



## Professional Learning Materials

# Making Observations

This session helps participants directly engage students with the natural world through scientific observation. It provides participants with basic skills, behaviors and tools to use with students to help them become curious about nature. The goal is to empower students to engage with the natural world beyond outdoor science school. Many field instructors have found these tools transformative for their instructional practice, since they shift the attention from the instructor onto student-student and student-nature interactions. Many program leaders use *Making Observations* as a first exposure for staff to BEETLES approaches and professional learning sessions. The session also initiates discussion of some interesting pedagogical topics.

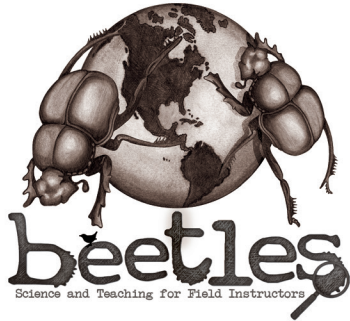
The session is designed to explore different methods and activities that can strengthen student skills in making observations, which is a key practice of field science. It is a key foundation for *all* the methods and activities *all* scientists use to explain and understand the natural world. Making observations is the first way we collect data in order to interpret and make sense of scientific phenomena. For our students, it's a skill that can be learned and improved through thoughtful instruction in outdoor science schools. Spending time making careful observations leads to engagement and emotional connections with the natural world; learning how to cultivate a mindset of actively engaging with your surroundings is a valuable life skill.

Goals for the session:

- To help participants learn the significance and value of helping students make more accurate, detailed observations.
- To model for participants activity routines that help students improve observation skills in order to deepen their engagement, curiosity, wonder, and emotional connections in nature.
- To provide a forum for discussion of how and when anthropomorphism and identifying organisms can be beneficial or detrimental to student observations and interactions with nature.
- To help participants learn how to make better scientific observations themselves.



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## ABOUT BEETLES™

**BEETLES™** (Better Environmental Education Teaching, Learning, and Expertise Sharing) is a program of The Lawrence Hall of Science at the University of California, Berkeley, that provides professional learning sessions, student activities, and supporting resources for outdoor science program leaders and their staff. The goal is to infuse outdoor science programs everywhere with research-based approaches and tools to science teaching and learning that help them continually improve their programs.

[www.beetlesproject.org](http://www.beetlesproject.org)

The Lawrence Hall of Science is the public science center of the University of California, Berkeley. [www.lawrencehallofscience.org](http://www.lawrencehallofscience.org)

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*California:* YMCA Camp Campbell, Rancho El Chorro Outdoor School, Blue Sky Meadow of Los Angeles County Outdoor Science School, YMCA Point Bonita, Walker Creek Ranch, Santa Cruz County Outdoor Science School, Foothill Horizons Outdoor School, Exploring New Horizons Outdoor Schools, Sierra Nevada Journey's School, San Joaquin Outdoor Education, YMCA Camp Arroyo, Shady Creek Outdoor School, San Mateo Outdoor Education, Walden West Outdoor School, Westminster Woods.

*Other locations:* Balarat Outdoor Education, CO; Barrier Island Environmental Education Center, SC; Chincoteague Bay Field Station, VA; Eagle Bluff Environmental Learning Center, MN; Great Smokey Mountain Institute at Tremont, TN; Wellfleet Bay Wildlife Sanctuary-Mass Audubon, MA; Mountain Trail Outdoor School, NC; NatureBridge, multiple locations; Nature's Classroom, multiple locations; North Cascade Institute Mountain School, WA; Northbay, MD; Outdoor Education Center at Camp Olympia, TX; The Ecology School, ME; UWSP Treehaven, WI; Wolf Ridge Environmental Learning Center, MN; YMCA Camp Mason Outdoor Center, NJ; and YMCA Erdman, HI.

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# Making Observations

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### TEACHING ABOUT TEACHING



The presentations in this guide have been designed to “practice what we preach.” This session reflects a learner-centered approach to instruction as participants experience a version of an effective instructional model while they learn about making observations. It’s important to maintain the structure of the session so participants experience observation methods for themselves—before discussing the implications for instructing students. Resist the temptation to provide a lot of information too early in the session. Simply *telling* instructors about observations goes against the whole idea—participants will gain much more from a meaning-making experience where they engage in, discuss and process this important pedagogical topic for themselves.

### PRESENTATION OPTION



**Want to spend more time outdoors than in?** This whole session can be done outdoors. Some slides can be skipped outdoors, but other text is important. You and your co-presenter can take turns writing text from slides on whiteboards, and/or printing some out using black font on white background on as large sheets as possible. You may want to put them in plastic page protectors.

### TIMING TIP



**Keep things moving.** The prompts provided in the session are purposefully designed to generate productive and interesting conversations, but interesting discussions can make it challenging to stay within the estimated time frame. You may need to gently limit some of the discussion, then pick up on the topic at another time, perhaps after staff has had some experience applying the teaching strategies.

## SESSION OVERVIEW

	Making Observations	Activity Locations	Estimated Time
Invitation	<b>Introducing Making Observations</b> The theme for the session is established with the guiding question: How can we help students make careful observations while encouraging wonder and curiosity? The idea that making observations is a <i>skill</i> that can be developed is emphasized.		10 minutes
	<b>Modeling Sensory Activities</b> Participants take part in a series of quick sensory activities involving sound, touch, smell, vision, different perspectives, getting down low, and hand lenses.		25 minutes
Concept Invention	<b>Modeling I Notice, I Wonder, It Reminds Me Of</b> Participants are engaged in this key model student activity that helps build “minds-on” observation skills.		50 minutes
	<b>Debriefing I Notice, I Wonder, It Reminds Me Of</b> The group thoroughly discusses the many benefits of the model activity, including why it is important for learning.		20 minutes
	<b>Discussing Choices for Encouraging Student Observations</b> Participants discuss how and when anthropomorphism and identifying organisms can be beneficial or detrimental to student observations and interactions with nature.		30 minutes
Application & Reflection	<b>Wrapping Up</b> Using a handout of activities and ideas from the session, participants plan how they might integrate them into their instructional practice. They conclude by writing in their journals about observation strategies to use with students and the benefits of teaching observation skills.		20 minutes
	<b>TOTAL</b>	2 hrs, 35 mins	155 + minutes



## PREPARATION

### Before the day of the session:

1. **Prepare to present.** Choose who will present each part of the session (see below for info on model student activities). Consider including staff who have already experienced the session. Read through the session write-up, slides, handouts, sidebars and background section (page 35) to prepare to present. The more each presenter is able to “own” the session, the better the presentation. Write notes on a printed version of the session, or however you prefer. If you choose to present the whole session outdoors, make large copies of slides and/or print out half-page copies for yourself to refer to the information on them, or write it on white-boards. Modeling of student activities should be done outdoors, but if you have severe weather, you can bring leaves in for *I Notice, I Wonder, It Reminds Me Of*, and do *inquiry Fever* with a collection of natural artifacts.
2. **Set up projection system/review multimedia.** Set up and test the projection system to be sure participants will be able to see items projected during the session.
3. **Read and familiarize yourself with the *I Notice, I Wonder, It Reminds Me Of* student activity guide; assess your ability to lead the activity.** Choose the staff member who is most experienced in successfully leading this activity with students to lead this part. The main body of that write-up is embedded in this *Making Observations* write-up. If you will be teaching the activity using the embedded write-up, we suggest you read through the separate BEETLES activity write-up for *I Notice, I Wonder, It Reminds Me Of*, particularly the *Instructor Support* section, taking notes on the embedded write-up included here.
4. **Identify outdoor areas for activities.** These should be nearby areas, but they don’t require anything special. Pay attention to local hazards, such as fire ants, and make adjustments as needed. An area with a lot of leaves of one kind of tree works well for *I Notice I Wonder It Reminds Me Of*. For *Inquiry Fever*, choose an area rich with intriguing stuff to find quickly, such as insects, spiders, lichen, acorns, etc.
5. **Make sure participants are prepared.** Make sure participants bring the gear they need to be comfortable outdoors. Tell them to bring their journals, and something to write with.
6. **Make copies.** See list at right.
7. **Plan when you might include a break in the schedule.** We recommend after modeling *I Notice, I Wonder, It Reminds me of*.
8. **(Optional) Make Session Overview to post on wall.** You may choose to make a Session Overview to post on the wall during this session. Some presenters & participants prefer having it, so they can see the trajectory of the session.

## MATERIALS

### For the group:

- ☐ Projection system and computer
- ☐ Slides
- ☐ A few index cards
- ☐ (Optional) Session Overview to post on wall
- ☐ (Optional) small nets and cups for participants to use to catch organisms

### For each participant:

- ☐ 1 hand lens (optional, but *highly* recommended)
- ☐ Journal and pen/pencil

### Copies and Printed Materials:

- ☐ *Activities & Main Ideas*, 1 per participant, page 32
- ☐ *Choices for Encouraging Student Observations*, 1 per participant, page 31
- ☐ (Optional) *I Notice, I Wonder, It Reminds Me Of* student activity guide (available at [beetlesproject.org](http://beetlesproject.org))

YOU ARE HERE:



10 minutes



TEACHING NOTES

## Introducing Making Observations

1. **Gather participants in a circle outdoors in view of a tree, and introduce the session.**
  - a. Gather participants in a toe-to-toe circle.
  - b. Welcome them. Make sure everyone is ready to begin and has the gear they need to be comfortable during the outdoor experiences.
  - c. Explain: The session is titled, *Making Observations*.
2. **Point out a nearby tree, and ask how they think their students might respond if asked, "What do you notice about that tree?"**
  - Listen to their responses.
3. **Explain that students often need coaching on how to go beyond superficial observations to making deeper observations:**
  - a. When you ask students that question, they often give a simplistic answer like "a tree."
  - b. As environmental educators, we know it's worthwhile to go beyond superficial observations with students.
  - c. In this session we'll be looking at how to help students (and ourselves) deepen observations.
4. **Pair/share the session's guiding question for ~2 min.: How can we help students make careful observations while encouraging wonder & curiosity?**
  - a. Explain: This will be our guiding question for the session.
  - b. Tell pairs to discuss their initial thoughts on the guiding question for ~2 minutes.
  - c. Ask two or three volunteers to share out with the whole group.
5. **Explain that observation is a skill that can be taught and developed, & we can all get better at it:**
  - a. Observation skills must be developed and practiced.
  - b. As field instructors we may have better observation skills than our students, but we can all improve.
6. **Explain that by teaching students specific observation skills, we can help affect the way they experience the world:**
  - a. Telling people to "look carefully," or "look hard" is generally too vague to be helpful. It's actually about learning *how* to observe.
  - b. A field activity with students can be a perfect opportunity to teach observation skills.
  - c. Developing this skill can affect the way your students (and you) experience the world.
7. **Briefly explain the session overview:**

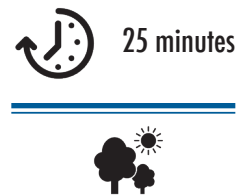


- a. In a minute, we'll be taking part in and comparing two different types of observation activities.
  - b. Later we'll discuss how instructional choices we make influence student curiosity and observations.
- 8. Explain two aspects to making observations: sensory-focused and mind-focused:**
- a. Two important aspects for encouraging better student observations are:
    - What our bodies are doing (sensory or hands-on)
    - What we are thinking (minds-on).
  - b. First, we'll dive into how to help students fully engage their senses in observation, then we'll look at how to actively engage their brains in observations.

## Modeling Sensory Activities

- 9. Explain that we'll be moving pretty quickly through a smörgåsbord of commonly used sensory activities from a variety of sources:**
- a. There are many sensory/observation activities. We'll begin with a quick smörgåsbord of some of these.
  - b. With students you'd probably spend more time on each of these, and spread them out, just doing one or two at a time, but to be efficient right now, we'll do them one after the other, and pretty quickly.
  - c. Activities in this session were inspired/derived from John Muir Laws, Joseph Cornell, Tom Brown, Coyote Mentoring, Steve Van Zandt, Emilie Lygren, and Todd Newberry.
- 10. Invite them to experience the activities from the perspective of participants, thinking about how each activity affects them as learners:**
- a. As field instructors, you might be familiar with at least some of these activities.
  - b. Try experiencing them from the perspective of participants, and think about how they affect you as a learner.
- 11. Remind participants to behave as adults during the activity; explain:**
- a. You'll be participating as adults, following your own curiosity, and discussing discoveries and ideas at your own level.
  - b. The leader will be modeling how to lead it with students, so you should support the leader, not derail discussions too far off-topic, and also keep focused on how students might respond to the activity.
  - c. Acting out negative student behaviors is not helpful. Imagining how your students might respond is helpful.
  - d. There will be some questions that might seem obvious to you, but are designed for students.

### YOU ARE HERE:



**How should participants behave during model activities?** Some leaders ask participants to behave like children during model activities. We've found this often leads to exaggerated parodies of student behavior, and the modeling suffers (or is ruined). Instead, ask them to participate as adults, but to imagine how students would respond. There may be times when they get carried away with discussion of adult content to the point that the effectiveness as a model is lost. You may need to point this out and remind them that their students may not ask those questions.

**These sensory activities are not written up as a "BEETLES" student activity.** Rather, they are culled from various sources. Many of them are probably familiar to you already. The blue box on the following pages indicates where the model student activities begin and end.

## TEACHING NOTES

**Shortening Sensory Activities?** If your situation makes doing the sensory activities challenging, you can shorten it as you see fit, because these ideas will not be that new for many staff. But it's important to do *I Notice, I Wonder, It Reminds Me Of* in its entirety, because it can be such a powerful tool, and when "short-cutted," it's not that powerful.

**Background information on people mentioned here.** See the background section for more information about each of the inspiring observation teachers listed here.

### 12. Share Mary Oliver quote about our "work" during the activities:

- a. Here's a quote from Mary Oliver to help us focus in on our "job" during these activities:

▶ "Let me keep my mind on what matters, which is my work, which is mostly standing still and learning to be astonished." - From the poem, *Messenger*, by Mary Oliver.

### 13. Give the following directions to help participants focus on listening:

- a. OK, you know what your work is now. Let's stand still, and "prepare to be astonished."
- b. Close your eyes in silence.
- c. Hold up a finger for each different sound you hear.
- d. Focus on each sound one at a time. What do you notice about each sound? Is it: High? Low? Loud? Long? Short? Is it one sound or a combination of sounds?
- e. Now try using the *Ear of the Musician*. Listen to the sounds as if they were music. Notice the blend of sounds, the spaces between sounds and patterns they form. Notice the beauty of the sounds together.
- f. Open your eyes. Next is a strategy that Tom Brown, a professional tracker, learned from an Apache tracker. It is used to copy other mammals with big ears. We call it, *Deer Ears*. Cup your hands behind your ears and push them forward in the direction of sounds you want to focus on.

### 14. Give the following directions to help participants focus on touch:

- a. Close your eyes again.
- b. Notice what you feel in your feet. Legs. Arms. Head.
- c. What does the air feel like against your skin? In your nostrils as you breathe?
- d. Can you feel the Sun? If so, where do you feel it?
- e. How does the ground feel beneath your feet? Soft or hard?
- f. Open your eyes and pick up something nearby. Notice its texture, temperature, smoothness or roughness—notice everything you can through touch.
- g. What does it feel like against your arm, neck, cheek?
- h. Choose a very different object and do the same, comparing it with the feel of the other object.

### 15. Give the following directions to help participants focus on smell:

- a. Can you smell anything in the air?
- b. Can you notice temperature and humidity differences by smelling?
- c. Check out the smells of some nearby objects. You may choose to crush part of a leaf to smell it.

## TEACHING NOTES

### 16. Give the following directions to help participants focus on vision:

- Focus in on just the colors around you. Notice all the different variations in browns, greens, etc.
- Now try to ignore the colors, and focus in on just the shadows and light around you, like in a black and white photo.
- Next is another strategy Tom Brown learned from an Apache tracker. This strategy is used to spot game, and used by many animals to spot danger. Tom Brown calls it *"Splatter Vision,"* and in *Coyote Mentoring* they call it *Owl Eyes*.
- Don't focus on anything, but instead try to look at everything in front of you at the same time.
- When you notice motion, you might then focus in on that object.

### 17. Ask for a few additional prompts from participants.

- Ask if a couple of participants want to add any sensory/observation prompts. Keep this brief.

### 18. Explain that by intentionally using your senses in different ways, you tend to notice more:

- You notice much more in nature if you intentionally use senses in different ways.
- You can do this by focusing in on one particular sense, or by taking in multiple senses.

### 19. Use a Tom Brown quote to highlight that you can also improve your observations by shifting perspectives:

▶ *"To see the world from ever-new vantage points is one of the most basic lessons in nature observation."* -Tom Brown's *Field Guide to Nature Observation and Tracking*.

### 20. Give the following directions to have participants observe a tree from as many different "vantage points" or perspectives as possible:

- Notice that tree. Looking at a tree from a distance is one perspective to observe a tree.
- Look down at the ground and take a few paces toward the tree. Now lift your head and look at the tree again. Keep repeating till you arrive at the trunk.
- Look up closely at the bark for an "ant's eye view."
- Now try to observe this tree from as many different perspectives as you can think of. Copy different perspectives you see others doing.

### 21. Pass out hand lenses (if you don't have hand lenses, skip steps 20–24).

- Pass out hand lenses.
- Tell participants to hang them around their necks till the field experience is over.
- While they are being passed around, tell participants to look at their

**Timing.** These sensory activities could be done for hours, but to get to other important parts of the session, use the prompts in quick succession, and don't spend too much time taking in participant feedback. It's just to give them quick "tastes" of some of the possibilities they can look into later.

**No hand lenses?** Hand lenses used to be widespread in outdoor science schools, but seem to have fallen out of use. If your program doesn't have them, you can still use this session and promote good observations skills in your students. However, they are an invaluable tool for engaging students with observing nature, and can open whole new mini-worlds to them. They are a simple, cheap, and important piece of technology for field observations. See the BEETLES activity *Hand Lens Introduction* for more information about how to use them with students.

**Todd Newberry.** See the background section for more about Todd Newberry.

fingerprints through the lens and compare them with others.

**22. Participants practice finding the “sweet spot” with hand lenses, focusing on their fingertips.**

- a. Tell them to try moving the lens farther and closer from their finger, and notice that it goes out of focus as they move it farther away.
- b. Emphasize the importance of having the lens right up against the eye and close to whatever you are looking at.
- c. Have the participants practice finding the “sweet spot”: the position of the lens between their eye and the object where the object comes into perfect focus.
- d. Have them find the sweet spot while looking at their hands, fingertips, hair, etc., and give them advice on their technique, as needed.

**23. Model how to explain hand lens fire safety rules. Explain:**

- a. I’m going to model how to do a hand lens fire safety intro, as I would do with students.
- b. You are never to use the hand lenses to focus sunlight.
- c. Using a hand lens to focus sunlight is dangerous and can result in wildfires that can damage property, forests, animals, and people.
- d. If anyone does this, they will immediately lose their hand lens privilege.

**24. Model how to use hand lenses to look at something small in nature: lens right up to eye, move head till object is in focus.**

- a. With something small and interesting from nature, like a leaf or piece of lichen, model putting the lens close to your eye, then slowly move your head and the lens close to the object till it’s in focus.
- b. Show some excitement when the object comes into focus for you, for example: “Dang, that looks cool! I can see the veins on this leaf—they look like tiny streams running into each other!”

**25. Explain that they will make observations of nature out loud with hand lenses for ~1 min:**

- a. Use your hand lenses to check out different things in nature right here.
- b. Say out loud what you are noticing as you look closely at something (It should sound like a cacophony of “I notice this!” “I notice that!”)

**26. Get their attention, share the following Todd Newberry quote and explain why it’s important to slow down, get down & look around to observe closely:**

- a. Todd Newberry is a former University of California, Santa Cruz professor known for his ability to teach observation skills. Once, after observing a class of students on an intertidal field trip who were all standing upright in the intertidal, he said:

▶ *“They drove 150 miles to the intertidal, but they didn’t go the last four feet. In order to observe anything you have to put your feet in the lowest*



place they can go, and then put your face down where your feet are.” -Todd Newberry

- b. Lots of people don’t go those last few feet and get down close enough to use a hand lens or notice the mysteries around them.
- c. We need to remind ourselves (and our students) to slow down, get down, and look around.
- d. It can open up some surprising and wild worlds!
- e. One of the great things about hand lenses, is that to use them, you’ve got to get down and close. They inspire kids to get down. They are a technology that brings kids closer to nature. They open up a world that you cannot enter any other way!

## 27. Explain that participants will use body radar and hand lenses while observing things in the area:

- a. You’ll have a few minutes to try out what in *Coyote Mentoring* they call, *Body Radar*.
- b. Wander around this area, using your senses and hand lenses, to explore wherever and whatever your body feels drawn to explore.

## 28. Lead a short debrief discussion about the sensory activities.

- a. Gather everyone in a circle.
- b. For ~1 minute, tell people to turn and talk to a person next to them about specific interesting things they observed during the sensory activities.
- c. Get the whole group’s attention, and ask,
  - ▶ *What is the value in doing sensory activities with students?*
- d. Listen to their ideas, and ask follow up questions, as appropriate.

## 29. Wrap up this section by pointing out that there are many great sensory activities, & segue into the next activity.

- a. There are so many great sensory activities and prompts out there, and we’ve only just experienced a few.
- b. We’ll spend more time focusing on a different aspect of observation in this next activity.

## Modeling *I Notice, I Wonder, It Reminds Me Of...*

### 1. Introduce John Muir Laws; explain:

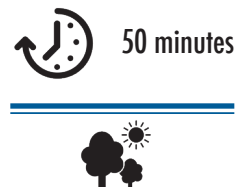
- a. John Muir Laws is a well-known naturalist/artist and author of innovative field guides who also teaches about observation skills.
- b. The following activity, designed to encourage deep observations, is the backbone of both his field work and his workshops—and one that he has shared with BEETLES (and with you).
- c. The activity describes a strategy for engaging students in observations in a different way than the activities shown so far.

### TEACHING NOTES

#### Some ways to hook students into sensory activities:

- Share your own enthusiasm.
- Provide pieces of plastic for students to sit, lie or kneel on, if they are worried about getting dirty.
- Provide each student with a hand lens.
- Give students a task, like counting (sounds, colors on the ground, branches on a tree, etc.)
- Body posture: If assigned to lie on bellies, attention is less likely to wander.

### YOU ARE HERE:



**John Muir Laws.** See the background section for more about John Muir Laws.

**The 3 “I’s” (eyes) of a scientist.** Some field instructors call this routine “The 3 ‘I’s’ of a scientist.”


#### TEACHING NOTES

The student activity has been embedded in this professional learning session for your convenience. In this section, students/participants are referred to as “learners” in order to help you identify the parts that are taken directly from the student activity. The blue box differentiates the student activity from the rest of the write-up.

**Observing as if it’s the first or last time.** You may need to challenge learners into observing more deeply. Ask them to imagine they’ve never seen the object or organism before, or imagine this is the last time they’ll ever see it, so they need to take in as much as they can. Or challenge learners to come up with an observation no one else in the group has made, or if it’s something they are familiar with, something they’ve never noticed before.

2. Pairs share how they might “hook” students into doing sensory activities.
  - a. Move the group to a different nearby area for a change of scene.
  - b. As they walk, tell them to share with a partner strategies for how they might “hook” student into doing sensory activities.
3. Lead the student activity, *I Notice, I Wonder, It Reminds Me Of*:
  - a. Use the student activity lesson embedded here, starting with “Why Observe?” to model this routine with your participants, modeling as closely as possible the way it would be done with students.

#### *Why Observe?*

1. Ask learners: Who are exceptional observers?
  - a. Ask learners if they have ever known or heard of someone in books, movies, or other media, who was really good at noticing things others didn’t.
  - b. Examples might include trackers, Helen Keller, detectives, coaches, artists, birders, someone they know, etc.
2. Ask learners: What makes some observers better than others?
  - a. Ask learners what they think allows some people to be better observers than others.
  - b. Listen to their responses and encourage discussion.
3. Share Sherlock Holmes quote, & ask or explain what it means.
  - Read out loud, or give a learner a card and have them read:  
 “I see no more than you, but I have trained myself to notice what I see.” Sherlock Holmes, as written by Sir Arthur Conan Doyle, from The Adventure of the Blanched Soldier.
4. Explain to learners that people often don’t notice a lot of interesting things around them, and that you are going to teach them some tricks that will help them be better observers, and to notice things others don’t notice.
  - a. During this activity, learners will focus on developing their observation skills to help them learn to notice things others don’t.
  - b. They will learn some strategies that can change the way they experience the world. They can learn to be better observers.

#### *Making Observations (I Notice...)*

1. Each learner picks up natural object, like leaves of the same type, then sit or stand in a circle.
2. Define observation, & introduce the first prompt: “I notice...”



## TEACHING NOTES

- a. Tell learners they will practice making observations first.
- b. Define observation and clarify what kinds of statements are not observations.
  - ▶ *An observation is something we notice with our senses (sight, touch, smell, hearing, taste—but don't taste anything unless you are told to!). I know I'm making an observation when I begin a sentence with the words "I notice" and then say something that describes something.*
  - ▶ *Observations are what you notice in the moment, not what you already know. Saying "I notice it's a leaf" is identification—not an observation.*
  - ▶ *Saying "It looks awesome" or "I notice it's gross" is your opinion—not an observation.*
  - ▶ *Saying "I notice the leaf has been eaten by bugs" isn't an observation because I didn't see any bugs eating the leaf- I just observed the holes. Saying "the leaf has been eaten by bugs" is a possible explanation for how the holes got there, not an observation.*
  - ▶ *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..."*
  - ▶ *If you run out of things to say, try saying, "I notice..." and see what comes out of your mouth. Try observing your object from different perspectives or using different senses. Listen to what others are saying, and see if that helps you notice different things.*
3. **Explain that learners will be sharing observations out loud with a partner, and they should take turns sharing observations out loud.**
  - a. Give learners a moment to partner up with someone standing next to them in a circle.
  - b. Tell learners that if they get "stuck" and run out of observations, they should try observing their object from different perspectives or using different senses.
4. **Give learners ~1 minute to make observations about their object out loud with their partner, then call for everyone's attention.**
5. **Pairs share their observations with a neighbor, then with whole group.**
  - a. Ask pairs of students to share a few observations with a neighbor.
  - b. Then, call on a few individual learners to share what their partner noticed with the whole group.
  - c. If learners are stating opinions or making identifications, gently ask them to make a concrete observation instead.
6. **Instructor role: monitor student energy, & keep things moving.**
  - a. Keep the energy up when learners are sharing in the large group. You don't need to hear from every learner or follow up on every idea shared.

### Verbalizing & mind wandering.

Research shows that when our minds wander, we don't realize it. You can't mind wander and verbalize at the same time. By saying these prompts out loud, it takes us out of our mind wandering, and focuses us back on what we are observing.

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

**For English Learners.** For those who work with English Learners, I Notice, I Wonder, It Reminds Me Of is particularly useful because it has sentence starters that can help them say complete sentences. For learners who speak very little English, let them use their primary language. Here are some suggested Spanish translations: I notice: "Yo noto..." or "noto..." or "observo..." I wonder: "me pregunto..." It reminds me of: "Me recuerda a..." or "me parece," or "me hace pensar..."

## TEACHING NOTES

**Don't be strict.** Learners 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—observation is always a good thing.

**More on how the routine influences our brains.** Saying things out loud helps us remember and notice things as it makes us process information in more than one part of the brain. Learning is social! The process of describing something and communicating it forces us to process that information in our brain in new ways. Descriptive conversations are the beginning of meaning-making and creating explanations about what we observe.

- b. While many learners may want to share their ideas, they'll get a lot of practice using the language by themselves and with partners.
- c. The group will stay engaged and excited if you move on *before* they get restless.

### Asking Questions (*I wonder...*)

1. **Introduce asking questions, & the second prompt: "I wonder..."**
  - a. Tell learners now they'll ask questions about their object out loud.
  - b. Tell them to use the sentence starter, "I wonder" with their partners.
2. **Learners ask questions out loud to themselves for ~1 minute.**
  - a. Give learners about a minute to ask questions in pairs.
  - b. Then call for the group's attention.
3. **A few students share questions with a neighbor, then with whole group.**
  - a. Ask pairs to share some of their questions with their neighbor.
  - b. Then ask a few to share some of their most interesting questions with the whole group.

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

1. **Introduce making connections & the last prompt: "It reminds me of," what it looks like, an experience, or information they already know.**
  - a. Tell learners they have one more tool to practice that helps make connections to things they already know: "It reminds me of."
  - b. This can be something the object looks like, an experience it reminds them of, or information they already know.
  - c. Explain it can be useful to 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.
  - d. Give examples of different kinds of "It reminds me of..." statements so learners get the idea. For example:
    - ▶ *The veins on this leaf remind me of the lines on my palm.*
    - ▶ *This leaf reminds me of the time I collected leaves at my grandmother's house.*
    - ▶ *My leaf reminds me of a TV show about uses for native plants.*
2. **Learners say "It reminds me of" statements out loud for ~1 minute.**
  - a. Challenge learners to come up with and say out loud in pairs as many "It reminds me of..." statements about their object as possible.
  - b. After about a minute, get the group's attention.
3. **A few learners share with a neighbor, then the group.** Invite learners to share some interesting connections, first with a neighbor and then with the whole group.



## Applying the Practice & Inquiry Fever

1. **Help learners think about how much they can discover in nature.**
  - a. Ask learners to look at their leaves/objects.
  - b. Point out how much they learned in a short time about one leaf—then invite them to look around at how much more there is to discover in nature.
2. **Explain that learners will be looking for anything they find interesting in nature, then making observations, asking questions & making connections out loud.**
  - a. Tell learners to hold onto the mindset they now have, and to get ready to use it some more.
  - b. Let them know they will look for anything they find interesting, then use the observation routine they just learned.
3. **Catching “Inquiry Fever”— Explain boundaries, (optional: share materials, such as cups, nets), then have learners practice skills in the area in pairs or small groups.**
  - a. Tell learners that now they know these strategies, they can observe and find out interesting information about anything.
  - b. Take learners to a nearby area rich for exploration, explain boundaries, and send them out to explore.
  - c. Tell them they can explore in pairs, or in small groups.
  - d. Encourage learners to use their new tools and to talk to and learn from one another.
  - e. Give learners at least 5–10 minutes so they can find and engage with something that interests them.
  - f. Offer tools like cups, bug boxes, nets, or hand lenses to enrich their exploration experiences.
4. **Circulate, model the strategies, & help students engage with their findings & with other learners.**
  - a. Help focus learners who may be disengaged by temporarily partnering with them or drawing their attention to something interesting.
  - b. Try to engage learners with each other’s discoveries.
  - c. Model how to make discoveries and use observational and questioning language as you connect with the environment.
5. **Whole group practice together with something interesting.**
  - a. At the site of something particularly cool or easy to see, call the whole group over.
  - b. Give learners the opportunity to make observations, ask questions, and come up with connections out loud, but one at a time instead of all at once.

## TEACHING NOTES

**Inquiry Fever.** Inquiry fever is when a group of learners is enthusiastically investigating nature, feeding off of each others’ discoveries, ideas, and enthusiasm. *I Notice, I Wonder, It Reminds Me Of* is designed to set learners up with an inquiry mindset and skills. Add the other 2 ingredients, and your students can catch the fever. The 3 ingredients for inquiry fever are:

- **Inquiry mindset and skills**
- **Permission and encouragement**
- **Interesting stuff and/or ideas to explore**

**Internalizing the process.** Allowing learners to freely use these prompts to explore things they find in nature will help them internalize the language & routine. This practice helps give them the skills to explore nature on their own without an instructor telling them what to do.

**Take a “Beauty Break,” or “Appreciation Break” and explain that aesthetic observations are important too.** Along the way, you might choose to announce a “Beauty Break,” pointing out something you think is beautiful in your natural surroundings. Then ask them to look around and each find something else they think is beautiful in the natural surroundings, and share it with at least one other person. Point out that aesthetic observations of nature are important too! It’s easy to take our surroundings for granted. Beauty Breaks, called out by instructors or learners, can help learners cultivate a practice of pausing to look around and appreciate where they are, wherever they are.

- c. Challenge learners to find out as much as possible as a group- and keep the discussion moving.

### Wrapping Up

1. Ask learners, “what surprised you,” and listen to their responses.
2. Ask learners to reflect on how they’ve learned to be better observers, all they noticed, & how there are interesting things everywhere.
  - a. Do they feel like better observers now? Why or why not?
  - b. Remind learners that even parts of nature that at first might not seem cool or interesting, like a leaf, can become exciting if they take the time to really look at it.
3. How to use these strategies with anything they encounter in nature anywhere.
  - a. Ask the group how they can use these skills in nature, both at the outdoor school or at home.
  - b. Tell learners that when they find anything cool, they can all observe, ask questions, and make connections so they can learn as a group.
  - c. You might want to come up with a phrase or codeword you or a learner can use to signal that there’s something to check out—when anyone hears the code word, they know to use these observation tools.
  - d. Remind learners that even if there’s only a brief sighting of an organism, like a snake slithering away or a hawk flying by, saying observations out loud will help the whole group notice more, and to remember the experience.

YOU ARE HERE:



20 minutes



### Debriefing *I notice, I wonder, It reminds me of...*

1. As you walk to where you will do the rest of the session, tell pairs to discuss benefits of the *I Notice, I Wonder, It Reminds Me Of* activity routine and compare it with the sensory activities. Explain:
  - a. Find a partner to walk and talk with.
  - b. As you walk, discuss with your partner:
    - The benefits of using a routine like this with students.
    - How the effects of this routine compare with the effects of the earlier sensory/observation activities.
2. Return inside.
3. Show slide 1: *Making Observations*. Lead a whole group discussion about using the *I Notice, I Wonder, It Reminds Me Of...* activity routine with students
  - a. Ask,
    - ▶ Let’s share out with the whole group some of the benefits you discussed of using the routine *I Notice, I Wonder, It Reminds Me*



slide 1



Of...

- b. Listen to their responses, and be sure to give enough time for a variety of ideas to be brought up by the group.
  - c. Refrain from sharing any benefits yourself until the group has fully expressed their thoughts.
4. **Bring up any of the following—but only if they were not already brought up by your group:**
  - a. It helps students get past seeing nature as a “green blur.”
  - b. It’s student- and nature-centered, not instructor-centered.
  - c. Some structure of what to look for/focus on makes it easier for students to take the “risk” of interacting and sharing ideas.
  - d. Focusing on asking questions causes us to make more and deeper observations.
5. **Explain that it’s best to follow the steps of the student activity write-up, rather than try to short-cut it:**
  - a. Some instructors try to short-cut the introduction of the routine, for example by just telling students the prompts and having them repeat them (“everybody say, ‘I notice’”), or just printing them in a student journal and telling students to use them.
  - b. BUT—it is **doing** the steps in the activity that really engage and empower students with the practice and mindset.
  - c. It doesn’t take long to introduce this routine, and the time is well-spent. It will pay off throughout the field experiences.
6. **Explain the brain’s tendency to avoid overload by choosing what to pay attention to, and what to “tune out:”**
  - a. We’ll be mentioning some research about the brain, teaching, and learning research during the session, as it relates to *I Notice, I Wonder, It Reminds Me Of...* and to making observations in general.
  - b. We are constantly surrounded by a huge amount of information, in the form of colors, shapes, patterns, organisms, etc.
  - c. It’d be overwhelming to process every bit of available information all the time.
  - d. Our brains make unconscious decisions about what to pay attention to, and the level of detail to notice.
7. **Show slide 2: *I notice*. Explain that our ancestors were most focused on, “can it hurt me?” and/or “can I eat it?” but we can use the “I notice” prompt to direct the focus of our observations:**
  - a. For our distant ancestors the priority for processing information from observations was probably, “can it hurt me?” and “can I eat it?”



slide 2

## TEACHING NOTES

**Make connections to what participants have said.** To increase the sense of relevance for your staff, and to show that you’ve heard and value their contributions, make connections between the talking points in numbers 5–15 to participants’ previous responses, if possible.

**Diving into the research.** If participants are interested in learning more about research on learning and the brain, direct them to the References section of this guide.

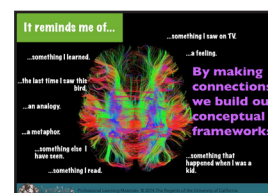
## TEACHING NOTES

**Building environmental literacy.** For more on the connection between making observations and environmental literacy, see the background section.

**Using the routine in other disciplines.** The steps and spirit of the 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 in reading (from the Seeds of Science, Roots of Reading curriculum, and inspired by the research of Cynthia Greenleaf), students underline what seems important in text (I Notice), & write questions and connections (I Wonder & It Reminds Me Of) in the margins. Sticky notes can be used when the page shouldn't be written upon. The routine can also be used to engage students with art pieces in art appreciation. Explaining these connections to classroom teachers can encourage them to carry the routine back to the classroom as part of classroom culture.

- b. Today, we may not be as worried about survival, but we still tune out lots of things around us.
- c. By using the "I Notice" prompt, we can direct the focus of our observations to things our brains might normally tune out.

### 8. Show slide 3: *It Reminds Me Of*. Explain that the "It reminds me of" prompt helps us make connections, metaphors, and analogies, that help build conceptual frameworks:



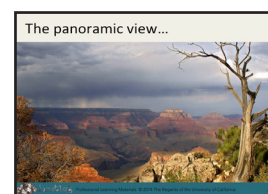
slide 3

- a. Cognitive scientists describe the process of learning as forming conceptual frameworks, as we make connections between ideas and understandings.
- b. Random disconnected bits of information do not as readily "stick to" or become part of our retrievable knowledge bank.
- c. Saying "It reminds me of..." helps create connections in our brains, enriching our conceptual frameworks, and helping us make sense of and remember what we are observing
- d. Metaphors and analogies are examples of these types of connections. By evoking comparisons, they also help us come up with more interesting questions.

### 9. Explain that the prompt helps students make learning relevant to their own perspectives and lives.

- a. Thoughtful educators often try to make learning relevant to students.
- b. This prompt helps students do this for themselves.
- c. It provides specific opportunities for students to make a point of making the learning relevant to their own perspectives and lives.

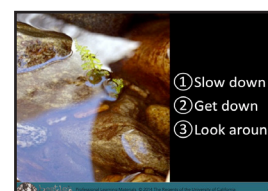
### 10. Show slide 4: *The Panoramic View*. Explain that people often don't know how to engage with nature, and tend to gravitate toward the panoramic view:



slide 4

- a. To many, appreciating nature means visiting dramatic panoramic features in national parks.
- b. Have you ever watched tourists at one of these spots? There's excitement and appreciation. But folks often stand around taking photos for a while, then move on.
- c. They don't know what else to do, and eventually get bored. Bored at the most astoundingly gorgeous locations in the natural world!!!
- d. They haven't learned how to engage with the natural world. Let's see what we can do to fix that!

### 11. Show slide 5: *Slow Down, Get Down, Look Around*. With tools like *I Notice*, *I Wonder*, *It Reminds Me Of...* students learn how to engage with & find awe in the natural world anywhere.



slide 5

- a. When you've learned how to engage with the

## TEACHING NOTES

Read more about awe and curiosity in the background section on page 35.

natural world, you don't need the Grand Canyon to do it.

- b. If you let go of the panoramic view, and "slow down, get down, and look around," there are breathtaking natural beauty and awe-inspiring discoveries to be found all around.
- c. It's probably the most powerful gift we can hope students take away from an outdoor science experience, one they can use in green spaces wherever they live: a park, schoolyard, backyard, etc.

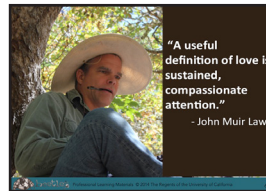
### 12. Explain that focusing on "right answers" can stifle curiosity, but focusing on observations, questions & connections encourages it.

- a. We are all born curious, but our students aren't always encouraged to let their curiosity flourish.
- b. Narrow questions and right answers have their place and purpose, but focusing on them too much can stifle curiosity and thinking.
- c. Routines that encourage students to make close observations, ask questions, and make connections can encourage them to be more curious and actively engage with their surroundings.
- d. Giving students permission and a safe space to be curious allows them to let go of the pressure of knowing or not knowing a "right answer" and helps their natural curiosity blossom.

### 13. Explain that time spent focusing on one thing in nature encourages emotional connections with nature:

- a. Imagine if I were to take the leaf (or whatever object you were examining) during *I Notice, I Wonder, It Reminds Me Of...* and crumple it.
- b. It's just a leaf! But students often become attached to the single leaf they focused on (even though they may be mindlessly stomping on other leaves all day).

### 14. Show slide 6: A useful definition...Share John Muir Laws quote, and explain that when students have multiple experiences "falling in love" with aspects of nature, they develop a relationship with nature.



slide 6

- a. Share John Muir Laws quote:
  - ▶ "A useful definition of love is sustained compassionate attention."
- b. By spending time paying close attention to something even as seemingly trivial as a leaf, we often develop an emotional connection and "fall in love" with it a little bit.
- c. If we give students multiple opportunities to spend time focusing on different specific aspects of nature, it helps them forge emotional connections with the natural world in general.
- d. Developing emotional connections to nature is an important component of environmental literacy.

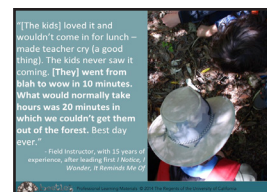
## TEACHING NOTES



**Nurturing a professional learning culture among your staff.** One of the most important things program leaders can provide is a healthy professional learning culture, in which there is an ongoing exchange of ideas about pedagogy. Crucial to this is creating a space in which instructors feel safe sharing their successes, challenges, and ideas. Do your best to facilitate as needed to make sure that's what's happening. It's more important for your staff to feel this learning culture is the case, than it is to "finish the discussion." And, of course, discussion of such topics should never be finished anyway, but should be part of ongoing discussion among staff throughout their careers.

### 15. Show slide 7: *Instructor Quote*. Point out that the *I notice, I wonder, It reminds me of...* routine can be a backbone for instructing students outdoors.

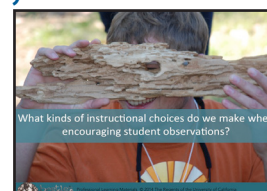
- Give time for participants to read the quote.
- Many field instructors have reported that this routine helped them do with students what they'd always wanted to do, but didn't know how: directly engage them with nature through observations..
- Many educators have found this routine to be transformative for students and for their own instruction in the field.
- Some use it as a backbone for what they do with students, incorporating it into such activities as *Sit Spots*, journal writing, *Card Hikes*, explorations, and investigations.
- Many use it whenever their group finds something students want to learn more about.



slide 7

### 16. Show slide 8: *What kinds of instructional choices...* Briefly review the session so far, and transition to discussing instructional choices & how they affect student observations & engagement with nature.

- We've discussed many of the benefits of making observations, and modeled how to do them with students.
- Now we're going to discuss some of the instructional choices we make, and how they affect student observations and engagement with the natural world.



slide 8

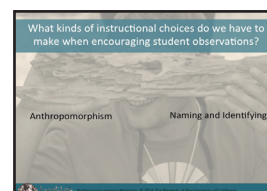
## Discussing Choices for Encouraging Student Observations

### 1. Explain that we make ongoing instructional choices that affect student abilities at making observations:

- There's no one way to get students to make deeper observations.
- The instructional "moves" we make affect how well students are able to make observations.
- As with teaching anything, teaching about observations means constantly making choices and addressing challenges to best serve a particular group of students.

### 2. Show slide 9: *What kinds of instructional choices...* They'll be discussing two topics about instructional choices related to observations: (1) anthropomorphism and (2) naming & identifying:

- This next activity is designed to start juicy conversations about the choices we make in encouraging student observations.
- This slide shows two topics related to making observations that we often run into when instructing students: anthropomorphism and

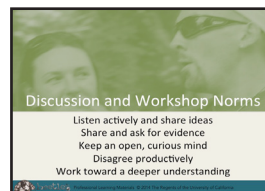


slide 9

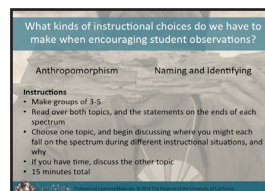


naming and identifying.

3. **Explain that they'll be discussing when anthropomorphism & naming & identifying might be helpful or detrimental to getting students to make observations in nature:**
  - a. When making observations, it's common for students to make anthropomorphic statements—for example, "The lizard likes that rock."
  - b. You'll be discussing whether or when this is detrimental to making observations, and whether or when it might be useful.
  - c. Another factor that can have a big influence on student observations is when and if to tell students names of what they encounter in nature. You'll be discussing different sides of this issue too.
4. **So they'll be discussing where they might fall on the continuum of these two instructional choices.** Tell them the handout has a spectrum of possible choices an instructor might make.
  - a. Each spectrum has a statement at either end, representing different views on the issue. Discuss what you think of them.
  - b. Each person might choose multiple points on the spectrum for different contexts.
  - c. The goal is not necessarily to reach consensus, but to think about and discuss with your group where you might fall on the spectrum during different instructional situations, and why.
5. **Show slide 10: *Discussion and Workshop Norms*. Introduce or remind participants of discussion norms.**
  - a. Introduce the discussion norms. If they're already familiar with them, then review.
  - b. Ask if there are any other norms they'd like to add.
6. **Show slide 11: *What kinds of instructional choices...* Provide directions for the activity. Explain:**
  - a. In groups of 3–5, read over each of the two topics and each spectrum of choices.
  - b. Choose one topic to begin discussing first. Each group member should share where they might place themselves on the spectrum during different instructional situations, and why.
  - c. If you have time, move on to the other topic, but don't rush it.
  - d. You'll have ~15 minutes total for your small group discussion.
7. **Pass out the *Choices for Encouraging Student Observations* handout to each participant and tell them to discuss for ~15 min.**
  - a. Try to check in for a few minutes with each group to get a sense of the topics they're discussing, and their ideas.



slide 10

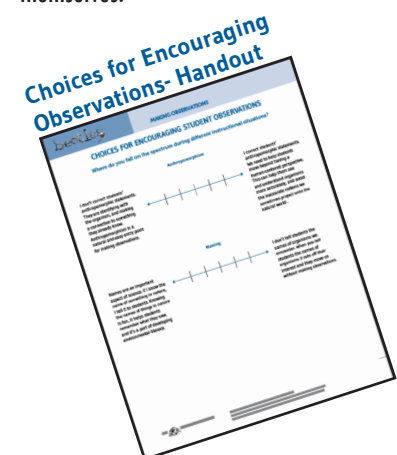


slide 11

## TEACHING NOTES

Sometimes these discussions can become heated, so depending on your staff and how accustomed they are to discussion, it can be time well spent to go over the science discussion norms offered here, and/or any that your program uses. If you anticipate that members of your staff may struggle with aspects of participating in discussion, such as letting others be heard, then you may want to emphasize those aspects, and ask the group to brainstorm how to prevent and deal with such issues before they arise.

Mix your more & less experienced field instructors. These conversations are best with mixed experience levels of field instructors in each group. On their own, new field instructors may not have enough information or experience to really delve deeply into the discussions. Left to their own devices, staff may group themselves based on experience, so you may need to regroup them, or ask them to mix themselves.



## TEACHING NOTES

**Assessment opportunity for you.** These discussions can be an opportunity to learn about your staff and their ideas about instruction. “It was great for me to get a feel for where each naturalist seemed to stand on those topics. Initially there were extremes on both ends in almost every small group, but, after discussion, they all appeared to recognize that it is a sliding scale that needs to be adjusted dependent on the group at that time.”

— Program Leader

**Connecting with nature.** Instructors often say that anthropomorphizing an animal helps students make a connection to it. Empathizing with an animal and thinking about the world from its perspective can also help students to build a connection—and can lead to more accurate observations. Instructors often make this point, and some coined the term “organismorphism,” to describe thinking about what it would be like to experience the world as a particular animal.

**If they want to keep the discussion going.** Like other juicy discussions, this discussion could easily go on beyond the recommended time. Keep the time you have for the entire session in mind. If you’re going over, you may want to gently limit the discussion, then pick up on the topic at another time, perhaps after staff has had some experience with applying the teaching strategies. One way to end a discussion without it feeling unresolved, is to summarize what’s been discussed so far.

- b. Take notes from what you hear on index cards. You can use these later during the debriefs to connect points you are making with what you heard them say during the discussions.
- c. Allow small group conversations to last about 15 minutes.

## 8. Bring attention back together to have a whole group debrief on each of the topics.

## 9. Debrief Anthropomorphism.

- Ask each group that discussed this topic to share one or two of the most salient points that came up.

## 10. Summarize points on both sides of Anthropomorphism; try to make connections to what you heard them say during discussion as you explain:

- a. At times, it may be useful to let students make anthropomorphic statements if it helps them relate to what they are observing.
- b. Metaphors and analogies are particularly useful forms of anthropomorphism. The prompt, *It Reminds Me Of...* encourages these.
- c. However—if we’re striving for *scientific habits of mind and accuracy*, it’s also important to sometimes point out when anthropomorphic ideas are inaccurate; anthropomorphizing pulls an animal into a human way of perceiving the world.
- d. In order to get as close as possible to what’s really going on when observing organisms, scientists strive for humility and open-mindedness.
- e. Scientists try to avoid making assumptions about organisms, such as what they feel, think etc., and to avoid projecting human traits on them.
- f. Empathizing—or placing ourselves into the life of an animal—can be different from anthropomorphizing, can be a powerful lens to catalyze learning, and can lead to a different perspective, which in turn could lead to novel observations.
- g. Simple word coaching can gently help students keep an open mind and consider multiple perspectives. For example:
  - Student: “the lizard likes that rock.” Instructor: “We can’t know what the lizard likes, but we can observe that it’s spending most of its time on that rock. How might the lizard benefit from spending so much time on the rock?”
  - Student: “Those bugs are fighting.” Instructor: “There may be some reason other than fighting that they are holding onto each other. What are some other possible explanations? Let’s keep watching to see if we can find out more about what’s going on.”

## 11. Debrief Naming and Identifying.

- Ask each group that discussed this topic to share one or two of the most salient points that came up.

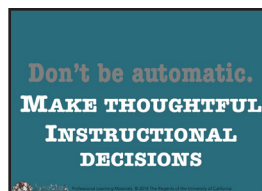
## 12. Summarize points on both sides of Naming & identifying, while trying to make connections to what you heard them say during discussions. Say:

- a. Learning names of organisms is useful, but when and how organism names are shared with learners can significantly impact observations and learning.
- b. Share this John Muir Laws quote:
  - ▶ *"Names are useful and important, but there's some sort of switch that can go off in our head once we have figured out the name for a species we are observing. That's why when teaching, instead of leading with the name, I 'trail' with it."*
- c. To encourage student engagement with and getting to know an organism through observations, questions, connections, and explanations, it's generally (but not always) best to hold off on providing a name until after students have made their own observations of the organism.
- d. It's also useful to have students look up organisms using simple accessible keys, to empower them to learn how to identify organisms for themselves.

## 13. In teaching, there aren't absolutes—for each instructional decision, the answer is "it depends."

- ▶ *The answer to almost every question about teaching is "it depends!"*
- ▶ These questions are deep and important, and worth discussing and re-discussing throughout your careers as educators.

## 14. Show slide 12: *Don't be automatic.* Explain that it's important not to fall back on habit & do things automatically, but instead to make thoughtful, intentional instructional decisions based on the situation:



slide 12

- a. Sometimes, as instructors, we fall back on habit, and don't consciously make decisions, but do so unconsciously or automatically.
- b. But our instructional choices impact how students learn.
- c. Thinking about the impact of our instructional moves, and making thoughtful choices, improves our instruction.
- d. To be excellent instructors, we need to be thoughtful about each specific situation—the students, what students say, our goals, the environment, moment in time, etc.—and try to make the best decision for that situation.

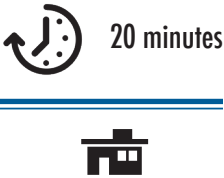
## TEACHING NEWTS

**Teaching Newts is much more challenging than teaching humans.** Meaning-making discussions are very difficult to orchestrate with amphibians that can't talk!

**A focus on observations lessens the immediate need to name or to know "what it is."** We've been asked, "But won't students be frustrated if I don't tell them what it is?" That's a common concern of field instructors who are new to the idea of sometimes holding back from telling students information up front. It's true that the first question people often have about something they find in nature is, "what is it?" But, by asking students to focus on making observations, they usually become intrigued by their observations, and don't have a problem with not being told what it is right away.

**Discussing when to introduce content.** A discussion related to when it's appropriate or not to introduce content is included in the BEETLES *Promoting Discussion* session. This is an extremely important, interesting, and complex discussion for instructors and leaders to have on an ongoing basis.

**YOU ARE HERE:**



20 minutes

**TEACHING NOTES**

## Wrapping Up

### 1. Show slide 13: *What do you notice?* Summarize how students need support to train their bodies & minds to engage in & make deeper observations.

- We looked at a tree in the beginning of the session and agreed that if you just ask students what they observe, they probably won't notice or engage very much.
- But if students have support and scaffolding for learning how to train their bodies and minds to make more accurate and detailed observations, their observations and engagement will be much deeper.



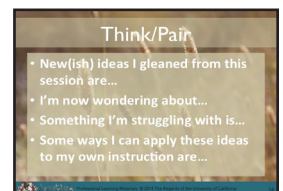
slide 13

### 2. Briefly discuss—what kind of evidence can we look for to tell if students are making deep observations. Say and ask:

- We can't know what's going on inside a students' head.
  - What are some external cues we can look for to assess whether a student is being deeply observant?
- ▶ *What do you think evidence of a deeply observant student might look like?*
- Listen to participants' ideas and share some of the following if they are not mentioned:
    - Looking closely at something for an extended period of time.
    - Incorporating senses beyond vision alone, when making observations.
    - Using a hand lens.
    - Describing observations accurately.
    - Finding new (and sometimes mysterious) things to ask questions about.
    - Noticing details, such as texture, color, etc.
    - Observing from different perspectives.
    - Connecting new observations to prior knowledge and others' observations.

### 3. Show slide 14: *Think/Pair.* Guide participants in a *Think/Pair* to plan, reflect & incorporate activities and ideas from the session into instructional practice; explain:

- You'll now have a little time to plan how you might integrate some of these activities and ideas into your practice.
- Use the *Activities and Main Ideas* handout to help remember some of what we talked about.
- Think individually first, using the sentence starters, then discuss your ideas with a partner.



slide 14

4. Pass out the handout, *Activities & Main Ideas*, & have them discuss with a partner for ~10 minutes.

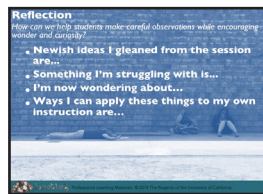
- Give participants about 10 minutes to think and discuss with a partner.

5. Get the whole group's attention and ask volunteers to share what surprised them, or ideas that may have shifted for them:

- To nurture a learning community, it's useful for others in the group to hear about your reflections.
- Would anybody be willing to share anything that surprised them, or something that has shifted your ideas?

6. Show slide 15: *Journal Reflection*. Have participants reflect in journals. Explain:

- Take a few moments to record in your journal anything you'd like to remember and/or incorporate into your teaching from this session.
- You can use the guiding question: How can we help students make careful observations while encouraging wonder and curiosity?
- You can also use the sentence starters.



slide 15

## TEACHING NOTES

### Activities & Main Ideas- Handout



## APPLYING SESSION TO INSTRUCTION

**The session is not over!** A critical phase of learning anything new is **application**, when the learner takes new knowledge and applies it. There is some application included in the session, but, as with all professional learning for instructors, the rubber meets the road (or trail), when the instructors apply what they've learned to their instruction, and when they keep thinking about it and discussing it with their peers. If you want your instructors to try out "new" activities/approaches, program leader support is crucial. Even if they're excited by new ideas, it's easy for them, especially veteran instructors, to keep doing what they have been successfully doing already, and not try out new activities/approaches. Below are a variety of follow-up activities and discussions to dig deeper into the topic, and help you facilitate thoughtful implementation.

- **Staff brainstorm of what they and you can do to encourage incorporation of observation strategies.** After the session reflection, your staff will have already written ideas they have about implementation into their instruction. You can tap into these, as well as other ideas, through a brainstorm of what they plan to do, and how you can support them in doing it.
- **Instructor Observations.** If you do observations of instructors, discuss how you might incorporate elements from this session into the observations.
- **Discussing Implementation of *I Notice, I Wonder, It Reminds Me Of*.** Assign your staff to each try *I Notice, I Wonder, It Reminds Me Of* during their next student program, and write in their journal about how it went. Then, lead them in a discussion of the activity at the end of the program. Here's some suggested questions to focus a reflection or discussion on:
  - » What impact did the activity have on your students' ability to make observations, and to engage with nature?
  - » What was successful about the activity?
  - » What might you do differently the next time you lead it and why?
  - » How did you incorporate the routine into students' other field experiences (e.g., journals, sit spots etc.), and what ideas do you have about incorporating it in the future?
- **Continuing a discussion.** If there was a topic that came up during discussion that you had to cut off, and it seems like your staff is still interested, set aside some time to continue the discussion.
- **Look for external professional learning opportunities.** Encourage staff members to attend workshops by John Muir Laws/Emilie Lygren on observations and journaling, and/or to try out some of the free activities from his website ([johnmuirlaws.com](http://johnmuirlaws.com)) Encourage attendance of workshops by Tom Brown (<https://www.trackerschool.com/>), Jon Young (<https://www.facebook.com/AuthorJonYoung>), Steve Van Zandt or Todd Newberry.



- **Assign your staff a reading related to the ideas in this session.** Tell them to use active reading strategies like underlining important points, writing out questions and connections in the margins, and asking critical questions like who wrote this, who is the audience, etc. Have them pair up with someone else and compare their notes and ideas, then bring this discussion into the whole group. Here are some suggested readings:
  - *Intentional Curiosity* by John Muir Laws, an excerpt from the book, *The Laws Guide to Nature Drawing and Journaling*.
  - *Lafayette Library's Science Cafe: Improving observational skills*, by Lou Fancher. This newspaper article covers more information about John Muir Laws and *I Notice, I Wonder, It Reminds Me Of*. Source: [http://www.mercurynews.com/my-town/ci\\_28022113/lafayette-librarys-science-cafe-improving-observational-skills](http://www.mercurynews.com/my-town/ci_28022113/lafayette-librarys-science-cafe-improving-observational-skills).
  - *Three Prompts for Deeper Nature Observation*, by John Muir Laws. This short article reviews much of the material from the session related to *I Notice, I Wonder, It Reminds Me Of*, and why it works so well when teaching students to make observations in nature. Source: <http://www.johnmuirlaws.com/natural-history/deep-observation>
  - *Falling in Love with Nature*, by John Muir Laws. In this short article, John Muir Laws speaks about how focusing “sustained compassionate attention” on organisms in nature helps create emotional bonds with the natural world, resulting in stewardship. Source: <http://www.johnmuirlaws.com/stewardship/falling-in-love-with-nature>
  - *The Science of Awe*, by Jake Abrahamson, an article about how experiencing awe can inspire collaboration, critical thinking, and other benefits. Ask your staff to brainstorm instances in your program that can lead to awe-inspiring experiences for students and to discuss how they might provide students with opportunities that model how they can find awe-inspiring experiences in any green space near where they live. Source: [http://greatergood.berkeley.edu/news\\_events/in\\_the\\_news\\_item/the\\_science\\_of\\_awe](http://greatergood.berkeley.edu/news_events/in_the_news_item/the_science_of_awe)
  - *Noticing: How to Take a Walk in the Woods*, by Adam Frank. A short article on how using science observation skills and mindset can lead to wonder in the natural world. Source: <http://www.npr.org/sections/13.7/2013/05/14/178467726/noticing-how-to-take-a-walk-in-the-woods>
  - *Fine-tuning the Senses*, by Tom Brown, an excerpt from the book, *Tom Brown's Field Guide to Nature Observation and Tracking*.
  - *A Philosophical Interlude* by Todd Newberry, an excerpt from the book, *The Ardent Birder*. In this chapter, Todd describes making detailed observations as being like interviewing an organism. The BEETLES Student Activity, *Interview an Organism*, is inspired by this approach. Some questions to ask: how might you apply “interviewing organisms” to you instruction; how can you help students ask questions that lead to deeper observations.

See the complete citation for *The Laws Guide to Nature Drawing and Journaling* in the reference list.



[johnmuirlaws.com](http://johnmuirlaws.com) is a rich resource for reading and learning about nature journaling and making observations.



- **Pass out copies of the optional handouts and discuss:**
  - The *More on Making Observations* section of the *Background Information for Presenters* on page 35.
  - *A Whole Bunch of Quotes Related to Making Observations* (on ): Ask participants to choose 1-2 quotes they find particularly meaningful and then discuss their choices with a partner.
- **Lead the following extended application activity, *Confidence & Accuracy in Observations*, on the next page.**



## Confidence & Accuracy in Observations

### 1. Introduce the Monkey Business Illusion video, and explain:

- You'll be watching a video related to developing observation skills. Your job is to pay attention to and count how many times the ball is passed between players wearing white shirts.
- Please watch the video in silence, and keep any reactions to yourself.

### 2. Play the Selective Attention Test video.

### 3. Lead a discussion on the video experience:

- ▶ Did you notice anything other than the basketball passing? What?
- ▶ Who noticed the gorilla walking by?
- ▶ Who noticed the curtains change color, or the player leaving?
- ▶ Why did some people not notice the gorilla, curtains, and player leaving?

### 4. Explain that we're not as good at observing as we sometimes think we are.

- We can be distracted from having a more general awareness when our attention is focused on particular things.
- In general, we're not as good at observing as we think we are, which is why we have to work at it.

### 5. Explain that humans are generally not very observant, but are overly confident, & our observations are an interpretation of reality:

- Our magnificent brains are adept at taking data in, quickly creating a picture ("filling in the holes") and making up what we can't actually see, based on our existing conceptual framework, in order to make better sense of the world.
- "Filling in the holes" works well for us... except when it doesn't.
- It's very easy to miss important details of our surroundings, yet we are often overly confident in our brief observations.
- Magicians and scam artists take advantage of these tendencies by manipulating our focus of attention, causing us to be deceived by our own observations.
- Our observations are not reality, but an interpretation or a model of reality created by our brain.

### 6. Share James Elkins quote:

- "My world is full of holes... The way I see is a little like the way a blind man taps along the street: he knows just that one spot where his cane touches down, and he hopes he can pretty much guess the rest."  
— James Elkins, *The Object Stares Back*

#### YOU ARE HERE:



30 minutes



#### TEACHING NOTES

#### Before you begin this session:

- You'll need a computer, projector, speakers, and an internet connection.
- Load the full video before you begin.
- The URL for the video is: [https://www.youtube.com/watch?v=IGQmdoK\\_ZfY](https://www.youtube.com/watch?v=IGQmdoK_ZfY)

## MAKING OBSERVATIONS

### 7. Explain how the more data we have, the more accurately our brains can fill in the picture:

- a. Our brain can take few data points with very little information, and fill in what's missing, like the blind man with the cane.
- b. The more data we have, the more accurate our impressions tend to be—we have more “touches from the cane.”

### 8. Share research points from the book, *Thinking Fast and Slow* about how our confidence doesn't always match the quantity of data we possess:

- a. There is research that has found that the less data we have, the less accurate we tend to be. That's probably not surprising.
- b. But what may seem odd is that the less information we have, the more confident we often are about our inferences. And the more information we have, the more uncertain we tend to be about what we know.

### 9. Lead a short discussion on why participants think this is so.

- ▶ *Can you recall examples of when someone had lots of confidence, but very limited information, or someone who had lots of information, but expressed their ideas with a degree of uncertainty.*
- ▶ *Why do you think it's often the case that less information = confidence, and more information = less certainty?*
- Listen to their ideas and ask follow-up questions to probe into thinking.

### 10. Explain that science emphasizes being open-minded and stating ideas with an appropriate amount of uncertainty.

- a. The work of scientists is gathering tons of information from an incredibly complex world and trying to make the best explanations possible, while simultaneously being open to new data and interpretations.
- b. The experienced scientist knows more about how much she doesn't know about her topic of study than most others do. It's no wonder a scientist who has spent years carefully studying something may sometimes seem less certain than someone with much less experience.

### 11. Explain that being a humble observer takes practice and training:

- a. It seems that humans have a tendency toward arrogance—we tend to assume that we understand more than we actually do, as we make observations.
- b. Strive for **humility** instead. “We can't possibly understand everything, but we'll do our best.” For scientific observations, it's necessary to train ourselves to be better and more humble observers.

### 12. Explain that making scientific observations is meant to be our best attempt at describing the world as closely as possible to reality:

- Although we are flawed observers, when we make scientific observations, we are trying to avoid our own biases, anthropocentrism, and our own projections from our conceptual frameworks.



## CHOICES FOR ENCOURAGING STUDENT OBSERVATIONS

Where do you fall on the spectrum during different instructional situations?

How might each instructional decision enhance or interfere with students' capacity to make observations?

### Anthropomorphism

(For example: "That lizard likes that rock" or "Those bugs are mad and fighting.")

I don't correct students' anthropomorphic statements. They are identifying with the organism, and making a connection to something they already know. Anthropomorphism is a natural and easy entry point for making observations.



I correct students' anthropomorphic statements. We need to help students move beyond having a human-centered perspective. This can help them understand organisms more deeply, and avoid the inaccurate notions we sometimes project onto the natural world by assuming everything experiences the world in the same way humans do.

### Naming/Identifying Organisms

Names are an important aspect of science. If I know the name of something in nature, I tell it to students. Knowing the names of things in nature is fun; it helps students remember what they saw, and it's a part of developing environmental literacy.



I don't tell students the names of organisms we encounter. When you tell students the names of organisms it cuts off their interest and they move on without making observations.

## ACTIVITIES & MAIN IDEAS

### Sensory/Observation Activities\*:

- Focus on sounds: counting sounds, quality of each sound, sounds as music, deer ears. *(Inspired/Derived from Joseph Cornell, Jon Young, Tom Brown)*
- Focus on touch: body, air, ground, then compare 2 objects. *(Inspired/derived from Tom Brown)*
- Focus on smell: air and nearby objects. *(Inspired/derived from Tom Brown)*
- Focus on vision: colors, shadows, & light, using "Owl Eyes." *(Inspired/Derived from Tom Brown & Jon Young)*
- Observing a tree from as many different perspectives as possible. *(Inspired/Derived from Steve Van Zandt)*
- Other sensory/observation activities [Sit Spots, Nature Drawing, Journaling, Card Hike etc.]
- "Slow down, get down, look around."
- Using hand lenses
- Body Radar [wandering wherever your body feels like going, and checking things out] *(Inspired/Derived from Jon Young & Coyote Mentoring)*
- Beauty Breaks/Appreciation Breaks *(Inspired/Derived from Emilie Lygren)*
- *I Notice, I Wonder, It Reminds Me Of...* *(Inspired/Derived from John Muir Laws)*

\*Inspired by John Muir Laws, Joseph Cornell, Tom Brown, Coyote Mentoring, Steve Van Zandt, Emilie Lygren, & Todd Newberry

### Main Ideas:

- The answer to almost every question about teaching is "it depends!"
- Don't be automatic with instructional decisions, but make thoughtful choices about how to guide students depending on the situation.
- Observation skills encourage wonder, curiosity, & emotional connections with nature.
- Names are useful, but answering student questions or telling names right away can sometimes discourage exploration, observation, thinking, curiosity. It's often effective not to "lead" with a name, but to "trail" with it.
- We should be sensitive to the moment, and to the spirit of inquiry, when deciding what information to provide, and when to do it.
- Instructors who share information judiciously, and after students have had opportunity to wonder and think about it, find that students can get more out of their observations.
- Anthropomorphism can cloud accurate perceptions of nature. But sometimes anthropomorphism is a way for students to connect with the natural world.
- By subtle word-coaching and by encouraging open-mindedness, we can help students see nature from different and more accurate perspectives.
- Being a good observer takes practice and training.
- Making scientific observations is meant to be our best attempt at describing the world as accurately as possible.
- We have a tendency to focus our attention and miss out on other things. We can choose to direct our focus of attention.
- Scientific observers should strive to be "humble" and attempt to make accurate, detailed observations.

## A WHOLE BUNCH OF QUOTES RELATED TO MAKING OBSERVATIONS

- "I see no more than you, but I have trained myself to notice what I see." —*Sherlock Holmes*
- "The world is full of obvious things which nobody by any chance ever observes." —*Sherlock Holmes*
- "Let me keep my mind on what matters, which is my work, which is mostly standing still and learning to be astonished." —*Mary Oliver*
- "A useful definition of love is sustained compassionate attention." —*John Muir Laws*
- "If you love it enough, anything will talk with you." —*George Washington Carver*
- "Names are useful and important, but there's some sort of switch that can go off in our head once we have figured out the name for a species we are observing. That's why when teaching, instead of leading with the name, I 'trail' with it." —*John Muir Laws*
- "Curiosity is not a trait that you have or don't have, but a skill that you can develop." —*John Muir Laws*
- "They drove 150 miles to the intertidal, but wouldn't go the last four feet." —*Todd Newberry*
- "There is almost never a reason not to be slow. Nature will not speed up just because you have arrived." —*Todd Newberry*
- "Naming and making lists of animals and plants is 'Glance & Go' nature watching. It might be a fun sport, but it's not natural history or science." —*Todd Newberry*
- "Without questions, natural history is a stand-off. You stare at nature and nature just stares back." —*Todd Newberry*
- "Why bother with metaphors and analogies? Because they are the threads we use to sew together the fabrics of our comprehended world." —*Todd Newberry*
- "To see the world from ever-new vantage points is one of the most basic lessons in nature observation." —*Tom Brown*
- "The only true voyage of discovery consists not in visiting strange lands, but in having new eyes." —*Marcel Proust*
- "Human beings have a strong, strong, strong tendency that if we see an animal do something that's analogous to what we do, like use a tool or answer an arithmetic question, we assume that the animal is doing it and understands the situation in the same way we do. And sometimes that's true but more often it's false." —*Alan Kamil, Center for Avian Intelligence at the University of Nebraska*.
- "One way to open your eyes is to ask yourself, 'What if I had never seen this before? What if I knew I would never see it again?'" —*Rachel Carson*
- "My world is full of holes...The way I see is a little the way a blind man taps along the street: he knows just that one spot where his cane touches down, and he hopes he can pretty much guess the rest." —*James Elkins, The Object Stares Back*
- "Much of the grand tradition of natural history falls somewhere in the valley between science and poetry." —*David Rothenberg, Why Birds Sing*
- "Hands-on experience at the critical time, not systematic knowledge, is what counts in the making of a naturalist. Better to be an untutored savage for a while, not to know the names or anatomical detail. Better to spend stretches of time just searching and dreaming." —*Edward O. Wilson*
- "Every kid starts out as a natural-born scientist, and then we beat it out of them. A few trickle through the system with their wonder and enthusiasm for science intact." —*Carl Sagan*
- "The best teachers are those who show you where to look but don't tell you what to see." —*Alexandra K. Trenfor*
- "You can observe a lot by watching." —*Yogi Berra*
- "The less people know, the more stubbornly they know it." —*Osho*

"People generally see what they look for, and hear what they listen for." —Harper Lee, *To Kill a Mockingbird*

"The more opinions you have, the less you see." —Wim Wenders

"In an age of acceleration, nothing is more exhilarating than to go slow. In an age of distraction, nothing is more luxurious than to pay attention. In an age of constant movement, it has never been more urgent to sit still." —Pico Iyer

"The most effective way to save the threatened and decimated natural world is to cause people to fall in love with it again, with its beauty and its reality." —Peter Scott

"Your eyes can deceive you. Don't trust them." —Obi-Wan Kenobi

"It is fortunate, perhaps, that no matter how intently one studies the hundred little dramas of the woods and meadows, one can never learn all of the salient facts about any one of them." —Aldo Leopold

"My parents were the best scientists I knew because they were always asking questions" —Mae Jemison

The more I wonder, the more I love." —Alice Walker, *The Color Purple*

"The world shows up for us, but it doesn't show up for free. We must show up, too, and bring along what knowledge and skills we've cultivated. As with a painting in a gallery, the world has no meaning--no presence to be experienced--apart from our ability to engage with it." —Alva Noë, *Varieties of Presence* (UC Berk philosopher focused on perception and consciousness)

"Explore the world. Nearly everything is really interesting if you go into it deeply enough." —Richard Feynman

"The moment one gives close attention to anything, even a blade of grass, it becomes a mysterious, awesome, indescribably magnificent world in itself." —Henry Miller

"We do not see things as they are. We see them as we are." —The Talmud

"Shh. Listen to the sounds that surround you. Notice the pitches, the volume, the timbre, the many lines of counterpoint. As light taught Monet to paint, the earth may be teaching you music." —Pete Seeger

"Before you judge others or claim any absolute truth, consider that you can see less than 1% of the electromagnetic spectrum and hear less than 1% of the acoustic spectrum." —Anonymous

"To develop a complete mind: Study the science of art; Study the art of science. Learn how to see. Realize that everything connects to everything else." —Leonardo da Vinci

"I think if you look at any facet of nature in enough detail, you find it fascinating. How could you not?" —Diane Ackerman

"When books and animals disagree, as they often do, the animal is always right." —Donald Abbott

"Every observation...is a result of a question we ask nature, and every question implies a tentative hypothesis." —Ernst Gombrich, *Art and Illusion*

"What we observe is not nature itself, but nature exposed to our method of questioning." —Werner Heisenberg, physicist



## BACKGROUND INFORMATION FOR PRESENTERS

### More on Making Observations

**Note:** This first section doubles as an optional handout to have staff read and discuss.

Being a careful and attentive observer of the natural world is a characteristic that is universally shared by scientists and naturalists. As Yogi Berra (not a scientist or a naturalist!) famously said, “You can observe a lot by watching.” Observations are the key to intimate understanding of nature. They elicit, first wonder, then curiosity that leads to our most interesting questions, and results in further exploration and investigation.

Making observations does not come naturally or easily to many people, especially those who spend hours each day looking at screens. We are more accustomed to walking through nature trying to see as many different things as possible. We keep walking until we see the next notable thing, and then move on again.

### Inspiration from Todd Newberry

Marine Biologist Todd Newberry, whose ethics inspired much of the BEETLES project, says, “Naming and making lists of animals and plants is ‘Glance & Go’ nature watching. It might be a fun sport, but it’s not natural history or science.”

Students need help to develop the skills of observation, and skilled teachers can put them in position to be more successful. First and foremost, observers need to **slow down**. Most things in nature unfold slowly, and as Todd says, “There is almost never a reason not to be slow. Nature will not speed up just because you have arrived.” Most animals, from beetles to bobcats, are startled by the arrival of humans (especially a hiking group of 20 of them), and will do their best not to be seen. People have to slow down and be quiet enough for a long enough time to let these animals recover from the shock of our arrival. For most observations, it also helps to get down low. Many organisms are small and located under or behind rocks, leaves, logs, grass, etc. The most interesting observations are often made while on one’s knees, belly, or back. Observers need to be at eye level with what they are observing. When you’re standing up, you’re at the height of most large predators—and most animals believe their survival depends on not being seen by you. Finally, observers need to get in close. Todd says, “I read the seashore with the lower half of my bifocals.” In order to observe details of structure and behavior, an observer has got to get close enough to really look carefully. Getting close can mean physically close and using, for example, a hand lens, or it can mean getting virtually close by using binoculars, a spotting scope, or a telescope. These tools draw us out of our own world and into the world of the organism we are observing. They open up worlds to us that our own eyes cannot perceive.

### Asking Questions and Curiosity

After getting into position, observers need to be armed with questions. Again, Todd Newberry tells us, “Without questions, natural history is a stand-off. You stare at nature and nature just stares back.” This can quickly lead to boredom, and you will hear students say, “I can’t find anything,” or “I need a new tide pool. Nothing is happening in mine.” Questions can overcome boredom, especially if you can get a quick answer back. It’s always easier and more interesting to be in a back-and-forth discussion than to be carrying the whole conversation oneself. So the trick is to find “interview” questions to which the organism itself can “answer” back. These are usually “what, where, and how many” questions, rarely “why and how” questions. The latter are usually unobservable and imponderable in the amount of time an observer has in the field.

Useful “interview” questions for students to ask: What are you doing? How many of you are there? How far apart are you? How far will you travel in five minutes? What else is around you? Are they the same things that are around others like you? Can I draw you? You will be surprised that while you are busy counting or measuring seemingly mundane details, other, unexpected and delightful observations will come to your attention. Many journalists

finish their interviews with, “Is there anything I haven’t asked you, anything that you’d like to tell me about yourself, anything you want to add?” Engaging with nature in this way builds students’ capacity for curiosity.

In *The Laws Guide to Nature Journaling*, John Muir Laws writes, “Curiosity has a critical role in learning. Curious investigation stimulates the reward center in your brain. It triggers the release of dopamine and activates the hippocampus, a brain region involved in forming new memories. As a result, a person in a state of heightened curiosity will learn more easily—and not only about what had caught their attention. Surprisingly, a person in an intense state of curiosity is also primed to absorb unrelated information that they were not innately curious about. Finally, curiosity makes it more likely that you will remember what you have learned (Gruber et al., 2014). Essentially, interest in one thing creates a curiosity vortex that sucks up unrelated material, making it easier to assimilate and remember.”

### Observations and Awe

Sharing a sense of awe is a natural team builder. Studies have shown that people who experience awe in nature together are more primed for collaboration. If your program has a focus on team building, it may be interesting to think about how providing students with awe-inducing experiences through making observations can also play a role in creating a collaborative spirit. What a cool gift we can give students by teaching them how to access their own awe-inducing nature experiences in any green spot where they live—becoming intrigued by a tiny organism, or spending time in a sit spot. As one article put it, “... a state of awe, an emotion that, psychologists are coming to understand, can have profoundly positive effects on people...In its wake, people act more generously and ethically, think more critically when encountering persuasive stimuli, like arguments or advertisements, and often feel a deeper connection to others and the world in general. Awe prompts people to redirect concern away from the self and toward everything else. And about three-quarters of the time, it’s elicited by nature.” From the article, “The Science of Awe,” by Jake Abrahamson: [http://greatergood.berkeley.edu/news\\_events/in\\_the\\_news\\_item/the\\_science\\_of\\_awe](http://greatergood.berkeley.edu/news_events/in_the_news_item/the_science_of_awe)

### Incorporating Writing

“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, helping students produce writing rich in detail and meaning. You can also encourage students to turn the process inward and write what they notice they are feeling, what they are wondering about, and what their experience reminds them of. For more information on how to help students generate creative, reflective writing from observation, see *Opening the World Through Nature Journaling*. Free download available from [www.johnmuirlaws.com/cnps-curriculum](http://www.johnmuirlaws.com/cnps-curriculum).

### Building Environmental Literacy and Connection with Nature

The NAAEE (North American Association for Environmental Education) defines environmental literacy (in part) as follows: “Those who are environmentally literate possess, to varying degrees: the knowledge and understanding of a wide range of environmental concepts, problems, and issues; a set of cognitive and affective dispositions; a set of cognitive skills and abilities; and the appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts. This definition treats the primary elements of environmental literacy—the cognitive (knowledge and skills), affective, and behavioral components—as both interactive and developmental in nature.”

Chawla defines environmental sensitivity as “a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences,” and continues, “Contact with natural areas has emerged as one of the most significant influences in all the studies reviewed, and free encounters with the natural world are becoming inaccessible to more and more young people in the urbanized world.”

Curiosity, other cognitive skills, environmental literacy, and a connection to nature are deepened through meaningful experiences in the outdoors. By bringing children outdoors for extended periods, residential outdoor science programs provide students with unsurpassed opportunities to develop observation skills and curiosity—both of

which components of environmental literacy and sensitivity. This is a signature benefit of these programs that simply cannot be replicated in a classroom. Helping learners become good observers is a fundamental part of that experience, and is a powerful and gratifying educational opportunity available to field instructors.

### Observations and the Next Generation Science Standards

If you look at the Next Generation Science Standards Science & Engineering Practices, you might notice that “making observations” is not highlighted as one of the practices of science. Helen Quinn, chair of the National Research Council panel that wrote the Framework for K–12 Science Education on which the standards are based, said that the authors did indeed recognize making observations as a critical science practice, but decided that it was necessary for and implied through several other practices. So even though it’s not listed separately, it’s considered to be a foundation of other practices, and is an important component in the NGSS.

### Background on Influential Leaders in Teaching Observation

**Dr. Todd Newberry** was a founding faculty member in biology at the University of California, Santa Cruz. He is a gifted and thoughtful educator, renowned for his inspirational teaching, as much as for his marine biology research. He has written many articles about teaching and observing, and a delightful book, *The Ardent Birder*, on his approach to helping learners explore the natural world by slowing down, looking closely, and asking good questions. Since his retirement in 1994, Newberry has continued to pursue his lifelong loves of birding and teaching.

**Emilie Lygren** is a naturalist, poet, author, and outdoor educator. She co-leads workshops with John Muir Laws on making observations, natural history, and field journaling. She is co-author of the curriculum, *Opening the World through Nature Journaling* and the book, *The Laws Guide to Nature Drawing and Journaling* (to be published in 2016). She is also a professional developer and curriculum specialist with the BEETLES project.

**John Muir Laws** is a trained wildlife biologist, a naturalist, educator, author, artist, and “field journaling evangelist.” His many publications include the books, *The Laws Guide to the Sierra Nevada*, *The Laws Guide to Nature Drawing and Journaling* (to be published in 2016) and the curriculum—*Opening the World Through Nature Journaling*. He teaches many workshops on ways to improve observations, memory and curiosity, conservation biology, natural history, scientific illustration, and field sketching—all while having fun and falling more deeply in love with the world ([Johnmuirlaws.com](http://Johnmuirlaws.com)).

**Jon Young** was inspired by his childhood mentor, tracker, and author Tom Brown, Jr., and has pioneered blending Indigenous mentoring techniques from around the world with the tools of modern field ecology. Under Jon Young’s guidance, Wilderness Awareness School reaches students all around the world with its programs that help people reconnect with their native environments. With Ellen Haas and Evan McGown, he is co-author of the curriculum *Coyote’s Guide to Connecting with Nature for Kids of All Ages and Their Mentors*, and is also the author of *What the Robin Knows*. He teaches at a wide variety of programs in California and around the U.S. (<http://jonyoung.org/>).

**Joseph Bharat Cornell** is a nature educator in the United States. He wrote the highly influential book *Sharing Nature with Children* in the early 1970s to promote outdoor learning, and since then has published: *Sharing the Joy of Nature: Nature Activities for All Ages*; *Sharing Nature With Children II*; *John Muir: My Life With Nature*; *Sharing Nature Pocket Guide*; *With Beauty Before Me: An Inspirational Guide for Nature Walks*; *Listening to Nature: How to Deepen Your Awareness of Nature*; *Journey to the Heart of Nature: A Guided Exploration*; *Ocean Animals Clue Game*; *Rainforest Animals Clue Game*; *Listening to Nature: How to Deepen Your Awareness of Nature*; *The Sky and Earth Touched Me: Sharing Nature® Wellness Exercises*, and *Sharing Nature: Nature Awareness Activities for All Ages*. Cornell founded the “Sharing Nature Foundation” in 1979 to help his work in promoting nature education. (<http://www.sharingnature.com/index.php>).

**“Solar Steve” Van Zandt** is a naturalist, director of a residential outdoor science school, credentialed teacher, singer-songwriter, and longtime environmental educator. He is a founder and active member of the beloved Banana Slug String Band which records and performs children’s music about science, nature, and the environment. He has

mentored interns at the San Mateo Outdoor Education program for many years, and leads workshops on “Keeping the Magic Alive” at California environmental education conferences.

**Tom Brown Jr.** is a naturalist, tracker, survivalist, and author. He grew up in New Jersey and was taught the skills of tracking, wilderness survival, and awareness by his adopted grandfather—a Lipan Apache—until he was 17. He became a professional tracker, and for decades has taught these skills through his “Tom Brown Jr.’s Tracker School” (<https://www.trackerschool.com/>). He’s the author of many books, including *The Tracker*, *The Search*, *Field Guide to Living With the Earth*, and others.

### Connections to other BEETLES Sessions

This session, in particular, introduces many foundational ideas that are further elaborated on in other BEETLES sessions. Here’s a brief outline on how to connect this session to other BEETLES professional learning sessions.

Diving into how people learn: *Making Observations* works well as an early exposure to student-centered instruction. It provides practical, easy to use tools instructors can use right away, and it begins dialogue about pedagogical issues without getting too deep into theory. *Constructing Understanding* goes more deeply into conceptual frameworks and how we learn. *Teaching & Learning* provides a practical “learning cycle” model for structuring learning experiences based on what is known from research about teaching and learning.

Diving into observations and explanations: *Field Journaling with Students* gives practical activities to use with students to encourage them to make better observations through journaling. *Evidence & Explanations* takes observations and questions, then delves into making explanations from evidence.

Diving into questions and exploration: The *Questioning Strategies* session delves into the different impacts on students and learning caused by different kinds of questions, and what kinds of questions encourage or discourage exploration and thinking.



## REFERENCES

- Abrahamson, J. (2014). The Science of Awe: Can psychologists chart what happens when nature blows your mind? *Sierra Club Magazine*: <http://www.sierraclub.org/sierra/2014-6-november-december/feature/science-awe>
- Bartlett, J. C. (1977). Remembering environmental sounds: The role of verbalization at input. *Memory & Cognition*, 5:4, 404–414.
- Bratman, G. N., Hamilton, P. & Daily, C.D. (2012). The impacts of nature experience on human cognitive function and mental health. *Annals of the New York Academy of Sciences: The Year in Ecology and Conservation Biology*. 1–19.
- Brown, T. (1983). *Tom Brown's Field Guide to Nature Observation and Tracking*. New York, NY: Berkley Books.
- Chawla, L. (1998). Significant Life Experiences Revisited: A Review of Research on Sources of Environmental Sensitivity. *The Journal of Environmental Education*, 29:3, 11–21.
- Chawla, L. (1986) The ecology of environmental memory, *Children's Environments Quarterly*, 3(4), 34–42. Board of Regents of the University of Colorado.
- Chawla, L. (2003). Bonding with the Natural World: The Roots of Environmental Awareness. *NAMTA Journal*, 28(1), 133–154.
- Chun, M. & Turk-Browne (2007). Interactions between attention and memory. *Current Opinion in Neurobiology* 2007, 17:177–184.
- Cornell, J. (1998). *Sharing Nature with Children*, second edition. Nevada City, CA: DAWN Publications.
- Gruber MJ, Gelman BD, Ranganath C. (2014). States of curiosity modulate hippocampus-dependent learning via the dopaminergic circuit. *Neuron*, 84:2, 486–96.
- Hutchinson G. E. (1965) *The Ecological Theatre and the Evolutionary Play*. New Haven: Yale University Press.
- Laws, J., Breunig, E., Lygren, E., & Lopez, C. (2012). *Opening the World through Nature Journaling: Integrating Art, Science, & Language Arts*; second edition. Moraga, CA: California Institute for Biodiversity.
- Lupyan, G. & Swingley, D. (2011): Self-directed speech affects visual search performance, *The Quarterly Journal of Experimental Psychology*, <http://dx.doi.org/10.1080/17470218.2011.647039>
- MacLeod, C., et al. (2010) The Production Effect: Delineation of a Phenomenon. *Journal of Experimental Psychology: American Psychological Association, Learning, Memory, and Cognition*, 36: 3, 671–685. <http://dx.doi.org/10.1037/a0018785>
- MacLeod, C. M (2010) When Learning Met Memory. *Canadian Journal of Experimental Psychology: Canadian Psychological Association*, 64:4, 227–240.
- Most, S. B., Simons, D. J., Scholl, B. J., Jimenez, R., Clifford, E., & Chabris, C F. (2001). How not to be seen: the contribution of similarity and selective ignoring to sustained in-attentional blindness. *Psychological Science*, 12, 9–17.
- National Research Council. (2007). *Taking Science to School: Learning and Teaching Science in Grades K–8*. Washington, DC: National Academies Press.
- National Research Council. (2010). *Surrounded by Science: Learning Science in Informal Environments*. Washington, DC: National Academies Press.
- National Research Council. (2012). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press.

- Newberry, T., & Holtan, G. (2005). *The Ardent Birder: On the Craft of Birdwatching*. Berkeley, CA: Tenspeed Press.
- Norris, K. (1998). *Mountain Time: Reflections on the Wild World and Our Place in It*. Oakland, CA: University of California, Natural Reserve System.
- Rueff, K. (1992). *The Private Eye: (5x) Looking/Thinking by Analogy*. Seattle, WA: The Private Eye Project.
- Simons, D. J. & Chabris, C. F. (1999). Gorillas in our midst: sustained in-attention blindness for dynamic events. *Perception*, 28, 1059–1074. [http://www.drjoebio.com/uploads/1/8/1/3/1813500/gorilla\\_in\\_our\\_midst.pdf](http://www.drjoebio.com/uploads/1/8/1/3/1813500/gorilla_in_our_midst.pdf)
- Van Matre, S. (2004). *Earth Education: A New Beginning*. Greenville, WV: The Institute for Earth Education.
- Young, J., Haas, E.; & McGown, E. (2010). *Coyote's Guide to Connecting with Nature*. Shelton, WA: OWLink Media Corporation.

