BACKGROUND INFORMATION FOR PRESENTERS

Facilitating discussions of ideas can result in powerful learning experiences. Discussion and discourse play an important role in meaning-making and developing ideas and concepts. Learning takes place through discourse within social and cultural 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 learners, engaging in discussions can foster more creative, complex thinking and offer opportunities to practice crucial abilities such as asking questions and communicating ideas effectively. For teachers, all types of talk and discussion in the classroom can offer a window into learners' prior knowledge, level of understanding, personality, lived experience, and ability to articulate ideas and reasoning.

Sometimes, however, discussions can be frustrating experiences. From the learner perspective, being told one's idea is wrong (or even not quite right) can discourage further participation; being singled out for an answer can be embarrassing; being constantly overlooked in favor of a more vocal learner can decrease confidence and self-efficacy. Discussions in which many ideas are voiced without moving toward a shared conceptual understanding can seem confusing or pointless. From the instructor perspective, it is easy to allow a few vocal learners to dominate a discussion; it can be challenging to engage reluctant-to-speak learners in discussion; off-topic responses, if not handled well, can derail a discussion; and it can be tricky to know when to communicate accurate information while also providing space for learners to share some of their own inaccurate ideas as they construct their own understanding.

Note: As a leader of this session, don't forget to refer to the *Tips for Promoting Discussion* handout. It was designed primarily for instructors interested in leading discussions with children, but most of the tips apply to presenters leading discussions with other adults.

Patterns of Discourse During Instruction

In BEETLES learning experiences, learners continually engage in collaborative science discussions. Learner-to-learner talk is a key component of a productive learning environment (Rivard & Straw, 2000; Duschl & Osborne, 2002; Varelas & Pappas, 2006; Varelas, et al., 2008), and BEETLES features learner talk as a key modality for instruction. We hope this helps instructors create learning environments that are both collaborative and inquisitive—where learners feel comfortable challenging assumptions, probing for information, and ultimately learning from one another. Becoming a skeptical thinker takes practice, so discussions should happen frequently (Driver, Newton, & Osborne, 2001; McNeill & Krajcik, 2008; Osborne, 2010).

Researchers have mapped out common patterns of discourse during classroom instruction. These patterns can be illuminating for teachers and program leaders thinking about promoting discussions in the outdoors. Some patterns work well for generating discussions, while others are appropriate for checking for understanding or other purposes. **Monologic** instruction is essentially a lecture in which the teacher does almost all the talking. **IRE**, in which the teacher **I**nitiates, student **R**esponds, teacher **E**valuates, includes more student speaking than monologic instruction, but the teacher is generally still speaking more than students, students only respond to the teacher, and the talk tends to be focused on students answering questions with the teacher evaluating student responses. In **IRF**, the teacher **I**nitiates, student **R**esponds, teacher **F**ollows up/gives **F**eedback, there's a bit more opportunity for students to talk, and it can be useful for finding out more about a student's thinking, but it still tends to focus on right answers evaluated by the teacher. Neither IRE nor IRF tends to allow students to fully express their ideas. IRE and IRF are common in instruction and tend to offer the illusion of interactivity, but they are not very different from when teachers ask a series of narrow questions (Thornbury, S. 1996). Monologic instruction, IRE, and IRF are all based on the teacher primarily transmitting information to students. Both **reflective discourse** and **dialogic instruction**, on the other hand, engage students in authentic discussion. In these patterns of discourse, broad questions with more than one acceptable answer and teacher responses to students that encourage divergent thinking generate lively and authentic discussion among students. Students get to share their thinking, ideas, and lived experiences; topics of discussion can be guided by student interests, increasing intrinsic motivation. Although research has found that discussion involving someone who knows more about a subject than a student (e.g., a teacher) is one important factor for learning, research also highlights the benefits of **peer-to-peer discourse** in learning. Students need opportunities to try out their ideas in the less intimidating context of discussing with peers.

Reflective Discourse

When a teacher facilitates a free-flowing exchange during which students and the teacher pose questions, respond to one another's comments and questions, and seek to understand one another's ideas, this exchange can be called reflective discourse. Students have the freedom to express their own authentic thoughts, ideas, and questions, which stimulates curiosity about the discussion itself (Van Zee & Minstrell, 1997).

Dialogic Instruction

In a dialogic learning environment, the teacher uses reflective discourse to validate and elaborate student ideas and guide them to "negotiate" their understanding with other students in the group. The teacher uses strategies such as uptake (Collins, 1982) in which a particular student's response is incorporated into a question to the group, to encourage students to build on one another's ideas. Student responses help shape the discussion, as opposed to relying on the teacher 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. The questions reflect a genuine interest by the teacher in students' thoughts and ideas. The discourse in these learning situations is less predictable and repeatable because it is mutually determined by both teachers and students, as teachers pick up on, elaborate, and question what students say (Nystrand, 1990a, 1991a). Dialogic conversations engage students because they validate the importance of students' contributions to learning and instruction. The purpose is not for the teacher to transmit information, but for students to collaboratively co-construct understanding themselves—through talking (Gomorra & Nystrand, 1992). Monologic instruction (also see below) offers students fewer chances to construct and articulate their own understandings of scientific ideas. It reflects the viewpoint that scientific knowledge comes primarily from the teacher (or another expert source) and does not give students the chance to learn science by thinking scientifically and by evaluating ideas against evidence as scientists do. Monologic instruction can achieve learning that consists of memorizing facts and information, but it can hinder deeper, more conceptually focused types of learning.

Monologic Instruction

In monologic instruction, the teacher shares, 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.

IRE and IRF

There are variations in teacher-directed talk. In one pattern, abbreviated as IRE, 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), usually to a different student.

Example of IRE (Initiate, Respond, Evaluate):

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)

Student responses may be short answers, while the teacher's evaluations of the responses may be long and elaborate. In another variation, often called IRF, the teacher initiates the conversation with a question or comment, the

student responds, the teacher seeks follow-up ideas and comments from the student, and then the pattern repeats with response and follow up (Sinclair & Coulthard, 1975).

Example of IRF (Initiate, Respond, Follow up/give Feedback):

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. (Feedback)

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. These patterns often fail to offer students opportunities to articulate their own understanding and express themselves in the language of the discipline (Alexander, 2005; Wellington & Osborne, 2001) or to engage in discourse with other students. 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 discussion takes place in pairs or groups of students where adults are either not present or are refraining from full participation in the discussion. Researchers find 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). Studies on discourse patterns have found that discussion between children can offer the opportunities for social interactions that help support student learning (Blum-Kulka & Snow, 2004).

Instructors' Role in Science Discussions

Learning science adds more complexity to the practice of leading discussions, because it also involves learning 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, such as an instructor (Scott, et al., 2006). "Learning science...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 they would be unaware of the status of the idea" (Driver, 1989, p. 482). That's why science teachers need 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 opportunities both to make their everyday ideas explicit and to apply and explore newly learned scientific ideas through discussion and other actions for themselves (Scott, et al., 2006). "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 they also need 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 discussion and insights from student conversations during the session offers participants information about the benefits of discussion with students and the benefits of allowing students to articulate their own thinking.

Giving students an opportunity to discuss their ideas in the context of analyzing the arguments of others significantly helps them to develop scientific knowledge. (Osborne, Erduran, & Simon, 2004).

Equity, Inclusion, and Discussion

Discussions can increase equity or can reinforce existing inequities and power dynamics. Discussions offer great opportunities to increase equity and inclusion, but they can also reinforce existing inequitable power relationships and the marginalization of some participants. Discussions can be inequitable when certain students dominate discussions, while others may be largely left out (Karp & Yoels, 1988). Discussions may also reinforce dominant cultural values while neglecting or undermining cultural values of more marginalized populations. With guidance about discussion-leading strategies, instructors can avoid contributing to these inequities.

Inequity that takes place during discussions often isn't noticed by participants or instructors. Inequity is what we have become used to in many contexts. It feels normal to many of us, especially to those who are more privileged and may benefit from it. Once we become aware of inequities, we can work to undo them.

> *...the "normalization of inequity" created by the dynamics of race and social class in education needs to be addressed. This is often difficult because the normalization process renders the dynamics of race and social class "invisible" to privileged members of society (also along gender lines) who are not faced with the daily injustices of inequity or are denied an accurate account of our collective history. It also obscures the emancipatory necessity of our work as educators. Thus, considerable work needs to be done to educate ourselves as to the significance of race and social class in the structure of education and in the complex process of self-formation. (Brown, 2005)*

Discussions are opportunities for instructors to increase equity. This takes increased awareness on the part of the instructor of how race, gender,

culture, social class, and language affect interactions during discussions. Instructors can examine their own unconscious biases and become ever more thoughtful and intentional about their facilitation moves. Equity and inclusion in discussions can be increased by encouraging those who may be participating less to move forward and by encouraging those who are participating a lot to move back some. These, and other strategies in this session, help instructors facilitate more culturally relevant, equitable, and inclusive discussions.

- **Broad questions.** Using broad questions can help promote equitable and inclusive learning environments. Broad questions have many acceptable answers, and they encourage divergent thinking, multiple perspectives, and increased participation from group members. When students are encouraged to share their own perspectives and lived experiences, cultural relevance increases. Using broad questions also contributes to a group culture in which students value one another's ideas and share and relate learnings to their lived experiences.
- **Wait time.** When instructors wait ~3–5 seconds before calling on anyone (and do not ultimately always call on the first person to raise their hand), participation increases, and the depth of student responses improves.
- **Pair talk.** Regular opportunities for pair talk (e.g., *Turn & Talk*, *Thought Swap*, *Think-Pair-Share*) and small-group discussions (e.g., *Two Cents*, *Less Structured Discussion*) allow all students to share their perspectives, opinions, and ideas, and they offer students practice for participating in larger group discussions. Instructors can listen in on pair talk and encourage reluctant students to share in the large group.
- **Different ways of participating.** It's also important not to force students to participate all in the same ways and to allow for students' different levels of comfort participating and reasoning together. "Sometimes silence and listening are fine" (Bacolor, Cook-Endres, Lee, & Allen, 2014–18). By varying between pair talk, small-group discussions, and large-group discussions, every student will likely find circumstances in which they are comfortable sharing ideas with peers. Students' comfort will likely grow and expand over time—at all different rates.

Cultural Considerations

An instructor who understands a bit about the cultures of their students can communicate better with them and is better able to offer relevant, meaningful learning experiences. Culture is at the heart of learning. "Culture, it turns out, is the way that every brain makes sense of the world" (Hammond, 2015). Culture influences how instructors understand and interpret students' responses and interactions, the ways they communicate with students, and the ways they perceive their students. Culture also influences how students communicate, receive, and process information.

When instructors have some understanding of the cultures of their students, they can craft learning experiences that are more nuanced and relevant to their students' lived experiences. This is particularly important for students whose culture differs from the dominant culture. Culturally responsive teaching involves awareness that the culture and lived experience of students are assets that can *enhance* learning.

> *While traditional classroom practices have been found to be successful for students whose discourse practices at home resemble those at school—mainly students from middle-class and upper-middle-class European/American homes—this approach does not work very well for individuals from historically nondominant groups. For these students, traditional classroom practices function as a gatekeeper, barring them because their community's sense-making practices may not be acknowledged... Recognizing that language and discourse patterns vary across culturally diverse groups, researchers point to the importance of accepting, even encouraging, students' classroom use of informal or native language and familiar modes of interaction... An emerging consensus in education scholarship is that the diverse knowledge and skills that members of different cultural groups bring to formal and informal science learning contexts are assets to build on. (A Framework for K–12 Science Education, 2012)*

Every instructor cannot become familiar with, much less conversant in, all the cultures of their students. Building an educational team that together has a range of cultural, racial, and linguistic backgrounds roughly mirroring those of students is as important to the quality of programming as the degrees, content background, and teaching expertise that instructors bring. As BEETLES advisor and partner José González, founder of Latino Outdoors, says, "You don't have to be Latinx to teach Latinx kids. It helps though, if you are curious about the lived experiences they bring with them to your program."

It's important that science discussions are inclusive of different perspectives, cultural viewpoints, and ways of expressing ideas. By asking broad questions, listening acceptingly to student responses, and modeling genuine curiosity, instructors can encourage a full range of ideas and contributions. By offering different ways of participating, such as emerging multilingual learners using their first language, instructors can help students become more comfortable sharing ideas. "Research suggests that educators should accept, even enlist, diversity as a means of enhancing science learning" (*A Framework for K–12 Science Education*, 2012). Students benefit from being encouraged to express themselves in ways they find most comfortable. This helps students feel comfortable sharing and refining ideas (Bacolor, Cook-Endres, Lee, & Allen 2014–18).

Students benefit from an instructor who recognizes and welcomes their assets. A culturally responsive instructor will encourage and focus on

the strengths and assets students bring to the learning environment (G. Ladson-Billings 2017). "I define culturally responsive teaching simply as…an educator's ability to recognize students' cultural displays of learning and meaning-making and respond positively and constructively with teaching moves that use cultural knowledge as a scaffold to connect what that student knows to new concepts and content in order to promote effective information processing. All the while, the educator understands the importance of being in relationship and having a social-emotional connection to the student in order to create a safe space for learning." (Hammond, 2015). Culturally responsive teaching has been shown to strengthen student connectedness with school and improve learning (Kalyanpur, 2012; Taum, 2009).

Science has a culture. During science education discussions, it's important to recognize that science itself has a culture and that some students may struggle with this culture, particularly if they perceive it as clashing with their home culture and if science is portrayed as superior to other perspectives. Science is an extremely useful, evidence-based way of understanding the natural world (not the supernatural world), but it should not be portrayed as *the* way, or the only way. For example, Traditional Ecological Knowledge (TEK) is an evolving body of knowledge based on hundreds or thousands of years of close observations of ecosystems by Indigenous peoples. TEK includes Indigenous views on ecology, spirituality, and human and animal relationships. TEK overlaps with traditional western science in some ways and is unique in many others (Barnhardt, Kawagley, 2005; Kimmerer, 2013; Margolin, 2021). TEK and other non-Western approaches can enrich science discussions.

Emerging Multilingual Learners

Students who have language abilities in a range of languages can all participate in a productive science discussion! Research has shown for decades that science discussions are great for language development. There are significant benefits to emerging multilingual learners when they speak with one another in their primary language or when they engage in discussion in English. Any time learners are making sense of ideas through discussion, they are improving their language development. When learners improve their fluency and academic literacy in their primary language, they greatly increase their ability to do the same in a second language. Listening and responding to authentic academic (science) discussions in English greatly accelerates English language development. Language learners come out winners no matter what language they use to engage in discussions.

Emerging multilingual learners whose first language is not English can fully engage in discussion. A fifth-grade learner who speaks English at a second-grade level still processes information and understands science concepts at a fifth-grade level! Participation from a wide range of learners enriches science discussions—so inclusion of emerging multilingual learners benefits everyone. If emerging multilingual learners struggle or are reluctant to communicate their ideas verbally in English, instructors can offer encouragement, highlight the value of their contributions, offer

opportunities to communicate in their primary language and in English, offer less intimidating opportunities to discuss with a partner or in a small group (a whole group can be intimidating), and use visuals and graphics to scaffold discussions to facilitate their participation.

> *NGSS instruction is largely dependent on language, and it may inadvertently exclude English Learners from full participation if steps aren't taken. Multilingual students have important insights to contribute to learning, and scientific communities greatly benefit from the diversity of thought and experience these students bring. Second language learners often have rich family and community practices and histories that can be leveraged to more deeply engage these students in STEM learning. Keep "big ideas" in science grounded in everyday examples that are accessible to all learners. (Wingert & Podkul, 2014–18)*

Participation in outdoor science discussions is beneficial for all learners, but it is particularly valuable for emerging multilingual learners.

- **Rich environment.** The outdoor environment is rich in interesting things to explore, investigate, wonder about, and share. Learners are surrounded by stimulating phenomena, so there are lots of interesting things to communicate about. Since using language is the best way to develop language, motivation to communicate is particularly important.
- **Low-stress environment.** Language is learned by discussing, listening, reading, and writing about things of interest to the learner in a low-stress environment. The outdoors can feel less stressful than the classroom for those who might be reluctant to speak. Outdoor science programs, where learners get to explore and discuss ideas, can be an ideal environment for emerging multilingual learners to practice using academic language. They're surrounded by stimulating phenomena, so there are always interesting things to communicate about.

> *A classroom rich in discourse is also a classroom that offers particular challenges for students still learning English. On the other side of the coin, engagement in the discourse and practices of science, built as it is around observations and evidence, also offers not only science learning but also a rich language-learning opportunity for such students. For both reasons, inclusion in classroom discourse and engagement in science practices can be particularly valuable for such students. (A Framework for K–12 Science Education, 2012)*

Strategies to encourage participation by emerging multilingual learners in discussion. All learners benefit from scaffolding and modeling of how to take part in science discussions, but emerging multilingual learners in particular may need these in order to be able to participate successfully.

- **Model what you mean.** Before a discussion, model what a science discussion might look and sound like. This may include basing explanations on evidence (*I think ___, because I observed ___.*),

respectful disagreement (*I think I understand what Marta is saying, but my observation was different.*), building on one another's ideas (*I agree with what Marta said because ___.*), and using appropriate language of uncertainty (*I'm not sure, but it seemed like ___.*).

- **Use real objects.** Whenever possible, use the real thing in nature to introduce questions or prompts. Objects and phenomena speak louder than words!
- **Show graphic organizers.** On large sheets of paper, cards, manila folders, or sentence strips, create graphics, cartoons, or written-out key words or questions to prompt discussion so all learners can see them. Whenever possible, use cognates (words that look similar in two languages, such as *decomposition/descomposición*, *ecosystem/ecosistema*, *ocean/océano*) to help learners recognize words.
- **Offer sentence starters.** Offer learners optional sentence starters or useful phrases to make it easier to share their ideas (*My evidence seems to show that ___. I respectfully disagree because ___. I want to build on something that you said ___. I agree because ___.*).

> *School science has a language all its own. Its vocabulary and sentence structure is complex—and aspects of argumentation and reasoning in science are different than in other disciplines. This can be troublesome for language learners if teachers do not make these differences apparent and explicit (e.g., compare and contrast argumentation in science and in other parts of students' lives). (Wingert & Podkul, 2014–18)*

- **Make connections to what learners already know.** Learning (language and science concepts) is about making connections, and part of learning something new is connecting it to something we already know (Cross, 1999). "Teachers must draw out and work with the pre-existing understandings that their students bring with them." (Bransford, Brown, Cocking, 2000, p. 19). To help learners with this aspect of learning, offer regular opportunities for them to discuss their prior knowledge about a topic (e.g., *What does this remind you of? Turn and Talk to a partner: What are some things you already know about waves?*). This is important for all learners, but especially for those who are still learning the language of instruction. This helps them connect what they're learning with experiences and ideas they already have.
- **Be flexible with modes of participation.** Encourage learners to communicate however they feel most comfortable: in their first language, in imperfect English, through gestures, by writing, etc. "Students often continue to think in their first languages for years after they begin to learn a second language. Help students build on their first language skills to gain deeper science understanding" (Wingert & Podkul, 2014) and give them time to translate in their head, if they need to, before responding.
- **Use hard words.** Don't avoid using relevant academic language with learners but avoid single-use hard words, which can be confusing. It

takes about seven meaningful exposures to a new hard word for it to become part of a learner's vocabulary. Choose a few key academic words and introduce them in context when learners have a need to understand and use them. Use these words multiple times, out loud and in writing. Encourage learners to use them in context.

- **Practice in pairs.** Use discussion routines such as *Turn & Talk* and *Thought Swap* for learners to have practice putting their ideas into words. Give learners lots of opportunities to discuss in pairs before sharing in a large group.
- **Plan for clarity.** When possible, write out your prompts and questions in advance to make sure they're clear. Try stating them in different ways to offer more than one way to understand your intent.
- **Ask for rephrasing and paraphrasing.** Ask learners to rephrase questions and instructions in order to check for understanding.
- **Consider hand signals.** Try having learners use hand signals during discussions (e.g., touch their nose if they agree, wiggle their fingers to show appreciation, tap their head if they want to build on someone's ideas) and include other ways that learners can participate nonverbally. In some settings, this can be very helpful; in others, it can be distracting to the person speaking.

Developing Independent Learners

Learners from lower economic backgrounds, students of color, and emerging multilingual learners are often offered more remedial instruction and fewer opportunities for developing as independent learners. Instructors can remove barriers and encourage learners to engage in productive struggle to learn and to learn how to learn. Participating in academic discussions supports learners to develop higher level cognition and the ability to take on more advanced learning tasks. Discussing ideas helps learners see themselves as independent learners and members of an intellectual community.

By reimagining the learner–teacher relationship as a partnership and encouraging and respecting learner contributions, instructors can decenter the learning experience to be less focused on the instructor and more focused on learners. Instructors can support learners to be "ready for rigor" by creating an environment that is intellectually and socially safe for learning, making space for learner's voice and agency, offering appropriate challenge to stimulate brain growth to increase intellectual capacity, helping learners process new content by using methods from oral traditions, and by offering learners authentic opportunities to process content (Hammond, 2015).

> *Classroom studies document the fact that underserved English learners, poor students, and students of color routinely receive less instruction in higher order skills development than other students (Allington & McGill-Franzen, 1989; Darling-Hammond, 2001; Oakes, 2005). Their curriculum is less challenging and more repetitive... This type of instruction denies students the*

opportunity to engage in what neuroscientists call productive struggle that actually grows our brainpower (Means & Knapp, 1991; Ritchhart, 2002). As a result, a disproportionate number of culturally and linguistically diverse students are dependent learners (p. 12)... As educators, we have to recognize that we help maintain the achievement gap when we don't teach advanced cognitive skills to students we label as "disadvantaged" because of their language, gender, race, or socio-economic status (p. 14) (Hammond, 2015).

Increasing Equitable Participation in Discussions

Group Agreements

The use of group agreements helps learners pay attention to their own participation and the participation of others during discussions. Group agreements help set up a "brave space" in which learners feel comfortable and accountable to participate. Ideally, learners help generate and decide on the agreements they will be using. By helping set up the agreements, learners tend to be more invested in holding themselves and one another accountable. Learners will be more likely to engage, try out new ideas, ask questions, challenge their thinking, and be more inclusive and welcoming of participation by their peers (Alvarez, 2016).

Group Agreements Help Create a "Brave Space"

Creating a brave space for science learning discussions involves a variety of factors. The term *brave space* refers to a place and state of mind in which participants are courageous in the face of discomfort, rather than feeling entitled to being comfortable. Use of the term acknowledges that group members often confuse discomfort with a lack of safety. Establishing group agreements helps learners understand how to participate productively in discussion even when they are uncomfortable and how to contribute to a brave space. Asking mostly broad questions contributes to creating a brave space, but so does listening to and responding acceptingly to learner responses to broad questions. If learners sense that the instructor is trying to lead them to a "correct" answer, or the instructor judges or privileges certain participants or ideas over others, or the discussion of ideas is not genuine, they may become reluctant to participate. It's important that members of the group are not asked to speak for a whole group with which they are perceived to identify (race, nationality, religion, etc.). That means that no presumptions should be made about identity (Alvarez, 2016).

TEACHING NOTES

How to introduce science discussion group agreements. Check out the BEETLES *Group Agreements for Science Discussions* Student Activity Guide.

***Agreements* vs *norms*.** We chose not to use the term *norms* because it can imply one normal/accepted way to participate in discussions. This can lead to marginalization of learners who don't identify with the assumed "normal" culture, which is typically white (Solomon, et al., 2005). Group (or community) agreements can shift the culture to be more inclusive, deliberately highlighting different acceptable ways of being and acting, and placing value on hearing and integrating different perspectives.

Additional resources:

Anti-Oppressive Facilitation for Democratic Process: Making Meetings Awesome for Everyone. Accessed online: http://infoshop.io/media/Aorta%20Anti-Oppressive%20Meeting%20Facilitation.pdf

The Adaptive School: A Sourcebook for Developing Collaborative Groups, 3rd edition, by Garmston & Wellman.

Group Agreements for Workshops and Meetings. Seeds for Change: https://www.seedsforchange.org.uk/groupagree

From Safe Spaces to Brave Spaces: A New Way to Frame Dialogue Around Diversity and Social Justice. Accessed online: https://www.anselm.edu/sites/default/files/Documents/Center%20for%20Teaching%20Excellence/From%20Safe%20Spaces%20to%20Brave%20Spaces.pdf