STUDENT ACTIVITY VIDEO GUIDE: WHAT SCIENTISTS DO

Student activity videos can be used to encourage reflective teaching practices, and to establish a culture of ongoing discussion about teaching and learning among instructors. Watching and discussing these videos as a community can help instructors not just learn and follow the steps of an activity, but also focus on teaching approaches that will support them in leading student-centered and nature-driven outdoor science activities in general. Afterward, every instructor can try out the student activity during a set time period (no longer than a week or two), with the expectation that they'll meet to discuss how it went. This process can inspire continued interest, discussion, learning, and improvement in instruction. As instructors plan and set goals for leading the activity, teach students, collect data on how it went (such as observations), debrief their experience, then make adjustments for next time, they engage in iterative cycles of reflection and discussion about their successes and challenges. This shared reflective practice helps all instructors to plan carefully for facilitating activities and to make more effective decisions while teaching students. It also helps instructors learn how to keep learning to be better instructors.

Time: ~45-120 minutes

PREPARATION FOR LEADER

1. **Read the activity and watch the video.** Read the student activity write-up (http://beetlesproject.org/resources/for-field-instructors/what-scientists-do/), paying attention to instructor notes and sidebars with important information about leading the activity. Preview the video to help you effectively lead the discussion later.

2. **Make copies of the What Scientists Do Video Guide: Handout (page 7), and cut it up so you have one for each participant.**

3. **Set up equipment for showing the video.** If you have a very small group, you can all gather around a computer screen. With a larger group, you'll need a projector, a screen, and speakers. Test your system beforehand to make sure you have what you need, and that it will work well for everyone to see and hear. Make sure your WiFi or Internet connection is strong enough to stream the video from the YouTube link. If it isn't, you'll need to open the video when you have a strong connection and then figure out how to download it to your computer.

4. **Choose and post 3 questions for staff to think about during the video.** Choose 3 from the following 6 suggested questions to ask staff to focus on during the video:
   - In what ways does the instructor help set students up to be successful in the activity?*
   - How and when is information introduced?
   - What questions/prompts does the instructor ask/say, and how do students respond?
   - When are students exploring and trying to figure things out?
   - How does the instructor interact with and talk to students?
   - How did the stages of the Learning Cycle (Invitation, Exploration, Concept Invention, Application, Reflection) show up in the activity?

PREPARATION FOR LEADER

5. **Write and post the questions you have chosen so staff can be reminded of them while watching the video.** If you are doing multiple videos with your staff over time, you might want to vary these questions from video to video, though we suggest that you use the first question listed* for every video.

6. **Plan discussion questions to fit your timing.** If you only have 45 minutes, look at the questions in the Leading a Discussion About the Video section, and plan which questions to prioritize in case you don't have enough time for them all.

7. **Tell instructors to bring their reflective teaching journals.**

8. **Prepare a large version of your staff's discussion agreements to post in the room.**
   - Group Agreements. Before diving into these kinds of conversations about teaching, it's important to have established a set of group discussion agreements, to help keep discussion productive, inclusive, and respectful. If you haven't already established expectations for group conversations (sometimes referred to as norms), you'll need to introduce some general guidelines and their purpose (see the resources listed below). Alternatively you can spend time beforehand creating these agreements as a group, in order to build buy-in with your staff members. These kinds of discussion guidelines can be similar to, but distinct from, the expectations that instructors establish for conducting science discussions with their students.
   - Anti-Oppressive Facilitation for Democratic Process: Making Meetings Awesome for Everyone. Anti-Oppression Resource and Training Alliance (2017). Accessed online: http://aorta.coop/portfolio_page/anti-oppressive-facilitation/
   - Garmston, R., and Wellman, B. (2009). The Adaptive School: A Sourcebook for Developing Collaborative Groups, 2nd edition. Accessed online: http://www.thinkingcollaborative.com/norms-collaboration-toolkit/
   - National School Reform Faculty: A-Z protocols. Accessed online: https://www.nsrfharmony.org/free-resources/protocols/a-z

9. **Print out the Reflective Teaching Cycle diagram (page 6) to post in your room, or draw or print a larger version.**

Introducing the Video

1. **Explain to instructors a little about the activity:**
   - **a.** It's a framing activity (before and after trail activities) to help students recognize how they are engaging in specific field science practices.
   - **b.** The practices listed on the What Scientists Do diagram are designed to be easily recognized and understood by students.
   - **c.** Students can come to think of science as an adventure, and think about how they can engage in many of the same practices as scientists.

2. **Explain what they should do while watching the video:**
   - **a.** You'll be expected to lead this activity with students, and report back on how it went.
   - **b.** Take notes on effective teaching strategies you notice, and on other things you want to remember as you prepare to lead the activity with students.
   - **c.** Write down questions that come up about teaching this activity.
   - **d.** Be thinking about these questions (share the 3 of these you have chosen):
     - *In what ways does the instructor help set students up to be successful in the activity?**
     - *How and when is information introduced?*
     - *What questions/prompts does the instructor ask/say, and how do students respond?*
     - *When are students exploring and trying to figure things out?*
     - *How does the instructor interact with and talk to students?*
     - *How did the stages of the Learning Cycle (Invitation, Exploration, Concept Invention, Application, Reflection) show up in the activity?*

3. **Play the video as instructors take notes. (6 minutes, 35 seconds)**

Leading a Discussion About the Video

1. **Ask instructors a broad introductory question about the activity to begin discussion:**
   - *What did you find interesting or effective about the way this activity was led?*

2. **Ask follow-up questions, and encourage instructors to ask each other questions, to build on each other's ideas and to respectfully disagree with each other.**
   - Example questions:
     - *What do you think of that idea?*
     - *Does anyone have a different idea?*
     - *What evidence from what you saw makes you think that?*

3. **Ask instructors: In what ways does the instructor help set students up to be successful in the activity?:**
   - **a.** Listen to their ideas, and ask follow-up questions.
   - **b.** If any ideas listed here were not brought up by your staff, consider bringing them up yourself:
   - the introduction helps students learn what field science practices might look like
   - students may not think of practices like asking questions, exploring, explaining mysteries, etc. as being what scientists do unless this is pointed out
   - students can build confidence by participating in "sciency" behavior
   - students can understand and appreciate where scientific information comes from

4. **Ask instructors the other questions you chose to have them focus on, listen, ask follow-up questions, and roll with the discussion.**

5. Discuss how the practices listed on the diagram are related to the NGSS practices. Ask:

- *How are the practices listed on the diagram similar and different from how the practices are written in NGSS documents?*

> **Play it again!** Depending on how much time you have, staff interest, and where your discussion has led, it can be worthwhile to play the video again. Staff tend to notice different things each time they watch it.

6. Discuss the value of this activity for students. Ask:

- What do you think students get out of this activity?

7. Discuss possible challenges of leading this activity. Ask:

- What do you think might be some challenges to leading this activity?
- How might you prepare to avoid or deal with these challenges?

Planning to Teach the Activity

1. Pass out the student activity write-up, and have instructors read the activity.

- If this is the first time they've seen a BEETLES write-up, explain how it's organized: overview chart for timing, script with sidebars of just-in-time information, instructor support section, field card for brief notes, copy of student handouts.

2. When it looks like people have finished reading, ask if they have questions about the activity.

3. Have them think about how they might use this activity during a longer field experience within your program. Ask:

- *When and where do you think it might work well?*
- *How might this activity fit in with other activities you teach?*
- *What might be complementary activities?*

4. Share any expectations you may have about when they should lead the activity, and what kind of data they should collect.

a. If instructors are expected to teach the activity during a certain time frame, like before the next meeting, let them know this.

b. Tell instructors how you will set up a time to reflect and discuss how the activity went, or follow up in some other way.

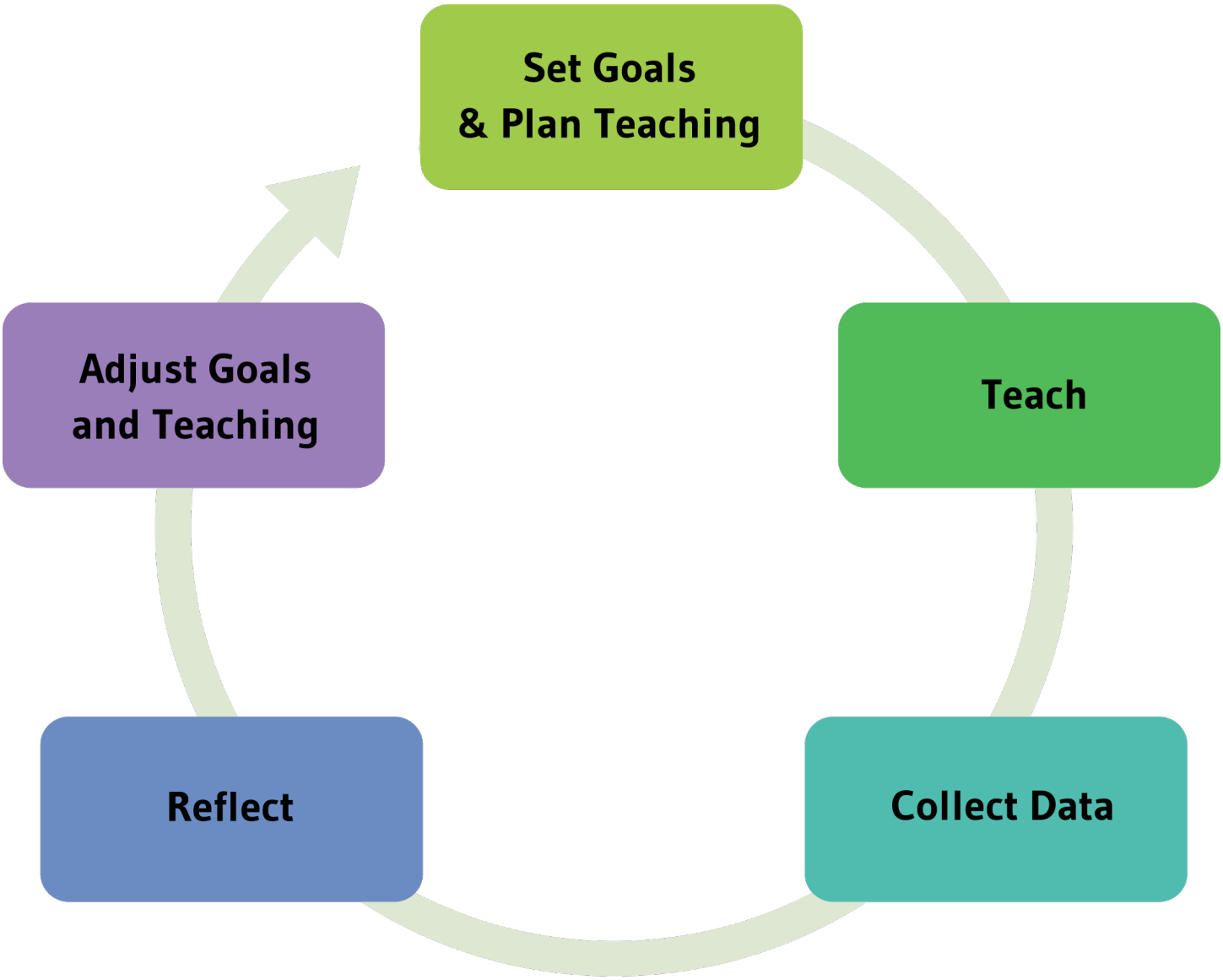
c. Explain what you would like them to pay attention to, such as student reactions, so they can evaluate how it went afterward, and can adjust their teaching as shown in the Reflective Teaching Cycle on page 6.

> "It's not the doing that matters. It's the thinking about the doing." John Dewey

5. **Give instructors time to think about and set goals for instruction.**
   - **a.** In addition to the goal of teaching the activity successfully, instructors should have other teaching goals.
   - **b.** Ask instructors to think about some aspect of teaching they'd like to get better at (there is always something if they are self reflective!).
   - **c.** It's helpful to have goals that are fairly specific, rather than general.
   - **d.** For example, "I'm going to try to lead discussions better," is not as useful as something more specific like, "I'm going to focus on asking more follow-up questions," or, "I'm going to focus on listening more carefully to student ideas."

REFLECTIVE TEACHING DIAGRAM

Research has found that thinking about teaching as a cycle that involves planning for instruction, teaching lessons, collecting evidence, reflecting, and making adjustments with the goal of improving learning, can all help instructors make the subtle shifts to continually improve their practice over time. You can use this diagram to help visualize the steps in a reflective teaching cycle and then think about how to engage in this type of iterative process.



WHAT SCIENTISTS DO VIDEO GUIDE: HANDOUT

Next Generation Science Standards Science and Engineering Practices

- Asking Questions and Defining Problems.
- Developing and Using Models.
- Planning and Carrying Out Investigations.
- Analyzing and Interpreting Data.
- Using Mathematics and Computational Thinking.
- Constructing Explanations and Designing Solutions.
- Engaging in Argument from Evidence.

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BACKGROUND INFORMATION FOR PRESENTERS

Instructors shouldn't alter the activities (at first): It's common for instructors (even novice ones) to want to change or adapt an activity the first time they present it. Unfortunately, this tends to lead to less-effective activities, because the instructor is usually making changes without fully understanding and appreciating the activity as it's designed. The wording in the activity is intentional and rigorously tested. There are some adjustments that instructors can make with any activity to better serve the unique group of students in front of them. These adjustments should be made after an instructor has taught the activity a few times the way it was designed. An advantage of watching and discussing the activity video is that instructors will likely understand and appreciate the activity more afterward than if they just read the write-up alone. The sidebars, teaching notes, and background section in every BEETLES activity can also help inform instructors' decisions about how to make these kinds of adjustments for different audiences without compromising the activity.

Instructors should use field notes. All BEETLES activities have a field card (a small card showing the main steps of the activity). Encourage instructors to carry field cards and use them as presenter notes when they teach. Some instructors worry that if students see them looking at notes, they might lose respect. Explain that, if anything, using notes is a sign of professionalism and will result in better teaching (as long as an instructor isn't staring at their notes or reading directly from them). Field cards help an instructor remember key questions and the order of steps and phases of the activity. (Heck, even though we wrote these activities, we all still use the field cards when we teach.)

Instructors should return to the actual Activity Guide (occasionally). While field cards are designed to be complete enough to teach from, they only include an outline of the activity. We recommend that instructors go back to the actual Guide every few times they teach the activity. There's a lot of information in BEETLES Activity Guides, and it's easy to forget parts. After teaching it a few times, a note that didn't seem important the first time they read it may suddenly make more sense and influence their instruction. BEETLES write-ups are meant to be "educative." They are not simply a series of steps to follow, but include a lot of information about the art of instruction. These are meant to help instructors not only teach the activity well, but also to keep learning and growing in their understanding about teaching. So, rereading the activity is important if instructors continue to lead it over time (and yes, we also reread the activities now and then, too).

Building a Culture of Reflection

An outdoor science program can be an amazing laboratory for developing the "art of instruction" where instructors push themselves and each other, focus on developing teaching skills, consistently try out new student activities, and continually reflect on teaching and learning. In this kind of setting, becoming a good instructor involves more than just learning a "shtick" and being able to consistently present it in an entertaining way. When a teaching staff has a healthy reflective-learning culture in place, you can feel it. It's exciting and stimulating to be part of a community trying out new approaches and discussing successes and challenges with peers. Program leaders who support this kind of reflective culture help young field instructors develop into thoughtful educators who go on to have rewarding careers in science, education, and beyond, and who continue to affect the world in meaningful ways. Establishing a reflective-learning culture provides a foundation for growth and change within your program. Research on teacher learning argues strongly for including reflective practice for both new and veteran teachers. Plus, it just makes sense that instructors who actively think about the effectiveness of their teaching, discuss these issues with colleagues, and develop strategies to improve will make more progress than those who aren't given these opportunities and structures for collaboration and ongoing support.

Working towards a common goal. Establishing a somewhat formalized "professional learning community" can encourage instructors to adopt new approaches to teaching and learning. The central idea is that every member of the community is working towards a common goal of figuring out the best teaching approaches and strategies to reach the audience for the program—and there is a regular structure in place to help everyone work together. A professional

learning community must establish a clear goal, like "creating the best possible learning experiences for our students." Programs that actively cultivate openness and growth among staff explicitly state that they have a goal of having staff explore various strategies to improve instruction. They also provide meeting time for staff to share examples of student work or debrief how a new activity went in order to learn what works best. Professional learning communities use specific discussion protocols that structure conversations to ensure an attitude of learning from practice rather than evaluating performance. When all staff are focused on achieving common goals, and when program leaders are equally focused on providing necessary support to instructors through coaching and mentoring, a learning community can form that leads to improved performance and increased job satisfaction.

Encouraging a growth mindset among instructors. An essential characteristic of a professional learning community is that members adopt a growth mindset. This means they understand that the abilities of individual learners (their students and themselves) can change and are not fixed or primarily due to innate talent. For example, an instructor who leads an unsuccessful discussion might then decide to not try leading discussions again because they feel they're not good at it and it's easier to stick with something they have more experience with, or they are convinced that their students can't do it. An instructor with a growth mindset is more likely to think about what didn't work, look into the sorts of abilities they can develop to overcome that issue next time, and try again (and again, and again…). When instructors and program leaders truly believe teaching abilities can grow (and that we all have room to grow!), they're more willing to make adjustments to their instructional practices and try out new strategies and approaches. Program leaders who nurture a growth mindset create an environment of receptivity that helps instructors build and improve their teaching skills.

Creating structures for coaching and mentoring staff. Studies of professional learning models report that a critical aspect of improving teaching practices is receiving timely feedback from more experienced educators and peers. Observing an instructor and engaging with them in discussion about teaching strategies and approaches can be a very effective way to improve specific teaching practices. BEETLES Reflective Teaching Tools (http://beetlesproject.org/resources/reflective-teaching-tools/) assist program leaders to observe students, then provide feedback that can help instructors meet their goals and make adjustments to teaching.

Field instructors often have opportunities to lead the same activities with different groups of students, and, when given appropriate feedback, they can effectively fine-tune their teaching skills. Providing reflective time during staff meetings, creating paid opportunities for staff to get together and discuss their teaching, and organizing a structure for peer-coaching (among other things) all support continual improvement and allow instructors to learn from each other's experiences.

Differentiating between evaluation and coaching. It's important to distinguish performance evaluation efforts from coaching. Evaluation efforts are mostly about informing the program or individual about how well they're meeting specific goals and expectations. Coaching, on the other hand, usually is about improving practice.

- **Evaluation:** When observing instructors for evaluation purposes, the criteria for success should be clearly communicated well in advance and can take the form of a checklist of teaching or student behaviors. The evaluative feedback provided is meant to let the instructors know how well they're meeting expectations.
- **Coaching:** Coaching or mentoring focuses on observations rather than evaluations or interpretations. The coach asks the instructor to choose a particular teaching strategy or technique they'd like to work on by receiving observational feedback about what actually happened. Program leaders have emphasized that instructors are much more open to feedback about their teaching when it feels like a collaborative discussion and when they have permission to try new, challenging things that they might not succeed at the first time. Coaches can support instructors to make their own thoughtful adjustments and improvements. Negative or positive evaluative feedback during this kind of learning process can actually undermine instructors' success.