Promoting Discussion

Deep learning takes place when we have the opportunity to struggle with ideas, and discussion is a tremendously powerful vehicle for students to do this. Formulating your own ideas into words, listening to others’ ideas, and becoming aware of contradictory ideas all set up learners to make better sense of the world. These discussions need to happen between peers as well as with more knowledgeable teachers. Promoting discussions that draw in all students, helps an instructor, as well, to better understand what students are thinking and to create an open intellectual environment where ideas are exchanged. Any setting in which deep learning is the goal should be teeming with discussion.

But discussion-based instruction can be challenging. Leading an effective large group meaning-making discussion requires curiosity, skills, knowledge, and experience on the part of both instructor and students. The tone set by the instructor is crucial: is the environment one in which it feels safe to share ideas and ask questions about what you don’t know? Outdoor science schools provide an ideal environment for developing and refining these skills, as instructors get to work with diverse groups of students and to repeat and refine activities throughout a season. This session provides valuable knowledge, strategies, and discussion practice to help instructors treat outdoor science schools as a laboratory for developing discussion skills.

Goals for this session are:

- Learn the profound role discussion plays in the learning process, specifically in scientific meaning-making.
- Discuss interesting and challenging questions on the role of discussion in education.
- Learn about a wide variety of discussion routines and strategies.
- Practice leading discussions, using discussion tools and instructor moves.

Note: Although all BEETLES professional learning sessions are interconnected and complimentary, this session has a “companion” session, Questioning Strategies, which explores the difference between broad and narrow questions, the role of instructors, and how to lead student dialogue in the context of exploration. Although they can be flexibly used, we recommend presenting Questioning Strategies before Promoting Discussion, so that instructors are first introduced to the role of different types of questions before focusing on student dialogue.

“The child begins to perceive the world not only through his [or her] eyes but also through his [or her] speech.”
- Lev S. Vygotsky, author of Mind in Society
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

Principal Investigator and Articulate Beetle: Craig Strang
Project Director, Lead Curriculum & Professional Learning Developer, and Idea Beetle: Kevin Beals
Project Manager, Professional Learning & Curriculum Developer, and Beetle Herder: Jedda Foreman
Curriculum & Professional Learning Developer and Head Fireball: Lynn Barakos
Curriculum & Professional Learning Developer and Champion-Of-All-The-Things: Emilie Lygren
Research and Evaluation Team: Bernadette Chi, Juna Snow, and Valeria Romero
Collaborator, Super Naturalist, Chief Scalawag and Brother-from-Another-Mother: John (Jack) Muir Laws
Project Consultants: Catherine Halversen, Mark Thomas, and Penny Sirota
Advisory Board: Nicole Ardoin, Kathy DiRanna, Bora Simmons, Kathryn Hayes, April Landale, John Muir Laws, Celeste Royer, Jack Shea (emeritus), Drew Talley, & Art Sussman.
Editor: Lincoln Bergman
Designer: Barbara Clinton

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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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To contact BEETLES™, email beetles@berkeley.edu
# Promoting Discussion

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TEACHING ABOUT TEACHING

Use effective discussion strategies while presenting this session on discussion. An important aspect of this session is that participants actually experience and feel what it’s like to be engaged in interesting discussions, so they recognize their value. Many people have had far more experience with being taught in a didactic manner than with learner-centered instruction, and can benefit from this kind of modeling. When leading a session about how to lead discussions, it helps (a lot) if the presenter models effective discussion strategies. Otherwise the session could seem like a “do as I say, not as I do” situation. Ideally, choose a staff member who has the most experience leading discussions on science ideas with children, to lead the discussions in the session. Presenters should also review the Tips For Promoting Discussion handout to implement as many of these strategies as possible in their presentation.

PRESENTATION OPTION

Want to spend more time outdoors than in? Other than the video watching bit, this whole session can be done outdoors. You and your co-presenter can take turns writing text from slides on white boards, and/or print 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, and then pick up on the topic at another time, perhaps after staff has had some experience with applying the teaching strategies.

SESSION OVERVIEW

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<tr>
<th>Promoting Discussion</th>
<th>Activity Locations</th>
<th>Estimated Time</th>
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<tr>
<td>Invitation</td>
<td></td>
<td></td>
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<tr>
<td>Introduction</td>
<td></td>
<td>5 minutes</td>
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<tr>
<td>Participants are engaged in the topic and the guiding question, “How can we nurture discussion about science ideas in outdoor science schools?”</td>
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<tr>
<td>Exploration</td>
<td></td>
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<tr>
<td>Thought Swap (or Walk &amp; Talk)</td>
<td></td>
<td>20 minutes</td>
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<tr>
<td>Participants take part in a discussion routine to whet their appetites for discussing discussion.</td>
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<td></td>
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<tr>
<td>Concept Invention</td>
<td></td>
<td>70 minutes</td>
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<tr>
<td>Discussing Discussions</td>
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<tr>
<td>Participants discuss the benefits of discussion, through watching and debriefing two videos of students engaged in discussion. This section utilizes a variety of discussion routines to provide participants with multiple experiences.</td>
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<tr>
<td>Strategies and Tools for Leading Discussions</td>
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<td>20 minutes</td>
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<tr>
<td>The whole group discusses the main steps towards academically productive discussions, including how to nurture a culture of discussion, provide opportunities to practice specific skills, and encourage good discussion habits through coaching. Three common challenges to leading good discussions are also addressed.</td>
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<tr>
<td>Application</td>
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<td>40 minutes</td>
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<tr>
<td>Discussion Lab</td>
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<tr>
<td>Instructors will volunteer to practice leading a small group in discussion. Small group and whole group debriefs follow to discuss which instructor moves were more and less productive.</td>
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<tr>
<td>Reflection</td>
<td></td>
<td>10 minutes</td>
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<tr>
<td>Wrapping-Up</td>
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<tr>
<td>Outdoor science schools are discussed as great laboratories for instructors to refine their skills through deliberate practice. Participants review and reflect on the session, and plan their own deliberate practice.</td>
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<tr>
<td>TOTAL</td>
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<td>3 hrs, 5 min</td>
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<td>165+ minutes</td>
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**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). Read through the session write up, slides, handouts, sidebars and background section (page 43) 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 most of the session outdoors (the videos need to be indoors), 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.

2. **Read and familiarize yourself with the Walk & Talk student activity guide, and other embedded discussion routines; assess your ability to lead the activities.** Choose your staff member(s) most experienced with successfully leading discussions with students to lead these parts of the session. Instructions for the routines are embedded in this *Promoting Discussion* write-up. If you will be teaching the activity using the embedded write-up, we suggest that you read through the separate BEETLES activity write-up for *Walk & Talk*, particularly the Instructor Support section, taking notes on the embedded write-up included here.

3. **(Recommended) Read the Talk Science Primer by Sarah Michael and Cathy O’Connor.** Throughout this session, modeling good discussion habits is very important. We highly recommend you read through this primer on discussions so you’re well versed on modeling productive discussion moves.

4. **Make sure participants are prepared.** This session has less outdoor time than other BEETLES professional learning sessions, but make sure participants bring the gear they need to be comfortable outdoors. Tell them to bring their journals, and something to write with.

5. **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.

6. **Preview and/or download videos and procure speakers.** Watch the videos. If you won’t have internet access during your session, make sure to download the video to your computer. You’ll also need quality speakers to make sure that the entire group can hear the videos.

7. **Create (or reuse) Discussion Norms poster.** Make a poster of discussion norms to post, including the following norms: Listen actively and share ideas; Use evidence; Keep an open mind; Share responsibilities; Disagree productively; Work toward a deeper understanding.

8. **(Optional) Create chart paper for the Discussion Lab discussion.** Make three columns on chart paper or a white board. Label the left column, “productive”, the center column, “instructor move” and the left column, “not-so-productive”.

9. **Make copies of video transcripts & gather sticky notes.** Participants will be writing notes on the transcripts, so if you plan to re-use them, you’ll need to pass out sticky notes for them to write their notes on, instead.

10. **Make copies of handouts.** See materials list to right.

11. **(Optional) Make Session Overview to post on wall.** You may choose to make a Session Overview to post on the wall during this session. It’s not necessary for a workshop like this, but many participants prefer having it.

12. **Plan when you might include a break in the schedule.** We recommend a break after the Discussing Discussions section.

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**MATERIALS**

**For the group:**
- Slides
- LCD projector
- Computer
- Access to in-session videos, *Kids Discuss Discussion* and *Kids Discuss Decomposition* (at http://beetlesproject.org/resources/for-program-leaders/promoting-discussion/)
- Discussion Norms poster
- (Optional) Chart Paper or White Board(s)
- (Optional) Sticky Notes, for note taking

**Handouts:**
- Transcript of *Kids Discuss Discussion* video, page 29
- Transcript of *Kids Discuss Decomposition* video, page 30
- *Discussion Lab Planning Sheet*, page 33 (1 per group of 4)
- *Discussion Map*, page 34
- “Goals and Instructor Moves for Productive Discussion” on page 35
- *Tips for Promoting Discussion*, page 36
- *Research Related to Promoting Discussion*, page 38
- *Discussion Routines*, page 41
Introduction

1. **Show slide 1:** *Promoting Discussion. Welcome.*
   a. Welcome participants.
   b. Make sure everyone is ready to begin and has the gear they need to be comfortable during any outdoor experiences you’ve planned.

2. **Introduce the session’s guiding question. Explain:**
   a. The session is titled, *Promoting Discussion* and the guiding question for this session is, “How can we nurture discussion about science ideas in the outdoors?”
   b. While there are many different types of discussions, this session is focused on meaning-making discussions that build on students’ science ideas.

3. **Show slide 2:** *Talk is not an add-on.* Explain that there is national consensus in the U.S. that discussion should be promoted in all subject areas & at all grade levels.
   a. Engaging students in the discussion of ideas can create powerful learning experiences.
   b. Recent National Research Council consensus reports and major teacher organizations emphasize the need for student discussion of ideas.
   c. However, research also notes that engaging students in discourse is largely underutilized by educators.

4. **Explain that discussions are challenging. This session will address some of these challenges.**
   a. Guiding a group of learners to make meaning around science concepts can be challenging.
   b. It can also be difficult for students to feel comfortable enough to participate in a public discussion of their science ideas.
   c. In this session, we’ll focus on many of the benefits of discussion, and introduce some strategies and ideas to overcome some of the major challenges, to make discussions more successful for both students and instructors.

5. **Show slide 3:** *Goals for the Session. Explain:*
   a. Give participants a minute to read the session goals.
   b. Ask if anyone has any questions.

6. **Show slide 4:** *Discussion and Workshop Norms. Introduce discussion norms:*
   a. Explain: Before we dive into discussion, its important to review some science discussion norms.

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**Not your first BEETLES session?** If your participants have been in other BEETLES professional learning sessions, explain:
- You’ve participated in many discussions during other sessions.
- In each, some might argue it’d be more time efficient if the leaders had just told you the concepts, such as what causes the dark part of the moon, rather than lead you in experiences and discussions.
- Hopefully, you’ve felt the value of struggling with and exploring ideas through discussion.
- This session picks up where the Questioning Strategies session left off—it focuses on how to use discussions to help students build on science ideas.
- This session “pulls back the curtain” to share some of the strategies and rationale behind other BEETLES sessions and student activities.

**Introducing discussion norms.** If your staff don’t have very much experience introducing discussion norms, you may want to model how to do it with students. Read the Background Information section for more information.
b. Read aloud the five norms.

c. Ask,

► Is anything missing from this list? Does anyone want to talk about any of these norms?

d. Ask: Can we agree to these to keep our discussions respectful and productive?

Walk and Talk

1. Introduce *Walk and Talk* and explain:
   a. This first routine is called *Walk and Talk*.
   b. You’ll be discussing your responses to a series of questions about discussion.

2. Explain that they’ll discuss an important topic in education, not to come up with a single answer, but to have an interesting discussion:
   a. This activity is an opportunity for you to engage in meaning-making discussion, to remember what that feels like from the perspective of a learner.
   b. It also brings up interesting topics that may be on-going discussions throughout your educational careers.
   c. The goal is not to come up with definitive answers. These topics are interesting to discuss because they are complex and juicy, and don’t have simple answers.

3. Start the *Walk and Talk* activity by guiding participants into two parallel lines, each facing a partner, including yourself. Explain:
   a. Stand shoulder-to-shoulder in two parallel lines, so each person is facing a partner in the line across from them, including leaders.
   b. You should be about six inches apart.
   c. Look across at the other line, figure out who your partner is, and give them a fist bump.

4. Make any necessary adjustments.
   a. Tell anyone without a partner to raise their hand, and make adjustments as necessary.
   b. If you have an odd number of participants, you could have a group of three.

5. Introduce procedure for discussing questions & “the touch of silence.”
   Explain:
   a. I’ll give you a question to talk about with your partner. You’ll have about a minute to talk while we are walking up the trail.
   b. I’ll stop walking and signal for quiet with the “touch of silence,” gently tapping the shoulder of the participants at my end of the lines.

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**TEACHING NOTES**

Substitute *Thought Swap* for *Walk & Talk*. If you need to save time, consider doing *Thought Swap* instead of *Walk and Talk*. *Thought Swap* is a stationary activity that can be done indoors or outdoors. The *Discussion Routines* handout in this session describes the adjustments needed to turn *Walk and Talk* into *Thought Swap*.

You are here:

20 minutes

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.

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.
c. When you feel the touch, you stop talking.

d. You will pass the touch (gently) down the line, till the whole group is quiet.

6. Ask the first Walk and Talk question for participants to discuss:

   - Describe a discussion you participated in that was engaging and productive. What do you think made it work?
   - Make sure those at the far end of the line can hear your question.
   - For large groups, ask someone close to the end to repeat the question, or just get a thumbs up that everyone heard.

7. Get participants’ attention for a whole group share-out.

   - After about a minute or two, tap the first two participants at your end of the lines and wait for the whole group to become silent.
   - Tell participants to take a step back, so it’s easier for everyone to see each other.
   - Repeat the question, “Describe a discussion you participated in that was engaging and productive? What made it work?”
   - Ask a few participants to share what their partner told them with the whole group.
   - Use neutral responses so everyone’s ideas seem equally valued.
   - Ask follow-up questions as you see fit such as, “Did anyone else talk about that too?”, “Does anyone have a different idea?” or “Did anyone talk about evidence that supports that idea? What evidence did you talk about?”

8. Orchestrate the partner switch:

   - The line opposite yours will shift with each question, while the line you’re in remains in place.
   - Tell the person across from you to walk down between the lines, and rejoin the opposite end of the same line.
   - It can be fun for the group to cheer them as they walk between the lines.
   - Tell their line to shift one position towards you, so everyone is facing a new person.
   - Everyone should now have a new partner. Tell new partners to fist bump or high-five to make sure everyone knows who their partner is.

9. Walk, discuss & switch partners for the next four questions.

   - Ask the questions below, shifting partners in the same way after each:
     - Why is discussion important for learning?
     - Some teachers and field instructors in outdoor science schools provide little opportunity for student discussion of science ideas. Why do you think that is?
b. Pause briefly after each question for participants to share out some things their partners said, and to discuss each question with the whole group.

10. Explain that there will be more opportunities to discuss the topic:
   • If you have more to say, that’s great! Because we’re just getting started, and you’ll have lots more chances to discuss discussion throughout the session.

11. Tell participants to return to their seats.

Discussing Discussion

1. Debrief Walk and Talk:
   a. Ask,
      
      What are the benefits of an activity routine like Walk and Talk? (or Thought Swap, if that’s what you did).
      
   b. Ask them to share out with the whole group. Listen to their responses, and ask follow-up questions as appropriate. Remind instructors that in whole group discussions, everyone who shares needs to speak loudly enough for everyone to hear (instructors need to remember to remind their students of this—you can’t have a discussion if you can’t hear what is being said).
   c. After multiple people in the group have shared, bring up any of the following points that have not already been brought up:
      • Accesses prior knowledge
      • Everyone gets a chance to participate and share ideas
      • Keeps group moving and uses walking “transitions” as efficient learning time
      • Gets learners interested in the topic
      • Students can rehearse in a safe two-person discussion before sharing with whole group
      • Great for English language learners to talk in a low-anxiety one-on-one setting
      • Peer-to-peer discussion is important for learning
      • Instructor gets to talk to a variety of students and hear their ideas
      • Helps form social connections in the group
      • Allows group to hear many ideas (during whole group share-outs) and to see different ideas valued.

2. Show slide 5: Research Shows-a. Explain that research shows that discussion is a critical component to learning concepts:
   a. The benefits of Walk & Talk exemplify many of the benefits of discussion in general.
b. Sharing and exploring ideas with peers and/or an educator encourages students to think more deeply and support their ideas with evidence and explanations.

c. Discussion allows learners to explore and test their assumptions and ideas, learn from each other, and become aware of complexities.

d. It makes thinking “visible” giving instructors a window to better understand what students are thinking.

e. Students who talk about ideas aloud remember them better.

3. Show slide 6: Research Shows-b. Explain that research also shows a variety of other important benefits of discussion:

a. It supports development of language skills, social skills and risk-taking, and develops learning communities.

b. There’s early evidence that discussion in one domain, such as science, benefits students in other academic domains and students’ general academic success.

4. Introduce Kids Discussing Discussion video; explain:

a. To explore some of the benefits of discussion further, we’re about to watch two videos.

b. The first video is of students after they have done an activity on transpiration and then participated in meaning-making science discussion. The video is of them discussing why and how that follow-up discussion helped them learn.

c. It takes place in a classroom, with a teacher who has obviously put a lot of effort into nurturing a culture of discussion.

5. Explain that participants should use the transcript of the video to take notes:

a. I’ll pass out a transcript of this discussion for you to read along with the video.

b. As you watch, take notes and summarize key points students make about why the discussion mattered to them.

6. Pass out the video transcripts & play the video.

7. Show slide 7: Two Cents Routine. Explain that they’ll use the Two Cents routine to debrief the video:

a. To debrief the video, we’ll use the Two Cents routine.

b. It’s also an opportunity to experience another type of structured discussion.
8. **Describe Two Cents routine procedure:**
   a. The routine’s name comes from each person putting in their “two cents,” with two opportunities to speak.
   b. In groups of four, you’ll take turns responding to the question. When it’s not your turn, you’ll listen and not talk.
   c. First round (one cent): Each person in the group gets one minute (or less) to share their ideas on the topic.
   d. Second round (two cents): Each person in the group gets one minute to respond to what others have said.

9. **Provide the prompt for this routine:**
   a. Explain: For this routine, you’ll respond to this prompt:
      
      Based on what you observed, what are some discussion elements that need to exist for successful meaning-making discussions? How might these elements influence your teaching?
      
   b. Give participants about 8-10 minutes to complete their discussions (depending on the group size).

10. **Introduce the next video, Decomposition Discussion:**
    a. This second video takes place on trail during a day at an outdoor science school.
    b. This is an optional discussion at the end of the BEETLES Decomposition Mission activity. It comes after students have spent about 45 minutes making displays of leaves and wood showing stages of decomposition, learning about the FBI (fungi, bacteria and invertebrates) and searching for potential decomposers and evidence of decomposers in the area. It is only the first few minutes of a longer 15 minute discussion.
    c. The purpose of this discussion is to help students make sense of their observations and challenge some of their assumptions about the definition of a decomposer.

11. **Explain that they should use the video transcript to take notes:**
    a. I will also pass out another transcript of this discussion.
    b. Again, use the transcript to follow along and take notes.
    c. This time, as you watch, focus on making observations of what the instructor and students are doing. Try not to make inferences or explanations yet. Some examples of observations you could make are: “I noticed that the instructor asked 3 questions in rapid succession,” or “I noticed that student 1 used evidence as she explained her idea.”
    d. Try to make as many observations as possible, jotting down notes to remember for a debrief discussion afterwards.
12. Pass out the video transcripts, then play the Decomposition Discussion video.

13. Show slide 8: Less Structured Discussion. Explain that they’ll use a less structured discussion to debrief the video:
   - In your small groups, discuss the prompt on the slide.

14. Refocus the group after ~10 minutes.

15. Show slide 9: Whip Around. Explain that another routine, Whip Around, will be used to debrief the two previous discussions:
   a. We’ll use another discussion routine, Whip Around, to do a quick “meta-debrief” of the discussions so far.
   b. Think about your experience using the Two Cents and the unstructured discussion styles, and come up with one word that describes each experience.
   c. Then, we’ll go around the room and each person will say in quick succession, first, their word describing Two Cents, and second, their word for the unstructured discussion.

16. Go around the room with each person quickly sharing their two words.

17. Ask participants to share some reasons for positive and negative experiences.
   a. Tell them you heard some positive words used to describe each experience, call on a few participants to share out what made either experience positive for them.
   b. Tell them you also heard some negative words too, (if you did) and call on a few participants to share some of their struggles.
   c. Explain that with all discussions and different routines, students may also have both positive and negative reactions.

18. Explain that different discussion routines have different purposes:
   a. Routines, like Two Cents, Whip Around, and Thought Swap (or Walk & Talk) each have different purposes.
   b. For example, Two Cents is often good for students who need practice taking turns and listening to each other, but some students, might get frustrated or feel constrained by the structure (like some of you did).
   c. We’ll talk more about different routines and their different uses later in the session.

19. Introduce the next discussion activity & explain:
   - We’ll use one more routine, Think-Pair-Share, to discuss this next prompt related to leading discussions.
20. Show slide 10: Think-Pair-Share. Read the prompt out loud & explain:

- How does content delivery influence a discussion?
  When is it appropriate and not appropriate to directly deliver content to students?

  a. This question is important for science discussions because how we use and introduce content can completely change the flow and nature of a discussion.
  b. Introducing content can ignite students’ curiosity and wonder, or shut it down.
  c. Think about this question silently to yourself first. You may want to write notes or sketches. Then after a minute or so, discuss your thoughts with a partner.
  d. After a few minutes, we’ll have a whole group discussion.


- After 1-2 minutes, tell the group to pair up and begin their partner discussions.

22. Orchestrate each partner sharing, then .

  a. After 1-2 minutes, remind the pairs to switch who’s been talking so both people get a chance to share their ideas.
  b. After another 1-2 minutes, bring everyone’s attention back to the whole group.

23. Lead a whole group discussion about the question while covertly modeling the Discussion Map.

  a. Ask participants to share out with the whole group. Structure the whole group discussion using the discussion map but don’t reveal this till later):
  b. Ask a broad question(s):
     - How does content delivery influence a discussion?
  c. Listen to responses and thinking
  d. Ask for evidence or explanations:
     - Why do you think delivering content might have a positive (or negative) effect in that situation?
  e. Ask for alternative opinions or ideas:
     - What do others think about that? Or, does anyone have a different opinion?
  f. Ask a question leading back to the main topic:
     - E.g.: When is it important not to deliver content directly to students?
  g. When you are ready to end this discussion, ask,
     - Who can summarize some of the main points of this discussion?
24. Explain reasons for the routines & discussions so far:
   a. The discussions so far have been intended to:
      • Provide opportunities to discuss important topics related to discussions.
      • To provide experiences feeling what it’s like to participate in productive discussions of ideas.
      • To model good discussion leading strategies.
   b. Now we’ll step back and look more metacognitively at what we did.

Strategies and Tools for Leading Discussions

1. Explain that the next part of the session focuses on strategies, tools, & “instructor moves,” for leading discussions:
   a. Productive discussions of ideas usually don’t just happen with a group of students. Instructors need to actively nurture discussion.
   b. The prompts, questions, and follow-up responses instructors use are called “instructor moves.”
   c. This next section focuses on some instructor moves and tools that are helpful to promote discussion.

2. Show slide 11: Productive Discussions. Point out that productive, juicy, authentic discussions are the ultimate goal, but there are steps to get there; explain:
   a. Juicy, authentic, productive discussions are often the goal, but you need structure and scaffolding to get there.
   b. Instructors may have a vision for how a discussion should go, but may be unsure of how to make it happen.

3. Show slide 12: Steps toward Discussion. Explain that to reach juicy discussion level, you need a culture of discussion, as well as, coaching, and facilitation.
   a. This diagram shows a simplified map to getting to productive discussions.
   b. You need to, first, create a culture that supports discussion, and second, begin to include opportunities to practice skills as well as intentional coaching and modeling.

4. Ask participants to reflect back on how this session has modeled setting up a culture of discussion:
   a. This session has been modeling many of these elements along the way. Let’s think back to what we’ve done so far.
b. Ask,
   - What are some ways this session nurtured a culture of discussion?

c. Listen to their ideas.

d. Mention the points below if participants do not:
   - Showed genuine interest and curiosity in participants’ ideas.
   - Established discussion norms and got buy-in
   - During *Walk and Talk* (or *Thought Swap*), asked participants to share what their partner said to show that it’s important to listen and pay attention to peers.
   - Made sure that everyone could hear each other.
   - Asked broad questions without right answers
   - Gave accepting responses to participants’ ideas

e. Ask,
   - What are some additional strategies you could use to help create a culture of discussion?

f. Listen to their ideas.

g. Mention any points from below that participants have not already:
   - Students knowing that their opinions are valued and that there are no right/wrong answers to the questions asked.
   - Instructors engaged as collaborators.
   - Model and insist on respectful talk
   - Model your own interest in the subject, including your own questions
   - Encourage participation from all learners, but don’t require equal participation from all.
   - Point out and model examples of productive discussion and science talk.
   - Have learners periodically self-evaluate their discussions.

5. **Explain that creating opportunities for students to practice, and helping them develop good discussion habits through facilitation and coaching are critical.**
   
a. Even after a culture of discussion has been established, most students are not in the habit of explaining their evidence and reasoning, or even listening carefully and responding to peers, so they need guidance.

   b. Students need practice through the use of routines, and with the help of coaching and facilitation.

6. **Explain that when students arrive at outdoor science school, instructors need to find out what discussion skills they have, then build on them:**
   
a. In some classrooms, students have very little exposure to discussion.

   b. But in other classrooms, teachers engage their students in learning through discussion, and their students may come to outdoor science
school already with skills to independently participate in authentic discussions (like the students in the Kids Discussing Discussions video).

c. It’s important to pay attention to the discussion skills and culture of your group, to see where they are when they arrive, and how far you can take them.

d. You’re not just helping them learn about whatever content you have in mind, you are helping them learn how to think and reason.

7. **Show slide 13: Discussion Goals. Explain that when facilitating discussions, leaders should have five goals in mind:**

   a. Research shows that there are five foundational elements to a productive, academic discussion.

   b. Making these elements a priority when leading discussions is critical to translate what is talked about into learning.

   c. These elements can be translated into goals for discussion leaders.

   d. Each goal builds on the previous one(s), but instructors may not accomplish all five goals at once, especially when working with groups that are not used to talking to each other.

8. **Read goals out loud and briefly explain them:**

   a. First, kids need to be interested and curious to have productive discussions. No one wants to discuss questions they’re not interested in!

   b. Instructors need to ask interesting, relevant questions; facilitate students coming up with their own questions; and use them in discussions.

   c. Second, students need to be able to explain and share their own thinking with the rest of the group.

   d. Third, students need to listen and pay attention to each other to be able to participate and add to the conversation.

   e. Fourth, students should deepen their own reasoning during discussion, using evidence or thinking through examples.

   f. Finally, the pinnacle of a discussion occurs when students respond to and participate in the thinking of others.

9. **Show slide 14: Discussion Goals and Talk Moves. Explain that each goal has instructor moves that go with it:**

   a. Each of these goals has been aligned to instructor moves (strategies and prompts) that help participants reach that goal.

   b. For example, to incite curiosity, you might ask a broad question or introduce some really interesting, mind-blowing content.

   c. Or to help individuals clarify their own thinking, you might ask them to “say more,” or think of an example that supports what they said.
d. In a few minutes, you’ll get a handout with these goals and their corresponding instructor moves.

10. Show slide 15: Types of Science Discussions. Explain that it’s also important to understand the type of conversation you’re leading:

   a. The broader context of the discussion is also important.
   b. Once you have a goal or goals in mind, pick the type of science discussion that best fits your students and your goals.
   c. There’s overlap between these categories, but understanding what general category you’re leading can help frame the discussion.
   d. Leading a conceptual development discussion is the most challenging.
   e. Leading nature engagement discussions first with groups can provide important practice time for both leader and students.
   f. Environmental issue discussions involve more opinions, and generally, instructors can introduce key evidence, but should hold back on sharing their own opinions.
   g. Environmental issue discussions tend to be easier to lead than conceptual development discussions, but are richer when they build upon both nature engagement discussion and conceptual development discussion.

11. Show slide 16: Using Routines. Explain that using routines creates opportunities for students to practice different elements of discussion:

   a. Different routines and structures help students isolate and practice different skills.
   b. By providing structure when needed, striving for high interest and participation, and by coaching, students can eventually arrive at some level of autonomy during discussions.
   c. Discussion, in general, will get easier for students as they become more familiar with sharing their ideas out loud, listening to each other, and responding to your prompts.

12. Explain that using routines often can support struggling students:

   a. It’s often easier for students (and instructors) to start with pair discussion, and work up to larger, whole group discussion.
   b. Repeating routines enables students to jump right into a discussion already knowing what’s expected and how to participate.
   c. The more discussion routines you’re familiar with as an instructor, the more you can adjust to your group’s needs.
   d. After the session, you’ll receive a handout with more discussion routines on it, and what some of their strengths and purposes are.

Remind participants that handouts with information on discussion goals, types of science discussions, and discussion routines will be provided later.
13. **Show slide 17: Discussion Map. Introduce Discussion Map. Explain:**

   a. Another effective strategy for facilitating discussions is the Discussion Map, which helps instructors guide and encourage discourse.
   
   b. This map comes from analyzing patterns of good discussion leaders.
   
   c. This straightforward map can be applied to discussions with any age group.

14. **Explain the steps of the discussion map:**

   a. The Discussion Map starts with a broad question, providing enough time for students to think and respond. Narrow questions are fine for other goals, but you usually need a broad question to start a discussion.
   
   b. Then the instructor listens to one or more student responses and reasoning, while giving accepting, neutral responses.
   
   c. Responding to students inappropriately can derail discussion. By reacting to student responses showing preference for some responses over others, like “yes, that’s right” or “no, but keep thinking,” we’re sending the message that only some student thinking is acceptable, or that there is a right answer.
   
   d. Next, the instructor asks for further explanation or evidence.
   
   e. Then, the instructor asks for different ideas.
   
   f. Finally, the instructor asks a new follow-up question that’s related to students’ ideas, but leads back to the main topic.
   
   g. You’ll get a handout in a few minutes with each of these steps and additional information and examples.

15. **Show slide 18: Discussion Map used in Our Discussion. Explain how you used the Discussion Map.**

   a. Explain: the whole-group discussion on when to introduce content with students was structured using this Discussion Map.
   
   b. Read each step of the Discussion Map out loud and cite examples from the earlier discussion on how introducing content influences discussions.

16. **Explain the value of the Discussion Map as modeled throughout BEETLES sessions:**

   a. Many of the discussions in BEETLES sessions and student activities were also designed with this Discussion Map in mind.
   
   b. This Discussion Map model is well-suited for educators interested in helping students construct their own conceptual understanding.
   
   c. It allows for diverse ideas to emerge and for students to compare evidence from different points of view.
   
   d. It helps keep the discussion flowing and interesting for participants.
17. Describe flexible use of Discussion Map:
   a. Like other instructional tools, the Discussion Map works best when used as a flexible model to guide discussions, rather than rigidly following it step-by-step.
   b. Ideally, each step of the map involves multiple student responses, and even student-to-student exchanges without the instructor intervening between each response.

18. Explain the importance of being curious about student ideas, listening carefully after each response & following students’ line of thinking and interest:
   a. The most important element of being a good discussion leader, is being authentically curious about students’ ideas. If you’re not, and are just going through the motions, students will know.
   b. These steps are a useful sequence of questions an instructor can use, but they don’t show the exact questions to ask.
   c. The questions depend on carefully listening to each student response, and doing your best to understand their thinking.
   d. The purpose is to raise different ideas, encourage students to discuss them, and choose pathways to pursue.

19. Explain that another key to discussion-leading is choosing pathways:
   a. One of the most important factors in discussion-leading is following (and guiding) the flow of the exchange of ideas.
   b. Having each student take equal turns speaking, or following-up equally to each student statement or idea does not tend to lead to an engaging, productive discussion.
   c. Productive discussions have direction and pathways, chosen by the instructor and/or the group.
   d. Sometimes a discussion leader simply listens carefully to statements, but sometimes chooses certain student statements or ideas for the group to discuss.
   e. Choosing these pathways has to do with the content goal of the instructor, and what the instructor thinks may keep students interested.

20. Show slide 19: Coaching Students. Explain that while students are becoming comfortable with discussion, it’s important to coach them:
   a. As students gain more experience in discussion through routines and facilitation, encouraging positive discussion habits through coaching is important.
   b. Pointing out to the group when a student uses one of these habits can make a difference.
c. Often students will do these things on their own, and all the instructor needs to do is point them out. If these habits are encouraged when they come up, students will catch on and begin using them more frequently.

21. Ask the group for other habits they might want to encourage, & other ways they can think of to coach students.
   a. The slide shows some examples of habits you might want to encourage. 
      ▶ What are some other habits you might encourage?
   b. Allow a few participants to share out.

22. Explain that using these different strategies takes practice:
   - It takes practice to lead effective discussions: incorporating instructor moves, keeping goals in mind, using the Discussion Map, and encouraging good discussion habits.

23. Show slide 20: Most Common Challenges. Explain that these are three common challenges instructors struggle with, & address how to keep kids engaged:
   a. These three challenges are often brought up by instructors.
   b. Using the routines and instructor moves we've talked about will help kids stay engaged and to address inaccurate ideas.

24. Explain that many instructors fear that students discussing inaccurate ideas will further ingrain them:
   a. Many instructors fear that letting students talk about an inaccurate idea will only further ingrain it.
   b. But research shows that providing kids with opportunities to talk about misconceptions, and figuring out why they are wrong is a crucial component of deep learning.

25. Explain that many instructors struggle with how to conclude a discussion:
   a. Sometimes a discussion can feel like, “it didn’t go anywhere” (a lot of different ideas and opinions but were expressed but we didn’t resolve them). Wrapping up a discussion should include some meaning-making.
   b. Your conclusion will flow from the previous conversation. It often works well to summarize (or ask someone in the group to summarize) some of the main points or patterns that have been discussed.
   c. If the discussion has not yet elicited strong explanations, you can use the discussion to lead into a different activity or experience that provides students with additional information.
   d. Some discussions might not be concluded till the end of a field experience, while others should be concluded much sooner.
   e. The conclusion should achieve some kind of normative understanding of the concept or topic, even if that understanding is that there is disagreement, and it should provide an opportunity for students to
reflect on their learning. In the conclusion, you can distill the many things said into a few cogent ideas, and you can choose to ignore unhelpful parts of the discussion.

f. At the end of the session, you’ll get a handout that has more ideas for overcoming each of these challenges.

26. Explain that getting better at leading discussions requires practice.

• This next activity is an opportunity to practice using some of the routines, strategies and instructor moves discussed throughout the session.

Discussion Lab

1. Explain that they’ll be putting discussion strategies into action using field-appropriate discussion topics:

a. So far, you’ve been discussing discussion – and having important instructor-level discussions about topics relevant to this valuable and challenging teaching practice.

b. Now you’ll try putting some of these strategies into action by trying them out with discussion topics you might use with students in the field.

c. The goal for this activity is to walk away with a plan for leading a discussion with students, and to have some practice leading that discussion with adults.

d. Leading discussions with adults isn’t the same as with kids, but it’s still valuable practice and can provide useful feedback.

2. Show slide 21: Discussion Lab Goals. Explain that the discussion lab is meant to be a time for practice and experimentation.

a. The lab is an opportunity to experiment with which types of questions and instructor moves work well to encourage meaning-making discussions.

b. It’s also an opportunity to mess around with the Discussion Map and learn together how to apply it to leading discussions.

c. It’s important to explore what works AND what doesn’t work so well. There’s no such thing as a perfect discussion. Don’t be afraid to volunteer and try things out.

3. Show slide 22: Discussion Lab Format. Explain the format:

a. First, in small groups, you’ll choose one person to be the discussion leader.

b. Second, in your groups choose a discussion topic or question. You can choose one from the Discussion Lab handout, or pick something else you’d like to discuss.

Choosing the right prompt for the Discussion Lab. There are two categories of questions included on the Discussion Lab Planning handout: environmental issues and conceptual development. For each category, there are a few suggested questions to choose from. For more of a challenge and potential for learning, encourage your participants to take on conceptual development prompts. Ideally, they should know some content about the prompt they’ll be using. If they want to come up with their own prompt, encourage them to think of science conceptual development prompts, or, if they are beginners, they may prefer starting with an environmental issues prompt, which tends to be easier to lead. The BEETLES BFF Questions introduced in the Questioning Strategies session is another useful tool when planning and leading discussions.
Third, work together to make a discussion plan. Use the Goals and Instructor Moves for Productive Discussion handout to choose a goal to focus on. Then use the Discussion Map to design your discussion.

d. You’ll have access to handouts about discussion routines and the Discussion Map.

e. You’ll have ~5 min. to make a realistic plan you’ll be excited about using with students.

f. When it’s time, volunteer discussion leaders will switch to another group to practice leading the discussion. Leaders will have about 7 minutes to practice leading the discussion.

g. While everyone in the group will be responsible for metacognitively thinking about the discussion, each group will also designate one observer whose job will be to take notes on the discussion.

4. Pass out the three handouts to each participant:
   - Discussion Lab Planning Sheet
   - Discussion Map
   - Goals and Instructor Moves for Productive Discussion

5. Divide into small groups, & begin planning time:
   a. Choose a person to prepare to be the “instructor.” The rest of your group will help in the planning.
   b. Quickly choose a question your “instructor” feels pretty comfortable with.
   c. Then your small group will help the instructor plan a main goal, and actions the chosen instructor might do during the discussion to accomplish that goal.
   d. You’ll have about five minutes for planning.

6. Ask the volunteer leaders from each group to switch to a different small group.
   a. After ~5 minutes of planning, ask the discussion leader from each group to switch to another group to lead the discussion.
   b. Ask the “instructors” to share what their primary goals are with their new group.
   c. Then, have each new group designate an observer.

7. Remind other participants of their roles & begin discussions.
   a. Emphasize that the topics are all child-appropriate, but to have an authentic discussion, participants should discuss at an adult level.
   b. Their teaching comments (about leading the discussion) should wait till later.
   c. Remind each small group to choose one observer to take notes about instructor moves and productive and not-so-productive prompts.
d. If possible, have discussion participants and the “instructor” seated in a circle on the floor/ground, like students might be in the field, with the observer standing or seated outside the circle.

e. Remind everyone that the “instructor” will be in charge of leading the discussion.

8. Remind discussion leaders to try to conclude their discussion.
   • After about five minutes, remind discussion leaders that they should try to conclude their discussions as best as possible with the remaining 1-2 minutes.

9. Bring everyone’s focus back to the whole group.
   • After discussion leaders have had a chance to conclude their conversations, bring the focus back to the whole group.

10. Show slide 23: Discussion Lab Debrief. Give small groups a chance to debrief; explain:
    a. Before we have a whole group discussion, you’ll debrief in your small groups about how the discussion went.
    b. Use the prompt on the slide to guide your debrief, and make sure the observer, leader, and discussion participants each have a chance to share what they noticed.
    c. You’ll have about 5 minutes to discuss in small groups, before we’ll share out in the whole group.

11. Lead a whole group debrief of the discussion, recording “productive” & “not-so-productive” instructor moves on the wall chart:
    a. [Optional] Make three columns on a white board or chart paper, with the far left column labeled, “productive,” and the far right one labeled, “not-so-productive.” In the center column, list instructor moves (actions, prompts), then ask the group to help decide whether to make an arrow next to the move pointing towards the left or right column.
    b. Ask participants to share out ideas they discussed in their small groups.
    c. Refer back to the discussion questions on the slide, as necessary.
    d. Remind them that some prompts that were unproductive in this situation might be productive in a different situation with different students or discussion topics.

12. Do another Discussion Lab rotation, if time allows.
    • Consider running more “discussion experiments” as long as you have time, but leave at least ten minutes for the wrap up and reflection of the whole session.

Multiple rotations. If you have time, you can run multiple rotations of the discussion lab to give more people practice. Make sure to give each small group a chance to debrief, before moving on.

Listen to a few of the small groups sharing, and use their conversations to pull out interesting discussion points for the whole group discussion.
Making Sense of the Session

1. **Show slide 24: A Productive Discussion Requires.** Explain that not all discussions are productive, but productive discussions have some key elements in common:
   a. Productive discussions have common elements, shown on this slide.
   b. The tools and resources in this session are designed to support those elements, to encourage more productive discussions to take place in the field.
   c. Ultimately, though, it’s up to the instructor. There’s no script that can create a productive discussion.

2. **Show slide 25: River Rafting as a Metaphor.** Explain how guiding a boat through rapids in a river can be a metaphor for leading discussions:
   a. A good discussion flows like a river. Making decisions about discussions is not all in your head, you’ve also got to learn to feel the flow.
   b. In most rapids there are different possible routes, just as students may bring up different directions the discussion may go. As an instructor, you have to pick a route to guide them through. If you don’t choose, you could end up on the rocks.
   c. A discussion leader constantly searches for interesting routes based on their goals for the discussion, and responding to what students say. The instructor considers different routes, chooses one, then directs the discussion towards that route.
   d. You might be taken off course temporarily by an eddy (a circular current), and you may need to take some strokes to get back into the downstream current. Students may come up with off-topic or off-the-wall comments, but a good discussion leader can gently guide the discussion back on topic with a few strategic moves.
   e. A discussion leader must be ready to improvise and shift course if the chosen route isn’t working out, or if unexpected currents, obstacles or turbulence cause problems.
   f. The instructor needs to pay attention to their “passengers” (i.e., the students’) emotional, social, physical, & intellectual needs.

3. **Ask participants to think of other ways river rafting can be a metaphor for leading discussions:**
   a. Ask,
   > Are there any other ways you can think of that the river rafting metaphor applies to discussion leading?
   - Listen to their ideas. Laugh at the ones that are funny.

**Appreciation to you from the Universe.**
Hey you! Yes you, you wonderful human being sitting there poring over this session, preparing diligently for a presentation. You should know that the Universe is extremely appreciative of your efforts. You are helping make the world a better place, and you are doing your part to fill outdoor science schools with children’s voices discussing ideas! Woo-hoo! You deserve a mango, some chocolate, a massage, or at least a really nice hug.
4. **Point out how outdoor science schools can be productive settings for instructors to experiment & refine their craft:**
   a. At outdoor science schools instructors often get many opportunities to repeat and refine activities, and to teach students of varying ages and backgrounds.
   b. In this way outdoor school can be a great “education lab” in which to experiment and improve your instruction skills.
   c. Discussion leading is extremely valuable for learning and teaching, but it takes practice to develop skills.

5. **Remind instructors to begin slowly & to choose routines to fit students’ needs:**
   a. With a new group of students, don’t jump in right away with whole group discussion. Begin with safer, easier routines, such as Walk & Talk, Whip Around, and Turn & Talk.
   b. Choose discussion routines that fit your students’ needs. If it seems like they need work on listening skills, try using the Tape Recorders routine. If they need work on taking turns, try using the Two Cents routine.

6. **Explain that instructors need to develop discussion-leading skills & should “baby step” the routines they try out:**
   a. Some instructors get excited about student discussion, they try leading a discussion, it doesn’t go well, then they become reluctant to use discussion in their teaching. Eek!
   b. It’s usually best to start out with the discussion routines that are easiest to lead, such as Walk & Talk, Turn & Talk and Whip Around. Work up gradually to more challenging routines and whole group discussion.
   c. If you lead a discussion and it doesn’t go well, don’t give up. Adjust your approach and try again.

7. **Show slide 26: Practice Makes Experts. Explain that opportunities for growth as educators are endless, but you need deliberate practice:**
   a. Allow time for participants to read the slide.
   b. Explain: After some time being an instructor, it’s easy to plateau at a functional, but sometimes uninspired, level of teaching.
   c. The beauty and challenge of being an educator is that you never really “arrive,” and there’s always room to grow.
   d. If you want to grow and improve as instructors, research shows practice alone is not enough - you need deliberate practice, in other words, you must challenge yourself.
   e. Choose something you want to work on, such as leading whole group discussions, break it down into smaller skills, such as those on the Discussion Checklist, like “asking more relevant broad questions of interest to students,” or “helping individual students share, expand, and clarify their own thinking.”

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**K Anders Ericsson.** A little background on the person quoted in the slide: K. Anders Ericsson is a Swedish psychologist, Conradi Eminent Scholar and Professor of Psychology at Florida State University who is widely recognized as one of the world’s leading theoretical and experimental researchers on expertise.
f. Make a plan, try it out, see how it goes, rinse and repeat.

Participants write in journals about the session using reflection prompts.

a. Tell participants to take a few minutes to write their reflections about where they are far as leading discussions, to describe any changes they’d like to make in their teaching, and make note of lingering questions.

b. (Optional) Tell participants to team up with 1-2 others to meet up on an on-going basis for planning, debriefing, and processing their efforts with implementing discussion strategies.

c. Pass out final take-away handouts to each participant while they’re reflecting.
   - Tips For Promoting Discussion
   - Research on Promoting Discussion
   - Steps toward Discussion
   - Discussion Routines
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 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 are excited by new ideas, it is easy for instructors, especially veteran instructors, to keep doing that they have been successfully doing already, and not try out new approaches. Leading discussions, in particular, will likely challenge even very experienced instructors in the beginning. 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 discussion strategies.** After the session reflection, your staff will have already written ideas they have about implementation into their instruction. You can tap into these, and other ideas through a brainstorm of what they plan to do, and how you can support them in doing it.

- **Discussing Implementation of discussion routines.** Assign your staff to each try out one or more of the discussion routines featured in the session during your next student program, and to write in their journal about how it went. Then, lead them in a discussion on the activity at the end of the program during a meeting. Here are some suggested questions to focus a reflection or discussion on:
  » What were some interesting student ideas that came up?
  » What surprised you?
  » Did you notice evidence of student meaning-making?
  » 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? What ideas do you have about incorporating it in the future?

- **Instructor Observations.** If you do observations of instructors, discuss how you might incorporate elements from this session into the observations.

- **Continuing a discussion.** If there was a topic that came up during discussion that you had to cut off, and if it seems like your staff is interested in, and would benefit from continuing the discussion, set aside some time to do so.

Together, make a chart of different discussion routines, including the advantages, challenges & uses of each. Title the first column of the chart, “Routines,” the second column, “Advantages,” the third column, “Challenges,” and the fourth column, “Uses.” Lead your group to fill in the chart, brainstorming a list of routines, their advantages, challenges and uses. Make this list available to the team on a wall poster or handout, so they can use it when choosing which discussion routines to learn/use. This is a nice application, in which instructors immediately apply what they have learned, think more deeply about each routine, and practice making informed choices about what to do with their students.

Discuss research findings on discussion. The information on the Research Related to Promoting Discussion handout can be discussed and re-discussed throughout an entire career in education. It’s worth it to spend more time discussing them during short staff meetings. We recommend assigning your staff to read one of the topics, and then think about it for a week or so of instruction before discussing what the research shows and how to apply it to their teaching practice.

Brainstorm site-specific broad questions for discussion. Assign your instructors to brainstorm and write down broad questions that could serve as good discussion prompts in the specific program and locations of your site.

Watch the BEETLES discussion strategy videos. Choose one video to watch together as a staff. Ask staff to take notes as they watch (using “I notice, I wonder, It reminds me of” as model for note-taking). Afterwards, lead a pair-share discussion. We don’t recommend watching all the videos at the time; rather, space them out and give instructors opportunities to integrate new ideas into practice.

Follow up with the Evidence and Explanations session. Once staff are feeling more comfortable, use the Evidence and Explanations session to continue talking about building a culture of discussion and encouraging more student talk.

View the discussion strategy videos at http://beetlesproject.org/resources/for-field-instructors.

Videos include:
- Building a Culture of Science Talk & Curiosity
- Diversity, Equity, & Inclusion
- Supporting English Language Learners
- Building Discussion Skills
- Responding to Students
- Constructing Explanations and Engaging in Argumentation
Teacher: Ok, I want to stop there and I want you to think about this question: did having the opportunity to talk about your ideas and to talk about this in a group, did that help you get a better grasp on this whole thing? So think about it for a second, and who would like to speak to that? Ok, let’s pass it to people who haven’t had much of a chance.

Bahia: I think it did help because usually I’m kind of shy about showing my other—showing my answers—sharing my answers with other people but a lot of the other people had the same idea like me, so I think that helped.

Teacher: Does that give you more confidence when other people have the same idea?

Bahia: Yeah.

No name: So I think it helped because at first I thought that it was just one reason but then I realized that everybody was talking about different things and I realized that no one thing could have taken that much water so then I realized that it was all those things put together.

No name: I think it helped a lot because before, I had almost no idea how it could escape and now I think that I understand it a lot better.

Teacher: Noel had his hand up.

Noel: For me this helped because you could, before it be only like our group and stuff, so it only had like a couple people to talk to. It wasn’t as much variety of reasons and stuff we can hear from.

No name: I agree with Bahia, and I also want to say that you never know when you can like change your mind. So if you have an idea and you don’t think there’s enough evidence, you always have somebody who can add, find evidence for you.

No name: I also think that lots of people that don’t really like to share their ideas, they’re really quiet, and when we’re in a circle like this, you can share whatever ideas you have and people can add onto them, and I feel like that gives them more confidence to share their ideas.

Teacher: Ok, do we have any final comments?

No name: I also agree with Noel because when everybody has their L-group and when one person from that group shares, it’s kind-of like hearing from the entire class and you get ideas from everybody and that’s a lot of ideas.

Jackson: Yeah, I’m pretty sure everyone would agree with this that there’s a lot more ways that we could have thought of in just of an L-group or by ourselves, how and why the water evaporated or got used from the vial, so I think this is really helpful that we have more people and it’s easier to learn what would’ve been harder to come up with in just an L-group or by ourselves.

No name: Adding on to what Jackson said, in our L-groups usually there’s like when one person speaks, then like everybody adds on and doesn’t share their ideas, and so here people will respectfully disagree and share their other ideas that we might of not shared in our L-groups.
KIDS DISCUSS DECOMPOSITION TRANSCRIPT

Instructor: So, we looked at, what were the decomposers we looked at before with the cards n them? What were they? One started with an F? Go ahead and call it out.

Students: Fungus!

Instructor: And then there’s one with a B?

Students: Bacteria!

Students: Invertebrates

Student: I caught a leaf

Instructor: You caught a leaf? Nice!

Student: humming

(Instructor reaches out and touches knee)

Instructor: OK, so those are some decomposers. Can anyone think of anything else besides for fungi, bacteria, and invertebrates that might be a decomposer, something besides for those that might break down things that used to be alive and their waste into simpler parts and smaller parts that become part of soil?

(pause)

Instructor: Anything else you can think of besides fungi, bacteria, and invertebrates? Keep thinking, think quietly to yourself.

(pause)

Instructor: Raise your hand if you have an idea. Something besides for fungi, bacteria, and invertebrates that might break things down into simpler stuff, things that used to be alive or their waste. Ryan, what do you have?

Ryan: Hyenas

Instructor: Hyenas?

Ryan: They’re sometimes scavengers and they eat whatever’s left dead.

Instructor: So, what do you guys think of the hyena idea? You guys know what hyenas are, right? Ok, so tell us more about hyenas that you know, Ryan.

Ryan: I watched a show. People say they’re scavengers and just pick up scraps which they do do. But sometimes they actually, um, kill as well as, uh, just hunt... They kill instead of picking up scraps.

Instructor: So, if a lion kills a gazelle or something and its lying there.

Ryan: Then the hyena comes over and

Instructor: Comes afterward

Ryan: Yeah

Instructor: And eats the scraps that are leftover?

Ryan: Yeah

Instructor: Or are you saying they sometimes kill the animal and eat it?

(Ryan nods)

Instructor: Ok, what do you guys think? Would you call that a decomposer? Are they breaking things that used to be alive down into smaller and smaller parts that become part of the soil? What do you guys think? Talk to the person next to you. Turn and talk.

(kids talking)

Instructor to two girls: Do you think hyena break things that used to be alive down?

Girl 1: Yeah, ‘cause, yeah ‘cause they
Girl 2: Yeah
(Instructor hand motions for them to continue)

Girl 1: When they....

Girl 2: I think they might be decomposers because, like, sometimes they get in fights to get like some things to eat too, so then when they’re done other animals can also come and eat and stuff.

Instructor: But are they breaking down something that used to be alive into smaller and simpler parts?

Students: Cricket! I see a cricket!

Student: Its right there!

Student: Can we catch it?

Instructor: Ok, next discussion question: Do you think that that cricket is a decomposer?

Students, many at the same time: Yes, yes.

Instructor: Turn and talk to the same person, do you think that cricket is a decomposer, and say what your evidence is.

(lots of students talking)

Student: I remember watching a TV show

Instructor: That’s your evidence, because you saw it somewhere?

Chaperon: Its an interesting question.

(Student shakes head)

Chaperon: You don’t think it eats dead things?

Student: No, it just eats grass.

Instructor: So the question is, is it a decomposer? Does it eat things that were dead and break them down into things that are simpler and smaller that could be part of the soil? So, lets do it with the talking stick. Who’s ready to talk to the whole group here? Let’s talk about the cricket, do you think the cricket is a decomposer? Here ya go.

Student: Um, no, because I believe that crickets only eat like, grass

Instructor: So, maybe crickets eat grass, so you’d say that its not a decomposer if its grass?

Student: Yeah

Instructor: If it eats grass, do you think its breaking things down that used to be alive down in simpler parts that might be part of the soil?

Student: Yeah

Instructor: Oh, you do.

Student: No...

Instructor: No? Oh, sounds like you’re a little conflicted, huh? That’s ok. Let’s take the talking stick, or why don’t you pass it to the next person. Raise your hand if you want to add to the conversation, and you’ll toss the stick to him gently.

Student: Tiger
(student throws talking stick)

Tiger: Owl! It’s heavy. Alright, so, I think the cricket is a decomposer and I think that everything that eats is a decomposer even if it’s a vegetarian or a like a carnivore or meat-eater.

Instructor: You just said something really provocative. You just said, “I think that anything that eats other things is a decomposer.”

Tiger: That eats anything

Instructor: That eats anything. OK, so say more about that. What makes you say that?
Tiger: Its because even if you’re a vegetarian, like you’re eating veggies and plants and plants can decompose and if you eat meat, that could decompose.

Instructor: So you’re saying that even if you eat meat or plants, anything that eats those things is a decomposer

Tiger: Anything that eats at all is a decomposer

Instructor: Anything that eats all. What do you guys think? Agree, disagree. Raise your hand if you’ve got something to say, to add to this conversation. This is a pretty interesting idea he just brought up there. Right behind you, pass the mic.

Ryan: I agree.

Instructor: Say why you agree. What’s your evidence?

Ryan: Because technically that is right because everything has to eat to survive. And no matter if you’re just like a little fish in the water, you still have to eat something.

Student: But trees cannot decompose.

Instructor: But remember, the main question is, are you breaking things that used to be alive down into something that is simpler and smaller parts, becoming part of the soil?

(Ryan nods)

Instructor: You think so, yeah?

Student: The cricket’s on your leg.

Instructor: Where?

Student: Catch it, catch it!

(Instructor tosses cricket out of the circle)

Instructor:Oops, cricket flew. So, lets go back to his point. He says, anything that eats anything is a decomposer. Turn and talk to the person next to you about whether you agree with that statement or not and say why you agree or you disagree with that statement

(students talking)

Student: Because that thing used to be alive.

Student: It’s like a cycle
**DISCUSSION LAB PLANNING SHEET**

**Directions:**

1. **Choose a discussion leader.** Choose one member of your group who is willing to lead a discussion in front of a small group. Quickly choose a topic from the list below (or come up with your own) that the discussion leader is comfortable with facilitating.

2. **Together, discuss and plan:**
   a. Select the goal(s) you might have for the discussion (use the *Goals and Instructor Moves for Productive Discussion* handout).
   b. Brainstorm potential follow-up questions, instructor actions, and/or interesting content to use during the discussion.
   c. Think about directions the discussion might go as well as how the discussion might be best concluded, but be prepared to flow with the discussion, and what participants bring up.

3. **Discussion leaders switch groups, so every group has a new “instructor:”**
   a. Each leader shifts to a new group.
   b. Choose one person in the group to observe and take notes of the discussion.
   c. The instructor kicks off the discussion.

**Possible Discussion Topics:**

- **Environmental Issues:**
  - Should wolves (or another organism) be (re-)introduced to the ecosystem we are in?
  - Should humans let wildfires burn?
  - Should wilderness areas be off limits to humans?
  - Should invasive species be exterminated?

- **Conceptual Development:**
  - Can humans be considered decomposers? What about other animals?
  - How do you think decomposition might happen in the ocean?
  - When the Texas Horned Lizard feels threatened, it shoots blood out of its eyes (or name any other interesting animal adaptation). How do you think this adaptation developed over many generations?
  - What are some examples of organism characteristics that are NOT adaptations?
  - How do fungi get energy and matter to survive?

**Tips:**

- **Listen and probe.** Most important is to carefully listen to what discussion participants have to say, what they are interested in, and let that guide the discussion. Be authentically curious about, and probe to find out more about what participants are thinking.

- **Plan and improvise.** Don’t get stuck on where you think the discussion should go. But be prepared to re-focus the discussion if it wanders too far afield, or to ask another question if they are losing interest.


**DISCUSSION MAP**

The discussion map is a useful structure for instructors to use to encourage student to construct their own conceptual understandings, unpack their ideas, and generally stimulate discussion and helps to “unpack” their ideas.

1. **Ask a broad question.** Examples:
   a. “What happens to the mass of a log as it decomposes?”
   b. “What might have happened to this deer?”
   c. “Why might lizards lose their tails?”
   d. “Should wolves be reintroduced to this ecosystem?”

2. **Listen to student responses. Accept responses neutrally (don’t imply that responses are good or bad).**

3. **Ask for evidence and probe student thinking.** Examples:
   a. “Tell me more about that”
   b. “What makes you think that?”
   c. “Can you show us what you mean?”

4. **Ask for agreement/disagreement from other students.** Examples:
   a. “Does anyone have a different idea?”
   b. “What are some other possible explanations?”
   c. “That’s an interesting idea. Let’s all turn and talk about that idea.”

5. **Add content to give students more evidence or ask a question leading back to the main topic.** Examples:
   a. “Check out this key and see how many different types of lichen you can find.”
   b. “What else should we consider to figure out where the mass of this log is going?”
   c. “Are there any other parts of this deer that might provide some clues about what happened to it?”
   d. “Try thinking about it from a predator’s perspective; can you think of another possible adaptation?”
   e. “What other organisms in this ecosystem might wolves effect?”

*When you are ready to end the discussion, briefly summarize the main points and patterns of what has been said and/or ask students to summarize for you.*

Cut out this pocket-sized version to carry with you in the field.

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**Discussion Map**

1. Ask a broad question
2. Listen to student responses. Accept responses neutrally.
3. Ask for evidence and probe student thinking.
4. Ask for agreement/disagreement from other students.
5. Add content or ask a question leading back to the main topic

When you are ready to end the discussion, briefly summarize the main points and patterns of what has been said.
GOALS AND INSTRUCTOR MOVES FOR PRODUCTIVE DISCUSSION

So you want to lead an evidence-based, meaning-making discussion? Have a goal(s) in mind and questions that match your goal(s):

<table>
<thead>
<tr>
<th>Goals and Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GOAL ONE: IGNITE INTEREST AND FAN THE FLAMES OF DISCUSSION</strong></td>
</tr>
<tr>
<td>☐ 1. Stimulate curiosity</td>
</tr>
<tr>
<td>&quot; Ask relevant, broad questions of interest to students.</td>
</tr>
<tr>
<td>&quot; Judiciously (and when helpful) introduce content that promotes further discussion.</td>
</tr>
<tr>
<td><strong>GOAL TWO: HELP INDIVIDUAL STUDENTS SHARE, EXPAND, AND CLARIFY THEIR OWN THINKING</strong></td>
</tr>
<tr>
<td>☐ 2. Time to Think</td>
</tr>
<tr>
<td>&quot; Partner Talk</td>
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<tr>
<td>&quot; Writing as Think Time</td>
</tr>
<tr>
<td>&quot; Wait Time</td>
</tr>
<tr>
<td>☐ 3. Say More</td>
</tr>
<tr>
<td>&quot; “Can you say more about that?”</td>
</tr>
<tr>
<td>&quot; “What do you mean by that?”</td>
</tr>
<tr>
<td>&quot; Can you give an example?”</td>
</tr>
<tr>
<td>☐ 4. So, are you saying...?</td>
</tr>
<tr>
<td>&quot; “So, let me see if I’ve got what you’re saying...?” (Always leaving space for the original student to agree or disagree and say more)</td>
</tr>
<tr>
<td><strong>GOAL THREE: HELP STUDENTS LISTEN CAREFULLY TO ONE ANOTHER</strong></td>
</tr>
<tr>
<td>☐ 5. Can someone rephrase or repeat that?</td>
</tr>
<tr>
<td>&quot; “Who can repeat what Javon just said or say it in their own words?”</td>
</tr>
<tr>
<td><strong>GOAL FOUR: HELP STUDENTS DEEPEN THEIR REASONING</strong></td>
</tr>
<tr>
<td>☐ 6. Asking for Evidence or Reasoning</td>
</tr>
<tr>
<td>&quot; “What makes you think that?”</td>
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<tr>
<td>&quot; “What’s your evidence?”</td>
</tr>
<tr>
<td>☐ 7. Challenge or Counterexample</td>
</tr>
<tr>
<td>&quot; “Does it always work that way?”</td>
</tr>
<tr>
<td>&quot; “How does that idea square with Sonia’s example?”</td>
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<tr>
<td>&quot; “Do you know if raccoons are active during the daytime?”</td>
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<tr>
<td><strong>GOAL FIVE: HELP STUDENTS THINK WITH OTHERS</strong></td>
</tr>
<tr>
<td>☐ 8. Agree/Disagree and Why?</td>
</tr>
<tr>
<td>&quot; “Do you agree/disagree? (And why?)”</td>
</tr>
<tr>
<td>&quot; “What do people think about what Ian just said?”</td>
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<tr>
<td>&quot; “Does anyone want to respond to that idea?”</td>
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<tr>
<td>☐ 9. Add On</td>
</tr>
<tr>
<td>&quot; “Who can add onto the idea that Jamal is building?”</td>
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<tr>
<td>&quot; “Can anyone take that suggestion and push it a little further?”</td>
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<tr>
<td>☐ 10. Explain another’s thinking</td>
</tr>
<tr>
<td>&quot; “Who can explain what Esmeralda means?”</td>
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<tr>
<td>&quot; “Why do you think Tiffany said that?”</td>
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</tbody>
</table>

*Adapted from Talk Science Primer, Michaels/O’Connor, TERC 2012*
TIPS FOR PROMOTING DISCUSSION

Be Kind to Yourself

- **Discussions are messy.** It’s impossible to lead a perfect discussion. There’s always room for improvement, and there are also many different pathways you could take. Let go of the idea that a discussion should always end with a neat and tidy conclusion. Embrace the idea that learning is a process, and discussions are a forum for accurate and inaccurate ideas to be brought into the open and examined by the group, and for the instructor to learn more about what’s going on in learner’s minds.

- **Be self-evaluative, but be kind to yourself.** If you are new to leading discussions, and you find your first attempt disappointing, don’t quit doing discussions! Just pat yourself on the back for effort, think, and talk about with others what you might do differently, and try again. It takes practice to be an effective discussion leader (but it’s really worth it!). Don’t be discouraged if discussions don’t go smoothly at first. Learners need practice with discussion, and instructors need practice leading discussions.

Nurturing a Culture of Respect and Curiosity

- **Introduce discussion norms and model respectful talk.** Discussion norms might include: *listen actively and share ideas; Use evidence; Keep an open mind; Share responsibilities; Disagree productively; Work toward a deeper understanding.* Learners need to feel safe, both from a fear of ridicule, as well as a fear of being “wrong.” Learners should feel that what they think is valued by others and by their instructor.

- **Nurture a culture of intellectual curiosity.** Many learners are accustomed to education being a one-way delivery of information and need some modeling and coaxing to share the sorts of tentative questions and ideas that are involved in intellectual inquiry and discussion. They may also be afraid of admitting what they don’t know in the presence of peers and especially leaders. Model your own interest in the subject, including your own questions and confusions. Show genuine interest in and acceptance for learner’s contributions, and encourage other participants to do the same. Participate in conversations and investigations by actively trying to figure things out together as a fellow collaborator. You may also want to build on the conversational language styles used by your learners.

- **Encourage participation from all learners, but don’t require equal participation from all.** Just because some learners aren’t speaking doesn’t mean they’re not engaged. Some learners will happily talk in pairs, but will be reluctant to speak in a larger group. With some encouragement and a non-intimidating question you may get a quieter person to share, but by forcing participation you could embarrass them and turn them off.

- **Point out and model examples of productive discussion and science talk.** In order to help student learners improve their discussion participation skills, it’s useful to point out examples when you or others model good discussion practices, such as asking for evidence, or building on someone else’s idea. Encourage learners to politely monitor each other’s discussion practices as well.

- **Have learners periodically self-evaluate their discussions.** After or mid-way in a discussion, you might ask the learners what aspects of discussion participation they have done well so far (see discussion norms above), and with which ones they could use some growth.

Starting Small

- **Start out with mostly pair talk and work up to larger group discussions.** Talk in pairs is much easier for learners to participate in and also for instructors to manage. Start out with mostly pair discussion strategies, and work up to occasional whole group discussions, when you feel ready.

- **Give options.** Provide many opportunities for learners to talk in pairs and small groups to encourage peer-to-peer learning, as well as to help them prepare for whole group discussions. Break up large group discussions with *Turn & Talks.*
Mix discussion with activity. Especially with children, mix up discussion with activity and other strategies. Just the act of moving to a different spot can re-invigorate learners.

Use rich experiences of learner-driven exploration of nature to develop science language and conceptual vocabulary.

Asking Questions

Plan thoughtful questions in advance, but, also, plan to improvise. Small adjustments in phrasing can sometimes make or break a discussion question, so it pays to plan and be thoughtful with your questions. But many great questions are improvised on the spot. A great discussion-inspiring question is “gold,” so write them down when you find them, use them again, and share them with others. Ask engaging broad questions, and be ready to shift to another question if interest decreases. Try to figure out what is interesting to them. Try to find questions that have some “gray area” to make discussion interesting.

Accept and probe. In general, give neutral accepting responses to learner statements, and ask other learners for their responses to other learners’ statements. Probe learners with follow-up questions to find out more what they are thinking.

Wait time. Use wait time (pause ~3 seconds after asking a question before calling on learners) to allow more thinking and for more learners to chime in. Allow learners to struggle with questions and ideas, rather than immediately providing them with an answer.

Guiding and Concluding the Conversation

Moderate, don’t dominate. Attend to the group dynamics. Instructors need to balance offering guidance while also allowing learners to drive the discussion.

Keep discussion as learner-driven as possible. Challenge students to respond to each other and grapple with each other’s questions. Avoid getting carried away with interjections of your own stories and perspectives.

Conclude the conversation by summarizing what has been discussed and by providing students a chance to reflect on their own learning. Ask them to think about what surprised them, new questions they have, what has changed in their thinking, or to respond to the prompt: “I used to think...Now, I think...”

Thinking Metacognitively

Make choices. Many different strands can come up during a discussion, and you can’t pursue them all fully as a group. Although you want to make sure every idea is heard and acknowledged, the discussion leader can help keep the group focused by choosing which paths to spend more time pursuing with follow-up questions, and also when to cut off discussion, or to table it for later.

Seek out the edges of your own understanding. Don’t be afraid when discussions steer towards topics and questions that you don’t fully understand. Let learners see you brainstorming and grappling with ideas. Engaging in authentic inquiry together makes you a “guide on the side.“ Some educators may avoid discussing unfamiliar topics because they are afraid they will lose respect from their learners. When you take time to figure things out alongside your learners, you actually gain their respect for being a curious and scientific thinker.

Pay attention to known common misconceptions and learners’ conceptual frameworks. Knowing that most learners think soil is the main “ingredient” of trees can help you frame and guide a discussion about where the mass of a tree comes from, perhaps by bringing pivotal pieces of evidence into the discussion. Awareness of common misconceptions can also help you recognize and understand them in statements made by learners. Try to figure out their ideas and background knowledge. Ask, listen and probe.

If a discussion feels false, take the opportunity to reflect on what you’re actually trying to do. It may be because the learners know that your real intention is delivering content, or trying to lead them to a specific answer. In those cases you may be pretending that it’s an open discussion, when you should probably just tell them what you want them to know.
RESEARCH RELATED TO DISCUSSION

PEDAGOGY
The following short excerpts from educational research highlight some important findings and/or conclusions:

The “wrong” answer. “...Knowing why the wrong answer is wrong in academic discourse can be just as important as knowing why the right answer is right.” Presenting science as an unquestionable body of knowledge turns students off as they lose motivation and instead passively accept answers, and often covers up prior misconceptions. Critique and challenging ideas is central to science, and it should be just as central in science education. Classrooms rarely provide students with the opportunity to not just understand the right idea, but also to understand why the right idea is right and why the wrong ideas are wrong.

From:

Discussion increases cognitive abilities. Early evidence indicates that opportunities to discuss ideas in one discipline can have positive impacts on student achievement in other disciplines as well. In essence, discussion “grows the mind.”

From:

Peer-to-Peer discussion. Research shows that peer-to-peer discussion is a critical component of the learning process. Students who have the chance to reason and talk together often came up with more accurate ideas, that they can as individuals In fact, studies show that scientifically accurate ideas tend to come out of peer discussions, even if each individual originally had inaccurate conceptions. Peer talk between pairs or groups of children is less hindered by adult–child interaction. The more equal participant structure of peer groups seems to support both divergent thinking and the development of new ideas. While the perceived superiority of adults might intimidate children from freely expressing their ideas, other children can provide more opportunity for discussion and reciprocal exchanges, thus promoting the types of social interaction that support construction of understanding.

From:
Wait Time. The concept of “wait-time” as an instructional variable was originated by Mary Budd Rowe (1972). The “wait-time” periods she found—periods of silence that followed teacher questions and students’ completed responses—rarely lasted more than 1.5 seconds in typical classrooms. She discovered, however, that when these periods of silence lasted at least 3 seconds, many positive things happened to students’ and teachers’ behaviors and attitudes. To attain these benefits, teachers were urged to “wait” in silence for 3 or more seconds after their questions, and after students completed their responses (Rowe 1972; Stahl 1990; Tobin, 1987). With this undisturbed “wait-time,” there are positive outcomes: the length and correctness of their responses increase; the number of their “I don’t know” and no answer responses decreases; the number of volunteered, appropriate answers by larger numbers of students greatly increases; and the scores of students on academic achievement tests tend to increase. When teachers wait patiently in silence for 3 or more seconds at appropriate places, there are also positive changes in their own behaviors: their questioning strategies tend to be more varied and flexible; they decrease the quantity and increase the quality and variety of their questions; they ask additional questions that require more complex information processing and higher-level thinking.

From:

Girls and Boys. Research confirms that teachers call on boys more often than girls, accept more called-out responses from boys than girls, give boys more wait-time to respond, and give boys more praise and remediation than girls (Sadker & Sadker, 1994; Biklen & Pollard, 1993). Teachers usually are not aware that they favor the boys in their classroom over girls and are genuinely surprised when they learn of these inequities when they confer with trained observers or watch videotapes of their teaching (Wellhousen & Yin, 1997).

From:

Students who Dominate. As reported in “The One or Two Who Talk Too Much” (1988), researchers Karp and Yoels found that in classes with fewer than 40 students, four or five students accounted for 75 percent of the total interactions per session. In classes with more than 40 students, two or three students accounted for 51 percent of the exchanges.

From:
Steps Towards Discussion

Culture of discussion --> Facilitation, practice & coaching --> Less structured juicy discussion.

Types of Science Discussions

• Direct Engagement with Nature
  – Using observations and making explanations based on evidence

• Environmental Issues
  – Discussing choices about human impacts and policy

• Conceptual Development
  – Building a better understanding of specific science concepts

A Productive Discussion Requires:

• A worthy topic

• Students to
  – elaborate and clarify thinking
  – support ideas with examples
  – build on and/or challenge another’s ideas
  – connect different ideas or applying an idea to a new situation

• A conclusion that paraphrases or summarizes what’s been learned and provides a chance for reflection.

Practice Makes Experts

“Not all practice makes perfect. You need a particular kind of practice—deliberate practice—to develop expertise. When most people practice, they focus on the things they already know how to do. Deliberate practice is different. It entails considerable, specific, and sustained efforts to do something you can’t do well—or even at all. Research across domains shows that it is only by working at what you can’t do that you turn into the expert you want to become.”

- From The Making of an Expert by K. Anders Ericsson, Michael J. Prietula, and Edward T. Cokely
DISCUSSION ROUTINES

An important part of the learning process is having opportunities to talk with others. Provided here are some activity structures - or routines - that offer opportunities for students to discuss while in the field. These routines can be used to discuss virtually any topic.

**Turn and Talk**

**Procedure:** Pairs of students discuss one or more questions. This very simple strategy can be done with planned questions, or can also be improvised at any point. “Turn to a partner and discuss, [insert question here].” It offers opportunities for everyone to talk about what they’re thinking, as well as to hear ideas of others.

**Purpose:** Provides 1:1 thinking and talking time for students; practice listening and responding to peers. It helps keep everyone engaged in large groups.

**Whip-Around**

**Procedure:** Quickly go from person to person in the group. When it’s each students’ turn, they say one or two words to answer the prompt. Instructor can ask follow-up questions to select students to go a little deeper.

**Purpose:** A quick and efficient check-in to get a baseline level of understanding from the whole group, and to seek out provocative statements to pursue more deeply.

**Thought Swap**

**Procedure:**

1. Choose a series of broad questions on a topic that will be interesting to discuss.

2. Line up participants and establish partners. Include yourself and other adults in the partnering. Participants stand shoulder-to-shoulder to form two parallel lines, so each person is facing a partner. Participants standing side by side should be at least 6” apart.

3. Explain procedure for discussing questions. You’ll be providing a question for them to talk about with their partner across from them. They will have about a minute to talk. You will signal them to be quiet to prepare for the next question or statement by gently touching the shoulder of the first two participants at your the end of the lines (the “touch of silence”). These two will then pass the touch on down the line, till the entire group is quiet.

4. Begin the *Thought Swap*. Pose the first question for participants to discuss.

5. Share responses with group. After about a minute, tap the first two participants at the ends of the lines and wait for the entire group to become silent. Repeat the question. Ask a few participants to share with the large group what their partner told them.

6. Change partners for discussion. Tell participants which one of the lines will shift with each question, while the other remains in place. Tell the person at the end of one line to walk down and rejoin the line at the opposite end. Have this line now shift one position to the left so everyone is facing a new person. Everyone now should have a new partner.

7. Do the same with the other questions.

**Purpose:** Facilitate more 1:1 peer discussions and provide an opportunity for the leader to engage in more in-depth discussions with individual students. Occasionally pursue interesting ideas and ask follow-up questions to ignite discussion with the whole group.
Walk and Talk

See BEETLES Walk and Talk Student Activity Writeup for a thorough description, and question sets.

Procedure: The Walk and Talk routine uses essentially the same procedure as thought swap, but students discuss in lines while walking along a wide trail. In this setting, students can spend more time discussing with each person before they switch partners and prompts. The sharing out about their discussion should be spread out to every few questions, when everyone can stop and gather on the trail. There is also the opportunity to include spontaneous questions that are inspired by any discoveries or experiences that happen during the walk.

Purpose: Facilitate more 1:1 peer discussions and provide an opportunity for the leader to engage in more in-depth discussions with individual students, while moving the group along the trail. Distract students while covering territory, such as a steep hill. Keep the group together.

Think-Pair-Share

Procedure:
1. Think. Give students an interesting broad question to think or write about briefly.
2. Pair. Pair students, and ask them to discuss the question(s) with their partner.
3. Share. Students share their discussion ideas with another pair of students or the instructor leads a whole group discussion about the topic.

Purpose: Provide individual thinking and reflection time as well as an opportunity for 1:1 peer discussion before sharing out with the whole group.

Tape recorders

Procedure:
1. Pair up students. Assign partners, with one student as “talker,” the other as “tape recorder.”
2. Explain roles. The “talkers” role will be to say all they can think of about the topic you give them, until you say, “stop.” The “tape recorders” job will be to listen to everything she says until you announce, “stop,” then try to repeat as much of it back as possible, like a tape recorder.
3. Begin talking and recording. Provide a prompt or a question and tell students to begin discussing. After a couple of minutes, get the group’s attention and instruct them to switch roles.
4. Discuss process. Now tell them to briefly discuss in their teams how it felt to be a “talker” and “tape recorder.” After a few minutes, ask for a few comments to be shared with the whole class.

Purpose: Provide opportunities for students to practice listening to each other.

Two Cents Routine

Procedure:
1. In small groups of about four people, students take turns talking. When it’s not their turn they listen and don’t talk.
2. First round (one cent). Each student in the group gets one minute to say what their ideas are on the topic.
3. Second round (two cents). Each student in the group gets one minute to respond to what others have said.

Purpose: Provides an opportunity for students to practice listening to each other and letting everyone speak in turn.
ProMoTing DiScuSSion

BACKGROUND INFORMATION FOR PRESENTERS

Forums for discussions of ideas have the potential of providing some of the most powerful experiences for learning. But sometimes discussions can also be frustrating experiences. From the student perspective, most of us only need to remember back to the humiliation of: being told one’s idea was wrong; the embarrassment of being singled out for an answer; the frustration of being constantly overlooked in favor of a more vocal student; or the feeling of being left behind in a discussion you didn’t quite understand. From the teaching perspective, one learns very quickly how a few very vocal students can dominate a discussion; how challenging it can be to engage the reluctant-to-speak student in discussion; how “off-track” responses, if not handled well, can derail a discussion; and how tricky it can be to communicate accurate information without discouraging participation by students who contribute inaccurate information.

From our own experiences in learning and teaching situations, we can all recognize the important role that conversation, discussion—TALK—plays in any socially-connected group of learners. It’s through such discourse that the meaning-making needed for the development of ideas and concepts can be accomplished. From the sociocultural viewpoint, learning occurs through discourse within social interactions (Rogoff, 1998; Vygotsky, 1978). Vygotsky emphasized the importance of discourse by arguing that higher mental functions have social origins that are first expressed between individuals before they are internalized within the individual—that learning relies on discourse. For students, engaging in discussions and conversations can foster more creative, complex thinking and enable them to practice crucial abilities, such as asking questions and communicating ideas effectively. For teachers, all manner of talk and discussion in the classroom can provide a window into students’ prior knowledge, skill-level, personality, previous experience, and ability to articulate ideas and reasoning. Such discourse happens in many ways.

Note: Although the “Tips for Promoting Discussion” handout was designed primarily for instructors interested in leading discussions with children, most of the tips also apply to instructors leading discussions with other adults.

Reflective Discourse

When a teacher facilitates a conversation where students, as well as the teacher, pose questions, respond to one another’s comments and questions, and seek to understand one another, this exchange can be referred to as reflective discourse. The student has the freedom to express his or her own thoughts, ideas, and questions while authentically engaged and curious about the subject of the discussion. The teacher and students can thus take part in a free-flowing exchange, asking and answering one another’s questions, and trying to understand the thinking of the other person (Van Zee & Minstrell, 1997).

Dialogic Instruction

In a dialogic learning environment, the instructor uses reflective discourse to validate and elaborate upon student ideas and guide them to “negotiate” their understanding with other students in the group. The instructor uses strategies such as uptake (Collins 1982) where a particular student’s response is incorporated into a question to the group, to encourage students to build each other’s ideas. The emphasis is on creating a “give and take” where student responses help shape the course of the discussion, as opposed to relying on the instructor asking questions to drive the exchange. A dialogic approach to instruction is often characterized by the use of broad questions, which do not have pre-specified answers and therefore convey a genuine interest in students’ opinions and thoughts. The discourse in these learning situations is less predictable and repeatable because it is mutually determined—in character, scope, and direction—by both instructors and students, as instructors pick up on, elaborate, and question what students say (Nystrand, 1990a, 1991a). Dialogic conversations engage students because they validate the importance of students’ contribution to learning and instruction. The purpose is not so much the transmission of information through the instructor, rather it’s the interpretation and collaborative
co-construction of understandings by the students themselves—through talking, although whose turn to talk may alternate between instructor and students (Gomorra & Nystrand, 1992). Monologic instruction (also see below) can be criticized for reducing opportunities for students to derive and articulate their own understandings of scientific ideas. It can also be criticized for reflecting the viewpoint that scientific knowledge is obtained primarily from the teacher (or another expert source), and for not giving students the opportunity to learn science by thinking scientifically, and by exchanging and evaluating ideas against evidence as scientists do. Monologic instruction may be a fine method to achieve learning that consists of memorizing facts and information, but it can hinder a deeper more conceptually-focused type of learning for students.

**Monologic Instruction**

*In what has been called monologic instruction, also termed a “teacher monologue,” the teacher explains, describes, clarifies, identifies, and questions.* In this type of instruction the main goal is for the teacher to present scientific views and explanations. The teacher is doing most of the talking.

**I-R-E and I-R-F**

*Of course, there are variations in teacher-directed talk.* In one pattern, abbreviated as I-R-E, the teacher initiates the conversation with a question or comment (I), the student responds (R), the teacher evaluates the response (E), and then repeats the pattern with another question (Lemke, 1990; Mehan, 1979).

**IRE example:**

"Teacher: What kind of flower is this? (Initiate)

"Student: It’s a trillium. (Respond)

"Teacher: Yes, it is trillium. It is white, and has flower parts in threes. (Evaluate)

"Teacher: What about this one, what kind of flower is this? (Initiate)

"Student: It’s a daisy. (Respond)

"Teacher: No, this one is Fleabane. You can tell because it has a taller stalk. (Evaluate)

The student responses may be short answers, while the teacher’s evaluations of the responses may be long and elaborate. In another variation, often called I-R-F, the teacher initiates the conversation with a question or comment, the student responds, the teacher seeks follow-up ideas and comments from the students, then the pattern repeats with response and follow up (Sinclair & Coulthard, 1975).

**IRF example:**

Teacher: What kind of flower is this? (Initiate)

Student: It’s a trillium. (Respond)

Teacher: What makes you say that it’s a trillium? (Follow-up)

Student: Because it has three leaves and three petals. (Respond)

Teacher: You’re right, it is a trillium. (Evaluate)

In both cases, the turn-taking switches back and forth between Teacher and Student regularly, and the teacher directs the conversation and makes knowledge public. Again, these patterns often fail to provide students with opportunities to articulate their own understanding and express themselves in the language of the discipline (Alexander, 2005; Wellington & Osborne, 2001). On the other hand, such interactions can be a way to extend the student’s answer, to draw out its significance, or to make connections with other parts of the student’s total learning experience (Wells, 1999).
Peer-to-Peer Discourse

Peer talk occurs in pairs or groups of students where adults are either not present or are refraining from full participation in the discussion. Researchers believe that having a more equal structure for participation in a discussion (i.e., when the teacher yields control to the students) promotes more active cognitive involvement, as students may not be as intimidated from freely expressing their ideas. (Rogoff, 1990, Piaget 1977). Recent studies on discourse patterns have found that talk with other children can help provide the opportunity for the kinds of social interactions that help support student learning (Blum-Kulka & Snow, 2004). These various patterns of talk are neither intrinsically good nor bad; their merits and demerits come from the reasons for and ways they are used to support and achieve intended goals. In teaching science, there is often tension between the teacher imparting information and directing the conversation to communicate the views of science, and “holding themselves back” in the conversation in order to encourage children to develop their own ideas, and for all students to voice their views. A single science lesson may incorporate a variety of different dialogue approaches, based on the needs at each stage of the lesson. For instance, a teacher may begin with reflective discourse to give students a chance to express their everyday views, to motivate and encourage students to be engaged, to legitimize students’ ways of thinking, and to probe their prior knowledge. The teacher may then shift to IRF to draw out more of students’ thinking and guide the expressions of their understanding towards scientific views. The teacher may transition to an IRE pattern to model how to connect students’ everyday ideas to scientific language, and then finish with more open-ended reflective discourse to give students the opportunity to practice using this academic language.

Instructors’ Role in Science Discussions

Learning science adds increased complexity to the practice of facilitating discourse, because it involves acquiring the language and tools of science and the accepted methods of reasoning in science (Anderson, Holland, & Palincsar, 1997; Kuhn, 1962).

This process of acculturation is not possible without guidance and assistance from a more expert mentor (Scott, et al., 2006). “Learning science, therefore, is seen to involve more than the individual making sense of his or her personal experiences but also being initiated into the ‘ways of seeing’ which have been established and found to be fruitful by the scientific community. Such ‘ways of seeing’ cannot be ‘discovered’ by the student—and if a student happens upon the consensual viewpoint of the scientific community he or she would be unaware of the status of the idea” (Driver, 1989, p. 482). Thus it is necessary for science teachers to engage students in dialogue about their everyday views of phenomena, and to introduce the perspective and conceptual understandings adopted by the scientific community (Scott, et al., 2006).

It’s important that students have the opportunity both to make their everyday ideas explicit and to apply and explore newly-learned scientific ideas through talk and other actions for themselves. (Scott, et al., 2006). The fundamental point here is that “meaningful learning involves making connections between ways of thinking and talking... between everyday and scientific views” (Scott, et al., 2006, p. 622). This type of discussion offers students the opportunity to voice their everyday views of the world in common language, but requires the assistance and guidance from more knowledgeable individuals to make connections between everyday views and scientific views (Scott, et al., 2006). Analyzing the patterns of talk and insights from student conversations provides participants with information about the benefits of talking with students and allowing them to articulate their own thinking.

Research shows that giving students an opportunity to discuss their ideas in the context of analyzing the arguments of others significantly helps with the development of scientific knowledge. (Osborne, Erduran, & Simon, 2004). So why do so many instructors rely mainly on monologic instruction and I-R-E, if there is substantial and widespread research supporting the idea of creating classroom situations in which students actively discuss ideas? It may be due to the following concerns and questions teachers often raise:

- How to ensure enough time for students to fully explore topics, while also covering concepts required by state
and district standards.

- Concern that students bringing up inaccurate ideas in discussion may be a distraction or an impediment to learning the correct scientific information (i.e., may reinforce misconceptions).
- How to keep students on-task and focused on discussing the assigned topic.
- What to do if the students bring up questions that the teacher cannot answer or topics that are unfamiliar.
- Being reluctant to “lose control” of the classroom discussion if it’s not teacher directed.

It can be challenging for teachers to create classroom situations in which students consider and discuss their everyday views, connect those views to scientific explanations, and, in the process, also encourage concept and skill development as dictated by standards and other state or district learning goals. By modeling dialogic reflective discourse strategies in this and other sessions, we hope to engage participants in seeing both the incredible value of discourse for their own learning, and also how scientific discourse can be successfully put into practice in learning situations with students.

**Modeling Discussion Norms with Students.**

If your instructors don’t have much experience with introducing discussion norms to students, consider having the group sit in a circle on the floor, and introduce each norm as you might with students. It helps to introduce the norms fairly quickly with students, but taking enough time to “act out” examples of some of them, and asking students for examples of others. For example, you might want to:

- **Act out what active listening looks like, and what the opposite looks like.**
- **Model how to ask for evidence, if a fellow student hasn’t shared it:** “what’s your evidence for that?”
- **Explaining that open-mindedness means you’re not stuck on ideas, and are ready to listen to others and change your mind.**
- **Share examples of how to disagree productively, such as, “I hear what you said, but what about...?” or “I disagree with that statement because...”**
REFERENCES