does anyone have a question that we could probably answer with more observation and research, with the tools and time frame we have right now? How would we approach answering the question?"

   d. "Does anyone have a question we might be able to answer over a longer period of time or with different tools than we have available right now?"

   e. "Does anyone have a question that you don't think can be answered with observation and research? Why not?" *Note:* Some questions might not be investigable because there are not tools available to make the types of observations

that would be necessary. Other questions that do not relate to the observable, natural world are outside the limits of what we can study as scientists. Point this out to students, depending on the types of questions they ask.

ALTERNATE QUESTION SCAFFOLDS

Other question scaffolds, such as the Crosscutting Concepts (p. 90) or the International Baccalaureate Key Concepts (p. 92), could either take the place of the 5W's + H steps or be introduced afterward in a follow-up session.

To introduce a Crosscutting Concept as a framework for questioning, give a brief summary of the concept (you can use the information on p. 90 to do this). Then offer some examples of questions that the concept might lead to, and give students time to practice using it to generate questions. The following are some examples.

Patterns

a. "There are patterns everywhere—where leaves come out of the stem on a plant, the shapes of clouds in the sky, the relative location of holes in the ground. These patterns can be clues to underlying processes at work, and we can begin to understand them if we intentionally ask questions to define and describe the pattern."

b. "Ask questions like 'Are there any patterns here?' 'How can I describe the pattern?' 'What does it look like?' 'Are there any exceptions to the pattern?' or any other questions that come to mind when you are using the idea of patterns to guide your thinking."

Cause and Effect

a. "All around us in nature, we see the effects of things that have happened in the past. The things we see happening right now will have impacts that we could observe in the future."

b. "When we use this Crosscutting Concept, we can think of what we can observe as 'effects' caused by events that happened in the past, and we can wonder about this—for example, 'What caused these holes to be here?' or 'Why are there more yellow leaves toward the bottom of the tree?' We can also wonder about what will happen—for example, 'If the slug eats all the leaves on the plant, how will it affect the plant as a whole?' or any other questions that come to mind when you are using the idea of cause and effect to guide your thinking."

Structure and Function

a. "How something looks, its shape, texture, and color, is connected to how it works. The shape of a hawk's wings allows it to soar in the air without flapping. A hummingbird's wings must flap constantly to keep it airborne, but their shape and size enable the hummingbird to make very precise movements."

b. "In nature, we can observe in detail the body part or structure of an animal or plant, then ask questions about how it might function or work in the context of the environment. For example, you might ask, 'How can I describe the structure of this leaf?' 'Why might this leaf by shaped this way?' 'How might the hairs on the leaf help it to survive here?' or any other questions that come to mind when you use the idea of structure and function to guide your thinking."

The other Crosscutting Concepts and the International Baccalaureate Key Concepts could be introduced in a similar way.