beetles
Science and Teaching for Field Instructors

Student Activity Guide

I Notice, I Wonder, It Reminds Me Of

Many field instructors cite this Exploration Routine as their most effective teaching tool. It supports students to develop a mindset of curiosity and use language to actively and directly engage with the natural world. Students can carry away and apply these important skills in any outdoor setting or area of their lives. During the activity, students choose a natural object, then make *I notice . . .* statements out loud with a partner and with the group. They do the same with *I wonder, . . .* questions and *It reminds me of . . .* connections. Then, students practice using these tools focused on whatever they find interesting.

Using this routine makes any field experience more student- and nature-centered. The skills of the routine can be applied during any part of a learning experience, focused on any part of nature. The routine can support social and emotional learning by offering skills for reflection and by setting a tone of learning, collaborating, and listening. The routine can also help instructors create an inclusive and culturally relevant learning environment by scaffolding cognitive thinking skills and leveraging the phrase *It reminds me of . . .* to encourage students to reflect on, value, and share relevant connections from their lived experiences and perspectives.

Students will...

- **Increase curiosity about and directly engage with aspects of the natural world.**
- **Make observations, ask questions, and relate findings to past experiences.**
- **Learn that descriptive observations are distinct from statements of opinion or identification.**
- **OPTIONAL: Make explanations based on evidence; Use the crosscutting concept of Patterns to focus observations; Focus on the skill of asking questions and identifying scientific questions; Use the routine as a tool for reflection and social emotional learning.**

Grade Level:
Grades 3-8. Adaptable for younger or older students.

Timing:
45-65 minutes

Related Activities:
This activity initially serves as an invitation to exploring nature. Afterward, it can be used at any time to enrich student observation and understanding of any part of the natural world.

Materials:
For the instructor: Whiteboard; Pen. *Optional, but highly recommended:* Interesting small natural objects each student can observe; nets, small collection cups, hand lenses.

Tips:
To ensure a successful experience, review the teaching tips found on page 2 and throughout this guide.

Setting:
Any setting in nature in which students can safely make observations will work.

Equity, Inclusion, and Cultural Relevance (reviewed by Youth Outside)**:**
This activity has been designed to demonstrate how to create an equitable, inclusive, and culturally relevant teaching and learning experience. Read more on page 14.

NEXT GENERATION SCIENCE STANDARDS

For additional information about NGSS, go to page 16 of this guide.

FEATURED PRACTICE

(Optional) Asking Questions
Students also build skills foundational to all 8 science practices.

FEATURED CROSSCUTTING CONCEPT

(Optional) Patterns

DISCIPLINARY CORE IDEAS

Specific DCIs will vary depending on activity focus and the guidance of the instructor.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Exploration Routine

I Notice, I Wonder, It Reminds Me of

ACTIVITY OVERVIEW

I Notice, I Wonder, It Reminds Me Of	Learning Cycle Stages	Estimated Time
Why Observe?	Invitation	5 minutes
Making Observations (I notice . . .)	Exploration	5 minutes
Asking Questions (I wonder . . . ?)	Exploration	5 minutes
Making Connections (It reminds me of . . .)	Exploration	5 minutes
Optional: Making Explanations	Exploration	5 minutes
Applying the Practice and Inquiry Fever	Application	5-10 minutes
Wrapping Up	Reflection	5 minutes
Optional Extensions: Using the Routine for Social Emotional Learning; Focus on Asking Scientific Questions	Application	10 minutes; 15 minutes
TOTAL		45-65 mins

TEACHING TIPS

Read the Instructor Support Section. Beginning on page 12, you'll find more information about pedagogy, equity and inclusion, student misconceptions, science background, and standards.

Make this an essential routine. Many instructors say this is their most effective tool for teaching students to observe and focus in nature. Offered at the beginning of a field experience, it scaffolds skills for engaging directly with nature. Once students are familiar with the routine, use it whenever the group finds an intriguing object or organism or anything they want to learn more about. These tools can also help to re-engage students who may be beginning to lose interest in an activity or discovery.

Don't shortcut the introduction. It's not effective to shortcut this activity by just telling students the prompts and asking students to repeat them, or by printing the prompts in a journal and having students use them independently. The activity structure and guidance from the instructor is essential for students to build and practice these observation skills. It doesn't take very long to introduce this routine well, and the time spent pays off throughout future field experiences.

Safety. Choose an area with few hazards, set and identify boundaries, and thoroughly warn students about any local hazards.

Field card. On page 20 of this guide, you'll find a condensed, pocket-sized version to use in the field.

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Why Observe?

1. **Ask students: Who are some amazing observers and what makes them good observers?** Ask students if they have ever known or learned about individuals in books, movies, other media, or in their lives who are really good at noticing things or making observations. Examples might include a peer, a family member, people with a certain kind of job, (e.g., coaches, engineers, detectives, trackers, writers), or historical figures such as Helen Keller or Harriet Tubman.

2. **Share one or both of the quotes below and invite students to share what it means to them.** Read one or both of the quotes below out loud, or give a student a card with the quote on it and invite that student to read it out loud to the group. Choose the quote you think will be most resonant with your students. Then, ask students what they think the statement means or why they think careful observation is important.
   - *"She knew because she looked."*
     —Zora Neale Hurston, author and filmmaker
   - *"I see no more than you, but I have trained myself to notice what I see."*
     —Sherlock Holmes, fictional detective, as written by Sir Arthur Conan Doyle

3. **Share that you will offer some tools that students can use to improve or build on their observation skills.** Offer the idea that it can be easy to miss or overlook the interesting things that surround us all the time. Share that during this activity, students will focus on developing their observation skills to help them learn to notice things and, in the process, they will become better observers. Students will also learn some strategies that can change the way they investigate or experience the world.

Making Observations (I notice . . .)

1. **Ask each student to find one of the same type of natural object and then form a tight circle.** Ask students to find one of the same type of a small natural object, such as a specific type of leaf, and then to sit or stand in a tight circle.

2. **Offer a definition for observation and introduce the first prompt: "I notice . . ."** Share that students will practice making observations first. Offer a definition for observation and clarify what kinds of statements are not observations.
   - *An observation is something we notice with our senses of sight, touch, smell, hearing, taste. Please don't taste anything unless you are told you can.*
   - *I know I'm making an observation when I begin a sentence with "I notice" and then describe what I see, feel, smell, hear, or taste.*
   - *Observations are what you notice in the moment, not what you already know. Saying "I notice it's a leaf." is identification or recalling what you already know, not making an observation.*
   - *Saying, "It looks awesome." or "I notice it's gross." is your opinion, not an observation.*
   - *Saying, "The leaf has been eaten by bugs." isn't an observation if we can't*

TEACHING NOTES

Quote from a 15-year field instructor after first time using this activity. "[The kids] loved it and won't come in for lunch—made teacher cry—[a good thing]. The kids never saw it coming. They went from blah to wow in 10 minutes. What would normally take hours was 20 minutes in which we couldn't get them out of the forest. Best day ever."

Acting out awesome observers. One instructor invited students to pose like amazing observers to engage students' prior knowledge.

Keep it interesting. Pay attention to the mood of your group and don't allow your introduction to the routine to become a chore. The main purpose of the routine is for students to engage with nature, and some groups will need to go at a faster pace. The main goal should be to find something that is interesting and support students in their curiosity about exploring it. Listen to students' ideas and pursue interesting threads of conversation. Avoid sharing information during this process, unless it's something that will lead students to more observations and questions. Try to keep the experience focused on discovery through direct student-nature interactions or student-student interactions.

Why use leaves? Even though leaves might sound like a boring object to observe, leaves have lots of interesting variations in shape and structure, color, and evidence of organisms eating them. Focusing students on common objects such as leaves also centers the learning on a part of nature that students will continue to have contact with in their lives. This contrasts the exclusionary narrative that nature is only found in pristine wilderness or is something students must go to, as opposed to something that is always around them.

see any bugs eating the leaf. It's a possible explanation for how the holes got there, not an observation. The observation is that it has holes.

3. **Offer some examples of observations.**
   - *Here are some examples of observations: "I notice this is yellowish-green in color, oval-shaped, and about the size of my thumb. It's rough in some places and smooth in others."*

4. **Share that students will say their observations out loud, taking turns with a partner. Then, offer suggestions for what students can do if they feel stuck**.
   - *If you get stuck, try observing your object in a new way, like by flipping it over, putting it next to something else, or using different senses. Listen to what your partner says and see if that helps you notice different things.*

5. **Ask students to partner with someone next to them in the circle.** Ask for a volunteer to be your partner.

6. **Give students approximately 1 minute to make "I notice . . ." observations about their objects out loud.** Share that students will have about 1 minute to observe and to keep saying their observations out loud until you say "Stop." After about 1 minute, call for everyone's attention.

7. **Invite a few students to share observations with the whole group.** Offer an example of an observation you made with your partner. Then, invite a few individual students to share observations with the whole group. If students are stating opinions or making identifications, gently remind them that they shared an opinion or identified something they already know. Remind students to focus on making observations. If there is time and it seems appropriate, help them reframe their observation or create a new observation. If it makes sense for your group, you can first ask pairs to share a few observations with a neighboring pair before they share with the whole group.

8. **Monitor student energy and keep things moving.** Keep the energy up when students are sharing in the large group. You don't need to hear from every student or follow up on every idea. While many students may want to share, they'll get a lot of practice using the language while observing with their partners. The group will stay engaged and excited if you move on before they get restless.

Asking Questions (I wonder, . . . ?)

1. **Offer "I wonder, . . . ?" as a prompt for asking questions.** Share that students will now use a second prompt to ask questions about their object out loud. Invite students to use the sentence starter, "I wonder, . . . ?" with their partners and to ask as many questions out loud as possible. Offer the idea that students can ask a question about one of their observations if they feel stuck. Offer a few different kinds of "I wonder, . . .?" questions. For example:
   - *I wonder, how long has this leaf been on the ground?*
   - *I wonder, have any insects walked across this leaf?*

TEACHING NOTES

Why use leaves of the same type? When all students observe leaves from the same type of tree, the group sharing can be more collaborative and interesting as students make comparisons between what they've observed. Still, almost any natural object will work for this activity.

Make adjustments for the needs of your students. For more energetic groups, consider introducing each sentence starter and then giving students a chance to run or move out of the circle to find an intriguing object with which to practice. Once they've worked off some energy, they can return to the group to share what they've learned.

Listening and responding to students. How you respond to students' observations and comments matters. Create a culture in which students feel safe sharing ideas by frequently asking broad questions that have multiple acceptable responses and by giving all students neutral, accepting responses to your questions. When we react to student responses to broad questions by showing a preference for some responses over others (e.g., Yes, that's right. Or No, but keep thinking.), we're sending the message that only some student thinking is acceptable. When we give neutral, accepting responses (e.g., Hmm . . . interesting. Can you say more? Or Thank you for sharing. What do others have to say?), we encourage a group culture of participation and sharing. To learn more about creating an inclusive learning experience, see page 14 of the Instructor Support section.

Don't be too strict about the format. Students may come up with "I notice" statements during the "I wonder" time because they noticed something new or their question inspired an observation. That's good stuff! Don't be strict about the categories. Engaged student observation is always a good thing.

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2. **Invite students to ask "I wonder, . . . ?" questions out loud with their partners for approximately 1 minute.** Give pairs about 1 minute to ask questions out loud. Then, call for the group's attention.

3. **Invite a few students to share questions with the whole group.** Invite a few students to share some of their most interesting questions with the whole group. If it makes sense for your group, you can first invite pairs to share a few questions with a neighboring pair before they share with the whole group.

Making Connections (It reminds me of . . . .)

1. **Offer the last prompt: "It reminds me of . . . " and share that students can use it to describe what the object looks like or to connect to an experience or piece of information they remember.** Share that students have one more tool to practice that helps make connections to things they already know: "It reminds me of . . . ." This can be something the object looks like, an experience it makes them remember, or some information they know about it. Offer a few different kinds of "It reminds me of . . ." statements. For example:
   - *"It reminds me of" could be anything this object reminds you of—anything at all!*
   - *This could be something it physically looks like. For example: The veins on this leaf remind me of the lines on the palm of my hand.*
   - *Or, it could be an experience from your life. For example: This leaf reminds me of the time I collected leaves at my grandmother's house.*
   - *It could also be information or knowledge you have. For example: My leaf reminds me of something I learned from a show about uses for native plants.*

2. **Share that it can be helpful to focus on one part of the object.** Offer the idea that sometimes you can think of more comparisons if you focus on one part of the object, such as the edge of a leaf, the petal of a flower, the shaft of a feather, or the bottom of an insect's abdomen.

3. **Invite students to say "It reminds me of . . ." statements out loud for approximately 1 minute.** Challenge pairs to come up with and say out loud as many "It reminds me of . . ." statements as possible. After 1 minute, get the group's attention.

4. **Invite a few students to share connections with the whole group.** Ask students to share some interesting connections with the group. If it makes sense for your group, you can first ask pairs to share a few connections with a neighboring pair before they share with the whole group.

OPTIONAL: Making Explanations (I think maybe . . . .)

1. **Share that the next tool is for figuring out things in nature: making explanations.**

2. **Ask students why they think scientists explain their scientific observations and then share: Scientists make explanations about what**

TEACHING NOTES

Assign a "question person." Some instructors ask one student or a chaperone to be the "question person" for the day or the week. This person has the responsibility of recording any questions asked by members of the group and looking for opportunities throughout the day to investigate those questions further.

What does this remind you of? This question asks students to make connections between what they are observing and their own lived experiences, and it brings their voices into the learning conversation. It's also an opportunity for the instructor to hear students' thoughts and perspectives, to build a deeper understanding of students' thoughts, and to become more responsive. This also supports students' social emotional learning by offering opportunities to share, listen to, and understand one another's perspectives and see the value in listening to one another's perspectives. To learn more about creating an inclusive learning experience, see page 14 of the Instructor Support section.

Creating "inquiry fever." Inquiry fever happens when a group of students is enthusiastically investigating nature and feeding off one another's discoveries, ideas, and excitement. I Notice, I Wonder, It Reminds Me Of is designed to set up students with an inquiry mindset and skills. Add two other ingredients, and your students can catch the fever. The three ingredients for inquiry fever are: inquiry mindset and skills, permission and encouragement, and interesting stuff or ideas to explore.

Introducing explanations later. If students' attention is waning, introduce explanations at a later point in the field experience. You can also introduce explanations later if you think it would benefit your group to move on to the free-exploration part of the activity when students get to apply the skills on their own in the moment.

TEACHING NOTES

they notice to try to understand more about the world and to figure out how things work.

3. **Distinguish between observations and explanations and offer the sentence starter "I think maybe . . . ."** Share that observations can lead to questions and that it can be fun and interesting to try to explain them based on evidence and reasoning.
   - *Observations are things we learn through our senses.*
   - *When we make observations and wonder about things, we discover mysteries we can try to explain.*
   - *Scientific explanations are how we try to explain or make sense of what we see based on evidence and reasoning.*
   - *We can start our explanations with the words "I think maybe..."*

Scaffolding and student engagement. Using think-alouds to show how students might participate in a discussion, or using a prompt such as "I think maybe . . . " supports students' participation by modeling learning behaviors they can use during the activity. It also supports literacy and language development. To learn more about creating an inclusive learning experience, see page 14 of the Instructor Support section.

4. **Model making some explanations based on observations of your leaf or of another nearby natural object visible to the group.** Share an example by modeling using the language of uncertainty, identifying which part of your statement is the observation and which is the explanation, and coming up with multiple explanations. For example:
   - *We noticed our leaves were hairy and wondered why they were so hairy. We could come up with a possible explanation, like maybe it's hairy to protect the leaf from being eaten because it seems like it would be hard to chew. The observation is that it's hairy. The explanation is that it might make it harder to eat. Can anyone think of a different explanation for it?*

5. **Invite students to identify the explanation and observation in your example statements.** Share another example explanation. This time, ask students to identify the observation and the explanation.

What is evidence? Most students tend to already have a pretty good idea of what evidence is, but sometimes it's helpful to offer a definition: Evidence is data that help answer a question, form an explanation, or disprove an explanation. (Data is factual information, such as observations, measurements, and test results.) During this activity, instead of offering a full definition for evidence, you may choose to just ask students, "What is your evidence?" "What is the observation your explanation is based on?"

6. **Invite students to use the language of uncertainty when making explanations.** Share that using language such as "I think maybe . . ." or "I wonder, if . . ." or "Could it be that . . ." helps us remember that we don't yet know for sure what is happening and helps us stay open-minded to other possible explanations.

7. **Ask students to include evidence in their explanations and offer an example.**
   - *When we make explanations, we need to include evidence. Evidence can be observations we have made.*

   Share an example based on something you're actually observing:
   - *For example: I think this half of the tree is dead, and the other half is still alive. My evidence is that all the branches on that half are brown and very dry, while the branches on the other side are soft and have green leaves.*

8. **Invite a few students to share some observations of their leaf/object that they might try to explain.**

9. **Invite students to make explanations by saying, "I think maybe . . ." statements out loud with their partners for approximately 1 minute.**

10. **Invite a few students to share interesting explanations with the group, reminding them to include evidence.** Invite students to share

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explanations with the group. If they don't include evidence, ask, "What's your evidence for that?" or "What makes you think that?"

Applying the Practices and Inquiry Fever

1. **Invite students to think about how much they can discover in nature.** Encourage students to look at their leaves/objects. Then, remind them how much they learned in a short time about one leaf! Invite students to notice that there are leaves, twigs, stones, critters, and all kinds of other things to discover everywhere!

2. **Share the George Washington Carver quote:**
   - *"Reading about nature is fine, but if a person walks in the woods and listens carefully, [they] can learn more than what is in books . . ."*
     —George Washington Carver, plant scientist, farmer, and inventor

3. **Share that students will get to search for anything they find interesting in nature and then use their new skills to make observations, ask questions, and make connections out loud.** Encourage students to hold on to the mindset they now have and to get ready to use it even more. Share that students will get the opportunity to look for anything they find interesting and then use the observation routine they just practiced to learn about what they are interested in.

4. **OPTIONAL: Crosscutting concept: Invite students to pay attention to patterns.** If you'd like to emphasize the Next Generation Science Standards (NGSS) crosscutting concept of Patterns in this activity, invite students to pay attention to patterns. Share that this is one way scientists focus their observations in nature.
   - *When scientists observe and investigate nature, they often look for patterns.*
   - *This leads to more observations and interesting questions about why the pattern occurs.*
   - *Try to find interesting things to practice observation/investigation skills and look for patterns.*

5. **OPTIONAL: Crosscutting concept: Show examples of patterns from the field.** It's important to model for students your excitement and learning behaviors by sharing examples of the kinds of patterns field scientists might look for. Many students who have only been introduced to the idea of patterns in the context of math may only think of them as repetitive sequences of numbers or shapes. Give these or other relevant examples:
   - *Is there a pattern to the height of woodpecker holes on trees? Are they mostly at certain heights?*
   - *Is there moss growing all over the rocks, or only on the tops or in another growth pattern?*
   - *Is there a general rule about where we can usually find water striders in the stream and where we don't?*

6. **Share the boundaries for inquiry fever and then invite students to start practicing their observation strategies in pairs or small groups.** Ask students if they are excited about having these strategies for investigating

TEACHING NOTES

Internalizing the process. Encouraging students to use these prompts to explore things they find in nature throughout your field experience will help them internalize the language and routine. This practice with exploring independently helps students build their investigation skills so they're more likely to keep exploring when they are on their own without an instructor inviting them to engage with nature.

Introducing the Next Generation Science Standard (NGSS) crosscutting concept. The optional steps in this part of the activity are for instructors who want to integrate the NGSS crosscutting concept of Patterns into this activity. For students to appreciate this big idea of science, they'll need to have multiple experiences with using this lens to explore nature. See the Instructor Support section on page 12 for more information about making connections between this activity and the NGSS.

Quiet or shy students. Some students may be reluctant to say their observations out loud in the whole group. Opportunities to use the routine in small groups, pairs, or individually encourages more sharing from students who might be reluctant to speak.

Codeword: observation. You might want to come up with a phrase or codeword you or a student can use to signal that there's something cool to check out. When anyone in the group hears the code word, they will know to use these observation tools.

nature and if they think they can use these methods to learn about living things and other parts of nature. Take them to a nearby area rich for exploration, explain boundaries, and send them out to explore. Share that they can explore in pairs or in small groups. Encourage students to use their new tools to talk to and learn from one another.

7. **Give students at least 5–10 minutes to explore.** Offer materials, if available. Offer tools such as cups, bug boxes, nets, or hand lenses to enrich their exploration experiences. Allow enough time for exploration so students can find and engage with something that interests them.

8. **Circulate, model observation strategies, and support students to engage with one another's discoveries.** Help focus students who may be disengaged by temporarily partnering with them or drawing their attention to something interesting. Try to engage students with one another's discoveries. Model how to make discoveries and use observational and questioning language as you explore.

9. **Facilitate the whole group in practicing strategies together.** At the site of something particularly cool or easy to see, call the whole group over. Give students the opportunity to make observations, ask questions, and come up with connections out loud—one at a time instead of all at once. Challenge learners to find out as much as possible as a group and keep the discussion moving. This can be a great opportunity to build a collaborative learning culture in the group and practice using this routine as a whole group to explore a specific natural phenomenon.

Wrapping Up

1. **OPTIONAL: Crosscutting concept: Invite students to share any patterns they noticed and how this impacted their investigations. If students don't answer right away, try asking some specific pattern-related questions as a follow up to their observations. For example:**
   - *I noticed you were looking at those orange flowers. Did you notice a pattern in where they grow and where they don't? How did that help you learn about the flowers?*

2. **OPTIONAL: Crosscutting concept: Share that looking for patterns can help us get more out of science investigations.** Share that focusing on patterns is something all types of scientists do, and students can practice looking for patterns and coming up with interesting questions no matter what they're looking at. If possible, give students a chance to look for patterns in another context during their field activities and discuss how it helped them notice different things.

3. **Ask students to Thought Swap or Turn & Share about the following questions:**
   - *What helped you to learn during this activity?*
   - *Are there any skills you feel like you got better at during this activity? What did you do to develop these skills?*
   - *Did anything surprise you when you were exploring and observing?*
   - *Is there anywhere near your home or school where you would be excited to*

TEACHING NOTES

Observing as if it's the first or last time. You may need to encourage students to observe more deeply. Ask them to imagine that they've never seen an object or organism like this or that this is the last time they'll ever see it. They will need to take in as much as they can (this is a technique the author and environmentalist Rachel Carson used). Or, challenge students to come up with an observation no one else in the group has made. If it's something they are familiar with, challenge students to come up with something they've never noticed before.

Scaffolding cognitive routines. "The ultimate goal . . . is to help students take over the reins of their learning. This is the social justice aspect of culturally responsive teaching." –Zaretta Hammond, *Culturally Responsive Teaching & the Brain*

Taking the time to engage students in a cognitive routine like the one modeled in this activity helps them learn how to learn. It offers students transferable skills and learning behaviors they can use in the future, in and out of the classroom. The more opportunities you give students to apply these tools in different contexts, the more likely they are to own them and to be able to flexibly use them.

Logistics of the *Thought Swap* routine (formerly known as *Walk & Talk*). See the BEETLES Activity *Thought Swap* for the logistics of this discussion routine. Wondering why we changed the name from *Walk & Talk*? We received some feedback from our community partners on how we can use more inclusive language, and we decided to change the name so we were not normalizing walking as the only way of moving and talking as the only way of communicating.

use your observation skills to learn and explore?

4. **Invite students to continue using these strategies with anything they are curious about in nature.** Share that whenever students find anything cool during their field experiences, they can all observe, ask questions, and make connections so they can learn together as a group. Remind them that even parts of nature that at first might not seem cool or interesting, such as a simple leaf, can become exciting if they take the time to really observe. Remind students that even if there is only a brief sighting of an organism, such as a snake slithering away or a hawk flying by, saying observations out loud will help the whole group notice more and remember the experience more deeply.

5. **Offer the idea that students can also use these tools to learn anywhere, about almost anything.** Offer some examples of other things students could learn about by using these tools—such as art, sports, books, etc.—or ask students to share examples. If you're not doing the optional extension on social emotional learning, mention that students can also use these tools to make observations about themselves or a group.

Optional Extension: Using the Routine for Social Emotional Learning

1. **Share that students will get to use their observation skills in a slightly different way: as a tool to check in with themselves and with the group.**
   - *These observation skills are also a useful tool for slowing down and checking in with ourselves.*

2. **Share that when you say, "Go," students will find a spot to stand or sit alone for a few minutes that feels comfortable and interesting to them.** Invite students to find a spot where they won't be distracted by others. Offer clear boundaries for where students can go, as appropriate for your group and site.

3. **Share how students can use the prompts "I notice . . . ," "I wonder . . . ," and "It reminds me of . . ." as tools to focus on their feelings, the feelings of others, and interactions within the group.**
   - *You're going to use the same tools we used before, but this time your focus is not just the natural world.*
   - *You're also going to focus on your feelings, the feelings of others, and how people in the group are interacting.*
   - *What do you notice about yourself and how you are feeling? What do you notice about the interactions of this group? What do you wonder? Does this experience remind you of anything?*
   - *You can focus on looking at nature, yourself, what we've been doing, or the group.*

4. **Model using the three prompts ("I notice . . . ," "I wonder . . . ," "It reminds me of . . .") as tools to focus on the natural world, yourself, and the dynamics of the group.** Using your actual surroundings, curiosity, and feelings, share some observations, questions, and connections out loud. For example, "I'm noticing that the tree I'm sitting next to has different

TEACHING NOTES

Don't skip the partner discussions. Discussion gives students authentic opportunities to process content, formulate and share ideas, and make meaning. Turn & Shares and Thought Swaps give every student in the group the chance to talk about and process their ideas and to listen to those of a peer. Giving students the chance to share ideas in pairs or smaller groups before large-group discussions also increases student participation, makes discussions more engaging, and leads to a more equitable and inclusive learning space. The opportunity to think through ideas and "rehearse" what to share with the whole group in a safe, low-stakes situation is beneficial for all students and critical for students who are English learners or need more processing time.

Doing the optional extensions at a different time. You don't have to offer the optional extensions right away. You could also teach them later in the field experience, after students have had some practice, using the prompts "I notice . . . ," I wonder . . . ," and "It reminds me of . . ." as tools to study nature.

TEACHING NOTES

kinds of leaves than the tree on my other side. I'm noticing birds chirping nearby. I'm also noticing that I feel some tension in my belly. I think maybe it's because I'm feeling a little nervous. I'm wondering what the group thinks of me and if we will all get along. Being in a group like this reminds me a little bit of my soccer team at the beginning of the season before we knew each other. I notice when I shift my attention and notice the breeze in the leaves of the trees, I feel a little calmer and less nervous. I wonder if we will get to explore nature more' it was fun learning from my own observations."

5. **If you've introduced "I think maybe . . . ," share how it can be used to separate observations and explanations when thinking about ourselves or social groups.**
   - *In science, it's important to be aware of when we're making an observation and when we're making an explanation. This can also be useful when we're thinking about ourselves or our experience in a group.*

6. **Model an example of using the prompt "I think maybe . . ." as a tool to come up with explanations for feelings and social interactions.** For example, "An observation might be that the group is quiet. One explanation might be that I think maybe the group doesn't like me. Another explanation might be that I think maybe this group is boring. Yet another explanation might be that I think maybe they're nervous, just like I am."
   - *Often when thinking about ourselves or a group's interactions, we jump to explanations of others' behaviors instead of focusing on the observations.*
   - *We can use "I notice" to focus on our observations of ourselves and the group instead of jumping to explanations. We can use "I think maybe" to help us remember that there are many possible explanations for how people might be acting.*

   Be careful not to use an example that refers directly to a specific dynamic in your group of students or that might put individual students on the spot.

Using journals. If it works for your site and group of students, you might want to invite students to use journals to record their thoughts and reflections. If you do, make sure students know that the exercise is just for them and that no one will read what they write.

7. **Say or signal, "Go" and invite students to find a spot to quietly think about or record observations about self, group, surroundings, and their experiences.**

8. **OPTIONAL: When students return, invite them to share one insight or reflection about themselves with a partner of their choice.** Let students know to share only what they feel comfortable sharing. Ask listeners to try to listen without judgement and to not respond, except through signs of actively listening, such as nods, etc.

9. **Encourage students to continue to look for opportunities to use these tools to slow down, check in with themselves, and notice group interactions in the future.**
   - *In the future, you can use these observation tools to slow down and focus on your observations and feelings as well as the interactions of a group.*

10. **Offer the idea that if students are feeling stressed or anxious, one strategy they can call on to manage these feelings is to make "I notice"**

statements about their surroundings. Share that one strategy to manage feelings of stress or anxiety is to make as many "I notice" or observation statements about students' surroundings as possible. Focusing on natural objects or things we can observe inside a building or room can help ground our attention in things other than anxiety.

Optional Extension: Focus on Asking Scientific Questions

1. **Share that questions can be sorted into categories: testable, researchable (or "look-up-able") and not testable (given our current technology, but interesting to think about).** Share that some questions are testable (or investigable) and can be answered through conducting tests or investigations in science. Share that there are some questions that can be looked up in books or online, which we can call researchable (or "look-up-able"). Share that there are questions that are not knowable through science but are interesting to think about and could be explored through the lenses of literature, philosophy, or other fields.
2. **Invite students to share some questions they asked earlier.** Then, have students sort the questions based on whether they are testable, researchable (or "look-up-able"), or not testable given our current technology, but interesting to think about. Ask students to share some of the questions they had and to say in which category they think their questions belong. You might choose to record the testable questions.
3. **Invite students to sort their testable questions into two additional categories: testable right now through further observations, testable through longer investigations.** Choose a few of the questions students labeled as "testable" and ask whether they think those questions could be answered through further observations right now, or if they might require longer investigations in order to answer.
4. **If students are interested, invite them to try to answer some of their questions through making observations and/or to consider trying to answer other questions through longer investigations.** If student interest is there, invite them to try answering one or more of their questions through further observations. If students are really interested in one of the testable questions they've come up with, this can be a great opportunity to launch a student-led investigation that students could design in the moment or later in their field experience. (Consider the BEETLES activity *Exploratory Investigation* for guidance with this.)

TEACHING NOTES

Examples of sorting questions. Here are some examples of how an instructor might approach sorting questions:

"Some questions can be answered through further observation, such as Jordan's question about whether the color was the same underneath his leaf. What are some other questions like that?" (Let students respond.)

"Elisha's question about whether all leaves of this kind have spines couldn't be answered by observing her one leaf for more time. It might take a more planned investigation that includes other leaves. How could we work together as a group to investigate this?" (Let students respond.)

"Juan wondered how long these leaves take to break down into soil. We could answer that question if we had a few weeks of time. However, that would be hard for us to figure out right now. Maybe someone else has wondered the same thing and studied it. We could record that question and look it up online or in a book."

"Tina's question, 'What do dragonflies dream about?' is pretty fun to think about, but it's not something we can answer with the technology available to us right now."

TEACHING NOTES

An abbreviation for the long activity name. When this routine becomes integral to a program and comes up in discussion a lot, it can be cumbersome to refer to it as *I Notice, I Wonder, It Reminds Me Of* all the time. Instead, some affectionately abbreviate it using the acronym INIWIRMO (pronounced innie worm-o). Some instructors call this routine The 3 (or 4) I's of a Scientist, which includes a play on the word eyes.

Unleashing natural curiosity. We are all born curious, but our curiosity can get stifled over time. Offering students inquiry tools and giving them permission to explore and the autonomy to investigate anything that is of interest to them is one way that we can help them unleash their natural curiosity.

Translations for the prompts. *I Notice, I Wonder, It Reminds Me Of* introduces helpful sentence starters that can support emerging multicultural students and accelerate language development. Offering translations for the sentence starters is particularly helpful for students just beginning to learn English so they can respond in their own language. Here are some suggested translations into Spanish: I notice: Yo noto, noto, or observo. I wonder: Me pregunto. It reminds me of: Me recuerda a, me parece, or me hace pensar. Do some research about the languages spoken by students attending your programs and consider providing the sentence starters in those languages.

Instructor Support

Teaching Knowledge

Processing Information. We are surrounded by huge amounts of information, and our brains are capable of taking in and making sense of much of what we are exposed to in our environment. Yet processing every bit of available information all the time would be overwhelming. We continually make unconscious decisions about the appropriate level of detail and priority of the information we attend to. We often ignore details that are not necessary for our immediate goals. In our deep history, this sorting system has been an efficient way to sift through large amounts of extraneous sensory input in order to prioritize what might be useful for the survival of the species. One way to improve our ability to make observations is to remember that our brains are constantly tuning out unnecessary observations, but we can intentionally broaden or focus our attention to try to unearth new observations. Using the "I notice" prompt to pay attention forces your brain to continually make new observations.

Scientists who study memory function in the brain have found that making connections is what keeps our memories stable and accessible. Accessing memory involves making associations between new information and what we already know. The more connections made to prior knowledge, the more stable the memory, as it is more firmly placed within an existing conceptual framework. The "It reminds me of . . ." prompt specifically helps students make connections to what they already know. This creates relevance for students by allowing them to bring in their prior knowledge and connect to the experience of their own lives. Creating metaphors and analogies also helps to generate more interesting questions. It can also be easier to remember things that you've said out loud, because information is processed in both the speech and the auditory centers of the brain.

Deep observation is a skill that can be learned, and a field experience with students is a perfect opportunity. You may find that you can observe a bird with a group of students until the bird flies away, and when you ask students what they saw, they give only a few superficial responses. Telling them to look carefully or look hard is generally not very helpful advice. It's not just a matter of looking harder; it is a matter knowing how to look. Or, in the context of this activity, how to use the three prompts.

Developing these skills can change the way you and your students experience the world. When you move through the natural world making deep observations, generating questions, and making connections, you experience wonder and curiosity. You are directly engaged and interacting with nature. Providing students with opportunities to spend time focused on one thing in nature tends to help students forge emotional connections with nature. Naturalist/field guide author/instructor John Muir Laws says, "A useful definition for love is sustained compassionate attention." Giving students the tools to focus deeply on different aspects of nature helps them build their own emotional connections and fall in love a little with whatever they're spending time with. Do this with different aspects of nature, and students build emotional connections with the natural world and environmental literacy, in general.

Saying observations, questions, and connections out loud can be powerful. Students (and adults) may become bored in nature if they are not given the opportunity to make observations. The simple act of stating your observations, questions, and connections out loud can be very powerful. Students (and you) will find that they're actively engaging with an organism or object and noticing more things. They'll also tend to remember much more after using these prompts. Even when alone in nature, naturalist and field guide author John Muir Laws keeps up a stream of observations, questions, and connections, saying them quietly under his breath.

Introducing content. Avoid providing information that students could find out through their own observations; this might discourage students from investigating for themselves. Focusing on facts can often switch students into a more passive mode of being in nature. In this activity, concepts discussed will vary depending on whatever the particular "find" is. The good news is that the instructor doesn't need to have specific knowledge about the find for it to be successful. In fact, it's quite engaging for students to explore something that the instructor is authentically curious about and is investigating along with them. Encouraging students to make observations, ask questions, come up with connections, and talk with one another are the most important goals of this activity. Sharing your knowledge or facts about a particular object is optional and should only be done after students engage in some exploration. Sometimes, sharing a bit of information at the right time can incite more curiosity and allow students to apply their thinking in a new way.

Common Related Misconceptions

Misconception. Identifying organisms should be a primary goal for outdoor experiences.

More accurate information. Once we have identified something in nature, we don't often notice anything else about it. In this way, identification sometimes substitutes for deeply observing something. When organisms are reduced to a name or species, we can fail to notice the details of the individual we are observing. Exploring the complexity and nuances of nature by observing and asking questions can be more useful than just receiving an answer. Names are very useful but are usually best introduced (and more memorable) after students have the chance to observe the organism and make a connection to it.

Misconception. Observing in nature means being still and quiet.

More accurate information. You don't have to be quiet and still to observe. Saying things out loud helps cement ideas in our memories. Talking with peers sparks new ideas and opens windows for new observations and connections. Sometimes, being quiet and still in nature is the perfect tool for observing; sometimes, thinking out loud and discussing is also the perfect tool.

TEACHING NOTES

Using the routine in other disciplines. The steps and spirit of the I *Notice, I Wonder, It Reminds Me Of* routine, used here to actively engage students with the natural world, can also be used in other disciplines. In Active Reading, a strategy used to engage students with reading, students underline what seems important in text (I Notice) and write questions and connections (I Wonder, It Reminds Me Of) in the margins. Sticky notes can be used to avoid writing directly on s. This routine can also be used to engage students with art pieces in an art appreciation class. The possibilities are endless! Sharing these connections with classroom teachers can encourage them to carry the routine back to the classroom as part of classroom culture.

Writing prompts. "I notice, I wonder, It reminds me of . . ." can be offered as a writing prompt to students who are doing a solo sit or taking reflection time, supporting them to produce writing that is rich in detail and meaning. You can also encourage students to reflect on their own experiences and write what they notice about how and what they're feeling, what they're wondering about, and what their experiences or feelings remind them of.

TEACHING NOTES

Special Acknowledgment: We want to acknowledge Youth Outside (youthoutside.org) in supporting us to develop more equitable, inclusive, and culturally relevant instructional materials. To learn more about our collaboration with Youth Outside, see: http://beetlesproject.org/beetles-collaboration-youth-outside/.

"Classroom studies document the fact that underserved English learners, poor students, and students of color routinely receive less instruction in higher order skills development than other students." (Allington and McGill-Franzen, 1989; Darling-Hammond, 2001; Oakes, 2005) –Zaretta Hammond, *Culturally Responsive Teaching & the Brain*

Supporting Equitable, Inclusive, and Culturally Relevant Learning Experiences

This BEETLES student activity has been intentionally designed to create an equitable, inclusive, and culturally relevant learning experience for a community of learners. BEETLES design principles [*http://beetlesproject.org/about/how-do-we-approach-teaching/*] ensure that each student activity is nature-centered and student-centered. This enables all learners to access, participate, and engage in the learning experience.

When learners engage directly with nature, they all have access to learning, regardless of their prior knowledge or experiences. Centering learning on students' in-the-moment observations of nature builds an inclusive learning experience by focusing the conversation on an experience shared by every student, as opposed to relying on students' prior knowledge or past experiences. As students engage with nature, instructors are in the role of the "guide on the side." This approach shifts power from the instructor to learners, challenges the typical learning situation in which the instructor is the only expert, encourages students to share their ideas and experiences, and makes learning a more decentralized and collaborative experience.

When learners think like a scientist and practice academic language, they develop critical thinking skills that support them to become more independent learners (learners who have skills and thinking tools they use to learn regardless of the level of support available from a teacher or instructor). Giving students the opportunity to "think like a scientist" by making observations, asking questions, and constructing explanations, supports students' growth as learners, offering them the opportunity to build critical thinking skills and learning behaviors they can apply in any context. Many students in schools that have historically been under-resourced due to racist school funding policies, redlining, income inequality, and police profiling, have fewer opportunities to develop as independent learners. Specifically ensuring that students in these kinds of schools have opportunities to develop as independent learners is an issue of equity. Learning and practicing critical thinking skills in an engaging outdoor context supports students to succeed back in their classrooms, in science, and other academic disciplines. Offering opportunities for students to discuss ideas with their peers and knowledgeable adults makes science more accessible by connecting it to students' own actions, and discoveries in the moment-- not to knowledge they may not have, or experiences they may not have had.

Through discussion, learners make connections to prior knowledge, share their lived experience, listen to different perspectives, and have time to process the material. Productive discussions, in which many voices are heard and the group builds off each other's ideas, create an experience where students see themselves and each other as sources of expertise. This ensures that instructors don't fall back on positioning themselves as the only source of accurate or important information. Participating in discussions also supports students to develop cognitive rigor and the ability to take on more advanced learning tasks. Discussions make student thinking and ideas visible to the instructor. When instructors value, appreciate, better understand, and connect to students' lived experiences, they create a more inclusive and culturally

relevant learning space. Finally, multiple opportunities for discussion provide time and space for neurodiversity–allowing students to process information in different ways. Using discussion strategies like *Turn & Share* or *Thought Swap* (formerly known as *Walk & Talk*) that are part of every BEETLES student activity can help ensure that students have these kinds of opportunities for discussion.

Specifically, this activity promotes an equitable, inclusive, and culturally relevant learning experience by:

- offering curiosity tools, an inquiry mindset, and critical thinking skills that students can use to learn in any context and by supporting students in becoming more independent learners.
- engaging students with commonly found parts of nature (e.g., leaves), which contrasts the exclusionary idea that nature only exists in pristine wilderness areas, requires a panoramic view or unique geographic feature to be engaging, or is otherwise a place students need to go to as opposed to something they are always surrounded by.
- giving students multiple opportunities to connect to and share their lived experiences, and for students and the instructor to listen to and learn from these experiences and perspectives.
- providing space for students to come up with connections between what they are observing and prior experiences and knowledge, which supports their learning and retention.
- giving instructors an approach they can use to guide student-centered and nature-centered exploration and learning throughout the rest of the field experience.
- focusing the group's learning on a common experience to which everyone has access.

Overall, these factors contribute to creating a student-centered approach in which "the ultimate goal . . . is to help students take over the reins of their learning." (Zaretta Hammond, *Culturally Responsive Teaching & the Brain*). This approach to teaching supports students in becoming independent learners who are able to succeed, regardless of any individual teacher or learning context. BEETLES has intentionally designed the sequence and structure of this activity to support learning experiences where all students feel capable of success and have the tools to carry that success into other domains.

Using student-centered and nature-centered learning approaches is just one piece of the work we can do to create equitable, inclusive, and culturally relevant learning experiences. Instructors must also work to become more aware of their own unconscious biases and triggers around culture, identity, and race that impact their interactions with students and affect their students' sense of inclusion.

TEACHING NOTES

Resources on unconscious bias. There are many great resources on understanding and shifting unconscious bias. Here are a few that we have looked to consistently to work on our own unconscious bias and to better understand how it can affect teaching and learning in the outdoors:

- *White Fragility* by Robin DiAngelo
- *Culturally Responsive Teaching and the Brain* by Zaretta Hammond
- Youth Outside [http://www.youthoutside.org/]
- The Avarna Group [https://theavarnagroup.com/]
- Center for Diversity & the Environment [https://www.cdeinspires.org/]

TEACHING NOTES

About the Next Generation Science Standards (NGSS) The development of the Next Generation Science Standards followed closely on the movement to adopt nationwide English language arts and mathematics Common Core standards. In the case of the science standards, the National Research Council (NRC) first wrote a *Framework for K-12 Science Education* that beautifully describes an updated and comprehensive vision for proficiency in science across our nation. The *Framework*–validated by science researchers, educators and cognitive scientists–was then the basis for the development of the NGSS. As our understanding of how children learn has grown dramatically since the last science standards were published, the NGSS has pushed the science education community further towards engaging students in the practices used by scientists and engineers, and using the "big ideas" of science to actively learn about the natural world. Research shows that teaching science as a process of inquiry and explanation helps students to form a deeper understanding of science concepts and better recognize how science applies to everyday life. In order to emphasize these important aspects of science, the NGSS are organized into three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas (DCI's). The DCI's are divided into four disciplines: Life Science (LS), Physical Science (PS), Earth and Space Science (ESS) and Engineering, Technology and Applied Science (ETS).

Read more About the *Next Generation Science Standards* at http://www.nextgenscience.org/ and http://ngss.nsta.org/

Connections to the Next Generation Science Standards (NGSS)

BEETLES student activities are designed to provide opportunities for the three-dimensional learning that is called for in the NGSS. To experience three-dimensional learning, students need to engage in practices to learn important science concepts (Disciplinary Core Ideas) and relate that content to big ideas in science (Crosscutting Concepts). In simple terms, students should be exploring and investigating rich phenomena, trying to figure out how the natural world works.

I Notice, I Wonder, It Reminds Me Of features the scientific practice of *Asking Questions* and the crosscutting concept of *Patterns* as optional enhancements or extensions. Students also have the opportunity to build some understanding of relevant Disciplinary Core Ideas (DCIs) depending on the natural phenomenon they explore, the observations on which they focus, their prior knowledge, and the guidance of the instructor.

Featured Science and Engineering Practices

Building a foundation for engaging in all science and engineering practices. According to the National Research Council's (NRC) A Framework for K–12 Science Education, "The two main goals of science are (1) to systematically describe the world and (2) to develop and test theories and explanations of how the world works . . . careful observation and description often lead to identification of features that need to be explained."

- All aspects of systematically describing the world and developing explanations for how the world works—which are two of the fundamental goals of science—rely on the ability to make observations.
- Making observations is not one of the highlighted NGSS science and engineering practices because it's considered essential for competency in other practices.
- As students develop their observation skills through the *I Notice, I Wonder, It Reminds Me Of* routine, they prepare to engage in other practices of science.
- For example, to be engaged in the practice of *Constructing Explanations*, students need to make explanations about the world based on the available evidence. In the natural world, the evidence for explanations is usually what is directly observable.
- The more specific, accurate observations students can make, the more nuanced and evidence-based their explanations will be.

Engaging students in Asking Questions. According to the Framework, students not only need to ask questions about the phenomena they see in the natural world, they also need to categorize questions as scientific (testable, answerable through observations and experience) or nonscientific (questions that aren't answerable through direct observation). To fully engage in this practice, students need to consider how they might answer their own questions.

- During *I Notice, I Wonder, It Reminds Me Of*, students get plenty of opportunity to develop their ability in asking their own questions while observing natural phenomena.
- At the end of the activity write-up, we provide an optional section (Optional Extension: Focus on Asking Scientific Questions) that can more fully engage students with the practice of *Asking Questions* by sorting their questions based on which questions are testable or not and then discussing how they might approach answering some of their questions.
- Students benefit from the activity regardless of whether or not they take part in the optional extension, but you should make a decision about presenting this section based on your goals for your students.
- Learning more about *Asking Questions* is especially useful if it is a goal for students to focus on planning investigations.

Featured Crosscutting Concepts

Learning science through the lens of Patterns. The idea that patterns exist everywhere, and that taking note of them can lead to questions about why they occur, is an important lens for scientific investigations. According to the NRC's *A Framework for K–12 Science Education*, students should be using patterns to think about their observations and explanations across different disciplines of science (and mathematics).

- In the optional steps provided during the *I Notice, I Wonder, It Reminds Me Of* routine, students practice recognizing patterns during their investigations in the "Inquiry Fever" section and discuss what those patterns might tell them about the natural world during the "Wrapping Up" section.
- If integrating the crosscutting concept of *Patterns* and helping students make more focused observations is a goal for you and your students, include these optional steps in the activity.
- When students are prompted to notice patterns in the "Inquiry Fever" section of the activity, they move from making general observations to making more focused observations that might lead to interesting questions and explanations about phenomena in the natural world.
- Discussion of the patterns students observe during the "Wrapping Up" section is an opportunity for them to go beyond just recognizing patterns to begin thinking about how the pattern might occur and to understand the natural phenomenon more deeply in the process.
- For students to benefit fully from the crosscutting concept of *Patterns*, they need to also learn that looking for patterns is useful in all disciplines of science.
- If *Patterns* is a theme that will guide your field experience, ask students to notice patterns elsewhere and remind them that it's a useful way for scientists to approach their investigations of the natural world.

Applying other crosscutting concepts. Although *Patterns* is the featured crosscutting concept in this activity, a different crosscutting concept could be incorporated to meet other learning goals. For example, if your focus is on the

TEACHING NOTES

Why teach science and engineering practices? "Engaging in the practices of science helps students understand how scientific knowledge develops . . . It can also pique students' curiosity, capture their interest, and motivate their continued study." –National Research Council's Framework for K-12 Science Education. A focus on these science and engineering practices will help to ensure a more scientifically literate public who will, hopefully, be better able to make thoughtful decisions.

More on scientific/nonscientific questions. *The Laws Guide to Nature Drawing and Journaling* (written by John Muir Laws in collaboration with Emilie Lygren) states: "Science is a tool for studying observable experiences and phenomena–the stuff you can see, hear, taste, feel, or measure. *How many holes are in this tree? What time do moths begin to fly in the evening? How long is this earthworm?* These questions can be explored and, in some cases, answered through observation and experimentation. Some things cannot be observed, measured, or tested. *What is God? What is kindness? How do trees feel about the wind? Does the Gray Wolf have a soul?* These questions are outside the realm of science. It's an important part of the human experience to consider them, and you can use disciplines such as poetry, theology, and philosophy to do so."

About crosscutting concepts in the NGSS. Crosscutting concepts are considered powerful thinking tools for how scientists make sense of the natural world. The seven "big ideas" listed as crosscutting concepts are: Patterns; Cause and Effect; Scale, Proportion, and Quantity; Systems and System Models; Energy and Matter; Structure and Function; and Stability and Change. These concepts may sound familiar, as they are quite similar to the themes referred to in science literacy documents as being important ideas that unify all disciplines of science and engineering.

TEACHING NOTES

crosscutting concept of *Structure and Function*, you could instead ask students to: "Pay close attention to the structures of organisms as you do Inquiry Fever. See if you can notice how they are similar and different and what questions or connections this makes you think of. How do the structures relate to what they do for the organism?" This kind of focus on structure and function can prepare students to engage in more activities relating to that theme. If you use an alternate crosscutting concept, be sure to point out to students that it is a big idea that is also useful in other disciplines of science or when investigating any part of the natural world.

Featured Disciplinary Core Ideas

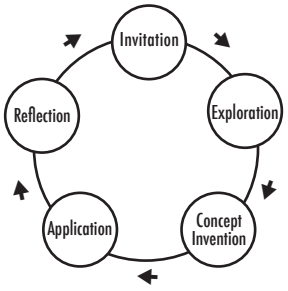
Building an understanding of Disciplinary Core Ideas (DCIs). The NGSS make it clear that students need multiple learning experiences to build their understanding of Disciplinary Core Ideas. I Notice, I Wonder, It Reminds Me Of provides students with an opportunity to build knowledge that might relate to some DCIs. The specific ideas that students engage with will vary depending on what they explore, the observations they make, their prior knowledge, and guidance from their instructor.

In the first part of this activity, students are given a structured opportunity in which to make observations, ask questions, and make connections. Although they might make observations related to certain DCIs during that time, the real opportunity for students to build understanding of science concepts is during and after the "Inquiry Fever" section. With the additional focus on a crosscutting concept during the "Inquiry Fever" section, students' observations can be focused on particular ideas that will help them make sense of their observations. For example, if students notice a pattern for where stones are found on a riverbank, the instructor can ask some questions about what might be causing this pattern, which may lead to an investigation related to understanding erosion or weathering. By paying attention to students' emerging ideas during the activity, you can try to connect them to an important scientific concept (or DCI) that can become the focus of the field experience and discussed more thoroughly during the final "Wrapping Up" section. It's important to provide students with multiple opportunities to deepen their understanding by making sense of these ideas in different ways and revisiting them in other field activities.

Activity Connections

Once students have completed the *I Notice, I Wonder, It Reminds Me Of* routine, they can be reminded to use these prompts at almost any Exploration phase of a BEETLES activity to deepen their literacy with a phenomenon and encourage them to engage in meaning-making.

This social and emotional learning portion of this activity can also be used to scaffold emotional awareness that students can call on in the BEETLES activity *Social Emotional Learning Routine*. Using "I notice," "I wonder," and "It reminds me of" prompts can also make an excellent segue into poetry and creative writing. Consider having students record as many of their ideas as possible. Later, ask them to combine their sentences into a poem. Often, students' observations, questions, and connections, when read, come off as pretty darned "poetical." As with saying things out loud, writing and drawing



***I Notice, I Wonder, It Reminds Me Of* completes a full learning cycle as a discrete activity.** Within the sequence of many activities, *I Notice, I Wonder, It Reminds Me Of* is primarily an Invitation, but students could also use these prompts to deepen their observations during the Exploration phase of any activity.

helps embed ideas in our memory.

This activity is based on an observation routine generously shared with us by John Muir Laws, naturalist, field guide author, and illustrator. Please see his website: [http://www.johnmuirlaws.com] for resources on nature journaling such as *The Laws Guide to Nature Drawing and Journaling*. For more educational resources on nature journaling, see the website and book *How to Teach Nature Journaling* [howtoteachnaturejournaling.com] co-written by John Muir Laws and Emilie Lygren.

TEACHING NOTES

FIELD CARD

Cut out along outer lines and fold along the centerline. This makes a handy reference card that will fit in your pocket.

I Notice, I Wonder It Reminds Me Of . . .

Why Observe?

1. Ask students: Who are some amazing observers, and what makes them good observers?
2. Share one or both of the quotes below and invite students to share what it means to them.
   - *"She knew because she looked." —Zora Neale Hurston, author and filmmaker*
   - *"I see no more than you, but I have trained myself to notice what I see." —Sherlock Holmes, fictional detective, as written by Sir Arthur Conan Doyle*
3. Share that you will offer some tools that students can use to improve or build on their observation skills.

Making Observations (I notice . . .)

1. Ask students to each find one of the same type of natural object and then form a tight circle.
2. Offer a definition for observation and introduce the first prompt: "I notice . . ."
   - *An observation is something we notice with our senses of sight, touch, smell, hearing, taste. Please don't taste anything unless you are told you can.*
   - *I know I'm making an observation when I begin a sentence with "I notice" and then describe what I see, feel, smell, hear, or taste.*
   - *Observations are what you notice in the moment, not what you already know. Saying "I notice it's a leaf" is identification, not observation.*
   - *Saying "It looks awesome." or "I notice it's gross." is your opinion, not an observation.*

   Saying "The leaf has been eaten by bugs." isn't an observation if you can't see any bugs eating it. It's a possible explanation for how the holes got there, not an observation. The observation is that it has holes.
3. Offer some examples of observations.
   - *Here are some examples of observations: "I notice this is yellowish-green in color, oval-shaped, and about the size of my thumb. It's rough in some places and smooth in others."*
4. Share that students will say their observations out loud, taking turns with a partner. Then, offer suggestions for what students can do if they feel stuck.
   - *If you get stuck, try observing your object in a new way, like by flipping it over, putting it next to something else, or using different senses. Listen to what your partner says and see if that helps you notice different things.*
5. Ask students to partner with someone next to them in the circle.
6. Give students ~1 minute to make "I notice . . ." observations about their objects out loud.
7. Invite a few students to share observations with the whole group.
8. Monitor student energy and keep things moving.

Asking Questions (I wonder, . . . ?)

1. Offer "I wonder, . . . ?" as a prompt for asking questions.
   - *I wonder, how long has this leaf been on the ground?*
   - *I wonder, have any insects walked across this leaf?*
2. Invite students to ask "I wonder, . . ." questions out loud with their partners for ~1 minute.
3. Invite a few students to share questions with the whole group.

Making Connections (It reminds me of . . .)

1. Offer the last prompt: "It reminds me of . . ." and share that students can use it to describe what the object looks like or to connect to an experience or piece of information they remember.
   - *"It reminds me of" could be anything this object reminds you of—anything at all!*
   - *This could be something it physically looks like. For example: The veins on this leaf remind me of the lines on the palm of my hand.*
   - *Or, it could be an experience from your life. For example: This leaf reminds me of the time I collected leaves at my grandmother's house.*
   - *It could also be information or knowledge you have. For example: My leaf reminds me of something I learned from a show about uses for native plants.*
2. Share that it can be helpful to focus on one part of the object.
3. Invite students to say "It reminds me of . . ." statements out loud for ~1 minute.
4. Invite a few students to share connections with the whole group.

OPTIONAL: Making Explanations (I think maybe . . .)

1. Share that the next tool is for figuring things out in nature: making explanations.
2. Ask students why they think scientists explain their scientific observations and then share: Scientists make explanations about what they notice to try to understand more about the world and to figure out how things work.
3. Distinguish between observations and explanations and

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offer the sentence starter "I think maybe . . . ."

- *Observations are things we learn through our senses.*
- *When we make observations and wonder about things, we discover mysteries we can try to explain.*
- *Scientific explanations are how we try to explain or make sense of what we see based on evidence and reasoning.*
- *We can start our explanations with the words "I think maybe."*

4. Model making some explanations based on observations of your leaf or of another nearby natural object visible to the group.
5. Invite students to identify the explanation and observation in your example statements.
6. Invite students to use the language of uncertainty when making explanations.
7. Ask students to include evidence in their explanations and offer an example.
   - *When we make explanations, we need to include evidence. Evidence can be observations we have made.*

   Share an example based on something you're actually observing:
   - *For example, I think this half of the tree is dead, and the other half is still alive. My evidence is that all the branches on that half are brown and very dry, while the branches on the other side are soft and have green leaves.*
8. Invite a few students to share some observations of their leaf/object that they might try to explain.
9. Invite students to make explanations by saying, "I think maybe . . ." statements out loud with their partners for ~1 minute.
10. Invite a few students to share interesting explanations with the group, reminding them to include evidence.

Applying the Practices and Inquiry Fever

1. Invite students to think about how much they can discover in nature.
2. Share the George Washington Carver quote:
   - *"Reading about nature is fine, but if a person walks in the woods and listens carefully, [they] can learn more than what is in books..." —George Washington Carver, plant scientist, farmer, and inventor*
3. Share that students will get to look for anything they find interesting in nature and then use their new skills to make observations, ask questions, and make connections out loud.
4. OPTIONAL: Crosscutting concept: Invite students to pay attention to patterns.
   - *When scientists observe and investigate nature, they often look for patterns.*
   - *This leads to more observations and interesting questions about why the pattern occurs.*
   - *Try to find interesting things to practice observation/investigation skills and look for patterns.*
5. OPTIONAL: Crosscutting concept: Show examples of patterns from the field.
   - *Is there a pattern to the height of woodpecker holes on trees? Are they mostly at certain heights?*
   - *Is there moss growing all over the rocks, or only on the tops, or in another growth pattern?*
   - *Is there a general rule about where we can usually find water striders in the stream and where we don't?*
6. Share the boundaries for inquiry fever and then invite students to start practicing their observation strategies in pairs or small groups.
7. Give students at least 5–10 minutes to explore. Offer materials, if available.
8. Circulate, model observation strategies, and support students to engage with one another's discoveries.
9. Facilitate the whole group in practicing strategies together.

Wrapping Up

1. OPTIONAL: Crosscutting concept: Invite students to share any patterns they noticed and how this impacted their investigations.
2. OPTIONAL: Crosscutting concept: Share that looking for patterns can help us get more out of science investigations.
3. Ask students to Thought Swap or Turn & Share about the following questions:
   - *What helped you to learn during this activity?*
   - *Are there any skills you feel like you got better at during this activity? What did you do to develop these skills?*
   - *Did anything surprise you when you were exploring and observing?*
   - *Is there anywhere near your home or school where you would be excited to use your observation skills to learn and explore?*
4. Invite students to continue using these strategies with anything they are curious about in nature.
5. Offer the idea that students can also use these tools to learn anywhere, about almost anything.

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Optional Extension: Using the Routine for Social Emotional Learning

1. Share that students will get to use their observation skills in a slightly different way: as a tool to check in with themselves and the group.

   ▶ *These observation skills are also a useful tool for slowing down and checking in with ourselves.*
2. Share that when you say, "Go," students will find a spot to stand or sit alone for a few minutes that feels comfortable and interesting to them.
3. Share how students can use the prompts "I notice . . . ," "I wonder . . . ," and "It reminds me of . . ." as tools to focus on their feelings, the feelings of others, and interactions within the group.

   ▶ *You're going to use the same tools we used before, but this time your focus is not just the natural world.*

   ▶ *You're also going to focus on your feelings, the feelings of others, and how people in the group are interacting.*

   ▶ *What do you notice about yourself and how you are feeling? What do you notice about the interactions of this group? What do you wonder? Does this experience remind you of anything?*

   ▶ *You can focus on looking at nature, yourself, what we've been doing, or the group.*
4. Model using the three prompts ("I notice . . . ," "I wonder . . . ," "it reminds me of . . .") as tools to focus on the natural world, yourself, and the dynamics of the group.
5. If you've introduced "I think maybe . . . ," share how it can be used to separate observations and explanations when thinking about ourselves or social groups.

   ▶ *In science, it's important to be aware of when we're making an observation and when we're making an explanation. This can also be useful when we're thinking about ourselves or our experience in a group.*
6. Model an example of using the prompt "I think maybe . . ." as a tool to come up with explanations for feelings and social interactions. For example, "An observation might be that the group is quiet. One explanation might be that I think maybe the group doesn't like me. Another explanation might be that I think maybe this group is boring. Yet another explanation might be that I think maybe they're nervous, just like I am."

   ▶ *Often when thinking about ourselves or a group's interactions, we jump to explanations of others' behaviors instead of focusing on the observations.*

   ▶ *We can use "I notice" to focus on our observations of ourselves and the group instead of jumping to explanations. We can use "I think maybe" to help us remember that there are many possible explanations for how people might be acting.*

   Be careful not to use an example that refers directly to a specific dynamic in your group of students or that might put individual students on the spot.
7. Say or signal, "Go" and invite students to find a spot to quietly think about or record observations about self, group, surroundings, and their experiences.
8. OPTIONAL: When students return, invite them to share one insight or reflection about themselves with a partner of their choice.
9. Encourage students to continue to look for opportunities to use these tools to slow down, check in with themselves, and notice group interactions in the future.

   ▶ *In the future, you can use these observation tools to slow down and focus on your observations and feelings as well as the interactions of a group.*
10. Offer the idea that if students are feeling stressed or anxious, one strategy they can call on to manage these feelings is to make "I notice" statements about their surroundings.

Optional Extension: Focus on Asking Scientific Questions

1. Share that questions can be sorted into categories: testable, researchable (or "look-up-able"), and not testable (given our current technology) but interesting to think about.
2. Invite students to share some questions they asked earlier. Then, have students sort the questions based on whether they are testable, researchable (or look-up-able), or not testable given our current technology, but interesting to think about.
3. Invite students to sort their testable questions into additional categories: testable right now through further observations, testable through longer investigations.
4. If students are interested, invite them to try to answer some of their questions through making observations, and/or to consider trying to answer other questions through longer investigations.

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