



beetles

Science and Teaching for Field Instructors

Student Activity Guide

Hand Lens Introduction

In this Exploration Routine, students learn how to most effectively use their hand lenses. They practice finding the “sweet spot” – the distance to hold the lens between eye and object so the object comes into focus. Without this introduction, students may become frustrated or distracted by hand lenses because they don’t understand how to use them. With this quick activity, students develop a healthy fascination with this transformational tool and feel empowered to use it like a scientist. This activity is also an opportunity to invite your students into inquiry. By modeling how to use a lens, how to say observations out loud, and by encouraging students to check things out and share discoveries, you can begin to set a tone of collaborative inquiry for your group.

Students will...

- Learn how to use hand lenses effectively to investigate a natural object.
- Begin exploring, observing, sharing and communicating about finds in nature.

Grade Level:
Adaptable for any age learner.



Timing:
about 7-10 (or more!) minutes

Related Activities:
This activity can be used before any activity that involves hand lenses.



Materials:
For the group:
1 hand lens per participant

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



Setting:
Any setting in which students can safely observe nature and organisms.

NEXT GENERATION SCIENCE STANDARDS

FEATURED PRACTICE

N/A

FEATURED CROSSCUTTING CONCEPT

N/A

DISCIPLINARY CORE IDEAS

N/A

For additional information about NGSS, go to page 6 of this guide.



THE LAWRENCE
HALL OF SCIENCE
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Hand Lens Introduction

ACTIVITY OVERVIEW

| Hand Lens Introduction | Learning Cycle Stages | Estimated Time |
|------------------------|-----------------------|----------------------|
| Introduce Hand Lenses | Invitation | 7-10 minutes |
| TOTAL | | 7-10+ minutes |

Field Card. On page 8 of this guide is a pocket-sized version of this lesson that you can use in the field.

Discovering mini-worlds. It's exciting to use a hand lens to look at leaves, mosses, lichen, tiny fungi, and other parts of nature! A hand lens gives students tool to discover new mini-worlds. Do your hand lens introduction next to a tree with mosses or a bunch of lichen to give students immediate access to an exciting and intriguing tiny world.

Glass lenses are better. Over time, plastic lenses get scratched up and become blurry and frustrating to use. Although they are pricier, glass lenses don't get scratched up like plastic lenses. They will last longer and be more useful to your students.

Hang onto your precious lenses! Use a thick cord or plastic lanyard to hang lenses around students' necks (yarn or string tends to tangle easily). Consider a numbering system to ensure you collect all your lenses at the end of the session and can trace any that go missing. Keep them in a cloth bag to protect the lenses and try to avoid banging the lenses together.

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Introduce Hand Lenses

1. **Explain to students that you're going to pass out a tool that can open up new worlds to them.**
2. **Pass out hand lenses.** Hand lenses on cords tend to get tangled, and if you try to untangle and pass them out one at a time while the rest of your students are standing around waiting, it could take a while. We've found the most efficient way to pass out hand lenses, is to unclip them from their carabiner, set them in the middle of the circle, and invite students to step forward and each get one. It really does work.
3. **Model how to use a hand lens: put the lens right up to your eye, then move head until object is in focus.** Explain that some people try to look at things through hand lenses while holding them at arm's length, but the best way to use them is to put the lens right up to your eye, then move your head closer to the object until it is in focus. Show students how close you put the lens to your eye, and slowly move your head and the lens close to a sample object till you find the sweet spot. Express some excitement when the object comes into focus for you: "Whoa, there it is! I can see the veins on this leaf - they look like tiny streams running into each other."
4. **Tell students to practice finding the "sweet spot" with hand lenses, focusing on their fingerprints.** While students are getting their hand lenses, tell those who have one to hold up a finger, and look at their fingerprint through the hand lens. Have the students practice finding the "sweet spot": the position of the lens between their eye and the object where the object comes into perfect focus. When they find the sweet spot, tell them to say, "whoa!" Coach them on the proper technique, as needed, until all students have successfully found the sweet spot.
5. **Model picking up a nearby object as well as getting up close to another object.** Once everyone has found the sweet spot by looking at their fingerprint, get their attention. While describing out loud what you're doing and observing, model picking up an object from close by, such as a twig, stone or leaf at your feet, e.g., "I'm not sure what to look at, huh, there's a stick with something on it, let me check that out, whoa! It looks like an alien forest on this stick, and there's some orange stuff on their I didn't even notice before." Then model getting down close to another object, like lichen on a tree, without picking it up.
6. **Tell the students to say out loud what they are noticing as they look up close at something (a log, a tree, the ground, etc.).** Tell students to find objects around them to look at and to say out loud what they are seeing. It should sound like a cacophony of "I notice this!" "I notice that!"
7. **Tell them to begin, and give them time to explore, while encouraging them to share finds.** Keep them close by. Point out interesting finds, encourage them to get down and close to things, and encourage them to share finds with each other. Getting them excited about checking out nature and sharing with each other can help set a tone and culture of inquiry for your field experience. This may take a couple of minutes or you could extend it, if students are finding cool things.

TEACHING NOTES

Making observations without lenses for comparison. You might want to have students observe something first without hand lenses, then add hand lenses to notice the difference.

"They drove 150 miles to the intertidal, but wouldn't go the last four feet - get low!" -Todd Newberry.

Use the most powerful lens. If your hand lenses have more than one lens of different magnifications, usually the smaller lens is the more powerful and is usually the one students should use.

Hand lenses are technology we can agree on. There is an on-going debate among environmental educators on whether or not students should be using certain technology, like screens, in the field. Some are concerned that students will engage less with nature if they are focused on the technology. But because the hand lens is a technology that opens up new micro worlds to students and increases student engagement with nature, it's one piece of technology we should all be able to agree is beneficial. We think it's the single most important tool for students to engage with nature.

TEACHING NOTES

Remind students. Throughout your field day, remind students now and then to use their lenses for a new perspective.

- 8. Ask students to be careful and respectful with their hand lens throughout the field experience.** Explain that students should wear the hand lens around their neck, and should be careful and respectful with the tool, so other groups in the future can use them. They should not use hand lenses to dig in the ground.
- 9. Give fire safety warning.** Explain that students are never to use their hand lenses to focus sunlight, which is dangerous and can result in fires, and even death. Be clear that if a student uses a hand lens to focus sunlight, they will immediately lose their hand lens privilege. This is a moment to be clear and firm, because otherwise students are often tempted to try doing it.
- 10. Encourage students to use their hand lenses to explore nature throughout the field experience.** Explain to students that there may be times you tell them to look at a specific part of nature through their hand lens, but that they can always use their hand lens to get a different perspective whenever the group is exploring. They can see things others aren't noticing. Encourage the group to show each other cool tiny things they discover, and to talk about what they notice while looking through their hand lenses.
- 11. Collect lenses at the end of the field experience.** It works well to have students line up and each put their hand lens on your hand one at a time. This helps you make sure you get them all back, keeps them from getting too tangly, and gives you a brief moment with each student.

Instructor Support

Hand Lens Management

Importance of hand lenses. We think hand lenses are the most important tool to carry in outdoor science experiences because they help students directly engage with nature, look closely, and discover new worlds. Hand lenses give students an immediately different perspective and allow them to see details they otherwise can't. Both glass and plastic lenses work great, but for the long term, we recommend programs buy glass lenses (though they're more expensive) because plastic lenses become blurry over time from scratching, which eventually makes them unusable.

Wearing hand lenses on a cord. If students carry hand lenses around their necks with p-cord, they can use their lenses whenever they're inspired during your program, and you don't have to keep handing them out and collecting them. Hand lenses in pockets tend to get used less often, and hand lenses carried in a hand tend to get lost.

Hand lens distribution. Hand lenses on cords tend to get tangled when stored, which can make them hard to pass out efficiently. We've found that thicker cord, like p-cord, tangles less than string (ugh!). We use a small carabiner to clip them together, then put the whole bunch in a cloth bag, to help keep them from rattling around and getting scratched. We've found the most efficient way to pass them out is to simply undo the carabiner, set the clump on the ground, and tell students to step forward and get one for themselves. If you try to untangle them one-by-one to hand them out, it creates a lot of dead time. At the end of a field experience, set up a system to make sure you get all your lenses back. See the BEETLES Video *Hand Lens Introduction* for more information on how to effectively and safely introduce hand lenses to students.

Purchasing Hand Lenses. We recommend two purchasing options:

Science Lab Supplies. There are many options here, though our favorite is the glass 5x/8x Double Lens for \$1.45/lens.

JP Manufacturing. Many, many options for plastic lenses, including incredibly affordable factory seconds.

Teaching Knowledge

Deep observation is a skill that must be learned, and a field experience with students is a perfect opportunity. Students often perceive nature as a "green blur," and experiences that focus in on details of nature help them notice the rich array of phenomena in nature. Hand lenses are a tool that provide an immediate and often striking perspective that can lead students into wonder, curiosity, and deeper observations.

Many of us associate nature with the panoramic view and with dramatic features in National Parks. Hand lenses focus students in on small stuff in nature, the stuff that is equally fascinating, and that is available in any patch of nature anywhere, including school yards or urban cities. If our goal is to help students develop a relationship with nature, and a lifelong practice of

TEACHING NOTES

TEACHING NOTES

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

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

engaging with nature through a scientific perspective, hand lenses are a valuable tool in achieving this. They help students become intrigued with the parts of nature they can continue to observe when they return home. And they are a very affordable piece of technology, should a student want to continue to use one after your program.

Developing observation skills can change the way you and your students experience the world. When you move through the natural world making deep observations, generating questions and making connections, you experience curiosity. You are directly engaged and interacting with nature. Naturalist/field guide author/instructor/great guy John Muir Laws says, “a useful definition for love is sustained compassionate attention.” Giving students the tools to focus deeply on different aspects of nature helps them build their own emotional connections, and “fall in love” a little with whatever they’re spending time with. Do this with different aspects of nature, and students build emotional connections with the natural world and environmental literacy, in general.”

Saying observations, questions & connections out loud can be powerful. Students (and adults) may become bored in nature if they don’t have the skills to make observations. The simple act of stating your observations, questions and connections out loud can be very powerful. Students (and you) will find that they’re actively engaging with an organism or object, and noticing more things.

Common Related Misconceptions

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

Connections to the Next Generation Science Standards (NGSS)

BEETLES student activities are designed to provide opportunities for the “three-dimensional” learning that is called for in the NGSS. To experience three-dimensional learning, students need to engage in scientific practices to learn important science concepts (Disciplinary Core Ideas) and make connections to the big ideas in science (Crosscutting Concepts). In simple terms, students should be using the tools of science to explore and investigate rich phenomena, trying to figure out how the natural world works.

Hand Lens Introduction is not a three-dimensional learning experience in and of itself, but it can be used as a tool within an activity (and during a sequence of activities) to give students the opportunity to engage in direct observation and exploration of the natural world.

Activity Connections

Checking out a part of nature with a hand lens can support the invitational stage of many lessons. Use *Hand Lens Introduction* as an invitation at the beginning of a hike or any new activity, to provide students with a tool that will enhance any other activities you do that involve observations of small features in nature. *I Notice, I Wonder, It Reminds Me Of* and *NSI: Nature Scene Investigators* are both great activities that engage students in following their own curiosity in making further observations in nature, and both are excellent activities to do immediately after *Hand Lens Introduction*.

TEACHING NOTES

FIELD CARD

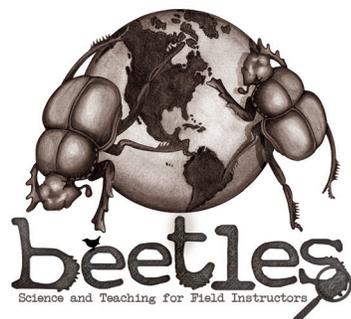
Cut out along outer lines and fold along the centerline. This makes a handy reference card that will fit in your pocket.



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Introducing Hand Lenses

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4. Tell students to practice finding "sweet spot" with hand lenses, focusing on their fingerprints.
5. Model picking up an object nearby, then get down and close to another, while telling students they'll check out interesting things around them with their lenses.
6. Tell students to say out loud what they are noticing as they look up close at something (a log, a tree, the ground, etc.) It will sound like a cacophony of "I notice this!" "I notice that!"
7. Tell them to begin, and give them time to explore, while encouraging them to share finds.
8. Ask students to be careful and respectful with their hand lens throughout the field experience.
9. Give fire safety warning.
10. Encourage students to use their hand lenses to explore nature throughout the field experience.
11. Collect lenses at the end of the field experience.



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

The Lawrence Hall of Science is the public science center of the University of California, Berkeley. 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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