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Science and Teaching for Field Instructors

Supporting Social Emotional Learning in Outdoor Science

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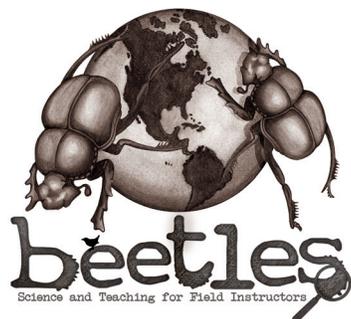


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ABOUT BEETLES™

BEETLES™ (Better Environmental Education Teaching, Learning, and Expertise Sharing) provides environmental education programs nationally with research-based approaches and tools to continually improve their programs.

www.beetlesproject.org

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Introduction

The Case for Social and Emotional Learning (SEL): Benefits and Research

Social and Emotional Learning (SEL) is an important and growing field within education. Researchers and practitioners have found that SEL is an essential part of supporting young people to thrive—in and out of the classroom. SEL helps build students' social skills, emotional awareness, and resilience. Developing social and emotional competence can offer students more ease in their interpersonal interactions, a positive sense of identity, increased agency to call on their strengths, the ability to pursue continued growth, and improved learning. All these competencies make students better learners, supporting them to tackle complex tasks and to show up as engaged members of their communities outside of school. Developing students' SEL competencies is also shown to increase their academic performance and chance of employment, while reducing emotional and behavioral challenges.

This concept paper is the result of a collaboration between the BEETLES Project and the Grow Outside Toolkit [<http://grow-outside.org/>]. BEETLES (beetlesproject.org) infuses outdoor science programs with research-based approaches and tools to improve science teaching and learning. Grow Outside, convened by NatureBridge and funded by the S. D. Bechtel, Jr. Foundation, brought BEETLES together with 11 Residential Environmental Learning Centers to explore how to maximize the opportunity for SEL in the outdoors. This paper is one of the many resources that resulted. To see others, please visit [<http://grow-outside.org/>].

What Is Social Emotional Learning and What Language Can We Use to Talk About It?

The Collaborative for Academic, Social, and Emotional Learning (CASEL) offers: "Social and emotional learning (SEL) is the process through which children and adults understand and manage emotions, set and achieve positive goals, feel and show empathy, establish and maintain positive relationships, and make responsible decisions." CASEL identifies five areas of core SEL Competencies: Self-Awareness, Self-Management, Social Awareness, Relationship Skills, and Responsible Decision-Making. For more detail on the five core CASEL competencies and an introduction to the CASEL Framework, see Appendix A, which provides some key context and vocabulary for understanding this document.

Why CASEL? CASEL is a leading organization in implementing SEL in school districts and classrooms and championing both research and practice in SEL. We have chosen to use CASEL because it is one of the most commonly adopted frameworks in school systems and because many outdoor science and environmental education programs seek to support and partner with classrooms and school districts. We will use CASEL's Core Competencies as a consistent set of terms to identify and discuss SEL skills in this paper, but there are other valuable frameworks for SEL. For more summaries of other SEL frameworks, check out these resources:

- <http://exploresel.gse.harvard.edu/frameworks/>
- <https://www.air.org/resource/identifying-defining-and-measuring-social-and-emotional-competencies>

Leading organizations and research coalitions advocate for an integrated approach to SEL *where students practice SEL skills as they participate in academic learning, and where SEL is integrated across all aspects of students'*

"By integrating social emotional learning (SEL) into the fabric of the school day, educators can support students in honing their existing skills and mindsets to help them succeed in school and in the broader world."—TransformEd

"These are skills that all people and all learners across their lifespan need to continuously develop in order to be positive contributors to their life and those around them."—Christina Cipriano, Director of Research at the Yale Center for Emotional Intelligence

"[Effective SEL happens] when students are asked to practice these skills as they learn academic content and in interactions with peers and adults."
—Aspen Institute Social Emotional and Academic Development Commission



educational experience. This is in contrast to SEL being taught as a stand-alone set of skills, only applied within nonacademic school activities, or framed as separate from the rest of students' education.

This integrated or embedded approach grounds SEL within a real-world context. Daily life doesn't offer blocks of time that are deemed social and emotional and others that are not social and emotional. Emotional responses to events and external stimuli are continuous and often subconscious. Students don't check their emotions at the door when they start science class, play on a sports team, or finish an activity focused on developing their social skills. Social interactions are an integral part of family relationships, attending school, navigating connections with peers, and making new acquaintances.

Outdoor learning offers a unique opportunity for developing SEL in a rich and complex setting. Environmental education and outdoor science organizations, especially those providing longer and overnight experiences, can play a unique and emphatic role in supporting students' social and emotional development. Environmental and outdoor science organizations can increase their impact by integrating intentional and consistent opportunities for students to practice SEL across all aspects of their programs.

This paper focuses specifically on how using student-centered and nature-centered teaching approaches in outdoor science and environmental education programs can consistently integrate opportunities for the development of SEL competencies. This paper will not offer a complete literature review of SEL, a complete guide to implementing SEL, or a full picture of all the SEL opportunities within outdoor science and environmental education. We recommend looking to the work of the following stellar organizations and reports for more on implementing SEL in classrooms and beyond:

- **Turnaround for Children:** <https://www.turnaroundusa.org/>
- **The ASPEN Institute National Commission on Social, Emotional, & Academic Development:** <https://www.aspeninstitute.org/programs/national-commission-on-social-emotional-and-academic-development/>
- **Science of Learning & Development Alliance:** <https://www.soldalliance.org/>
- **American Institutes for Research :** <https://www.air.org/topic/social-and-emotional-learning>
- **Learning Policy Institute:** <https://learningpolicyinstitute.org/product/social-and-emotional-learning-case-study-san-jose-state-report>
- **TransformEd:** <https://www.transformingeducation.org/>

Throughout, you will find vignettes that exemplify what SEL might look like in a day of instruction in an outdoor science program. The vignettes are based on actual outdoor teaching experiences with students—some of them verbatim, some of them composite. We'll begin with a vignette of a reflection at the close of a day's experience. Students are invited to share about the SEL skills and competencies they feel have improved during the day.

Defining Environmental Education.

Outdoor science and environmental education programs include organizations focused on community health, food justice, gardening, citizen science, and cultural history that haven't historically been included in the field of environmental education, as well as organizations that self-identify as outdoor or environmental education programs.

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Vignette of a Day of Instruction, Part 1: How Did We Grow Today?

It's the end of the teaching day at an outdoor science program. Students have spent the last five hours outside, working together to study the surrounding ecosystem, trying to figure out what lives there, and discussing connections to human communities and our impacts on ecosystems. Students have observed organisms and the landscape, recorded their ideas in journals, had discussions in pairs and in the large group, made explanations and considered evidence, and moved across different kinds of physical terrain. The group has also had time to laugh, joke, and relax together.

The instructor gathers students in a circle and asks:

- “What are some skills you feel like you got better at today? How did your skills grow throughout the learning experience? How did you grow today?”

Students think quietly, talk in pairs, and then share with the group::

- “I think I got more curious about things in nature.”
- “I got better at not just stopping after I asked a first question or got to a first answer.”
- “I improved at listening to others instead of just thinking about what I was going to say next.”
- “There were a few times when I was feeling kind of tired or kind of hot, but I still participated in the discussion, so I got to practice sticking with a challenge.”
- “I think I was more aware of how much I was speaking up in the group.”
- “I got better at making more observations and asking questions and other things that scientists do.”
- “We talked about some interesting things, and I feel like I realized that it's fun and interesting to talk about things in nature.”
- “I was trying to talk more, because I'm usually quiet. I was nervous at first, but it was actually fun to talk about this.”
- “I feel more like I could be a scientist, because today we got to observe and figure things out like scientists do.”
- “I asked for help a couple of times when I needed it.”
- “I started to feel more comfortable being outside and more excited to learn about nature.”

Students agree that it was fun and exciting to spend the day working and learning together outside. They also think about and discuss opportunities in their lives where they can continue to practice the social, emotional, and scientific thinking skills they used throughout the day—in their classes at school, with groups of friends, with sports teams or music groups, in local parks in their neighborhoods, and with their families.

Looking at the vignette above, one might wonder what kinds of experiences and teaching approaches led students to have these reflections at the end of one day of an outdoor education program? Read on!

Supporting SEL in Outdoor Science and Environmental Education Programs

The Outdoor Setting: Inherent Opportunities for SEL

Outdoor education and environmental education programs often offer a unique and fertile setting for learning in general. Key aspects of outdoor learning can support SEL and complement the learning students engage in at home and in the classroom:



A New Setting

Being in a different setting from students' everyday classroom or school can shift students' identity, sense of self, and offer a new layer of self-awareness. The novel setting of outdoor science or environmental education programs often include a different physical space, time with new social groups, or interactions with a range of role models and other adults. These can offer students opportunities to try out new ways of being and to see themselves, and be seen by others, in a new light. A new setting can sometimes shake up the social dynamics of a classroom or other pre-existing social groups.

The dynamic nature of real-world outdoor learning experiences allows for a wider range of social roles to be seen and valued than in the classroom. These attributes can build students' positive identities and lead them to build and recognize new strengths in themselves and in others.

A new setting can also present opportunities to grow students' self-management and communication skills as they navigate a new physical and social space and manage their needs in a setting different from their day-to-day lives. This surfaces opportunities for students to work on impulse control, stress management, and organizational skills.

A Rich and Dynamic Learning Context

Outdoor learning experiences can expand students' identities as learners and as scientific thinkers. Learning in the outdoors can be dynamic and engaging; students' meaning-making and understanding of science, environmental, or other concepts can emerge directly from their observations and experiences. As students engage in these learning behaviors in a context-rich setting, their practices mirror those of scientists, policy makers, and community organizations. When time for reflection is included in the experience, this further supports the development of students' positive identities and self-perception as learners.

Physical Challenges

Outdoor learning can also offer a range of different physical challenges, including weather or navigating difficult terrain. If instructors offer appropriate support and scaffolding as students meet developmentally and emotionally appropriate challenges, these experiences can also support students in developing resilience, perseverance, and confidence.

Health Benefits of Being Outside

Being outside also has health benefits and reduces feelings of stress and anxiety. Access to recess and time outside also increases students' focus on academics once they return to the classroom.

Many outdoor science and environmental education programs also use team-building games or challenge courses as common approaches for teaching SEL, and these stand-alone SEL experiences can have an impact on students. Relying solely on a dynamic outdoor setting and stand-alone SEL experiences, however, misses seminal opportunities for SEL in outdoor learning. Outdoor science and environmental education programs can be even more effective if they strive to achieve a fully integrated approach to SEL that aligns with

Physical challenges in the outdoors. For students to have positive and productive learning experiences, their physical and emotional needs must be tended to, including positive relationships with adults and teachers. Building positive relationships with students and supporting them in managing, regulating, and identifying their emotions in the face of challenging physical circumstances—such as inclement weather or navigating difficult terrain—is critical. Scaffolding self-regulation can allow students to build self-management skills they can call on in future experiences. Scaffolding could include: doing regular check-ins; supporting students in developing organization skills by asking, “What do you need to bring to be comfortable for the day? If there is something you need, can we provide it for you?”; modeling what it might look like to ask for help in a challenging situation (i.e., “I’m feeling a little frustrated. Can I take a moment to be by myself?” Or “This is challenging for me. Could someone help me out?”).

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Enhanced opportunities in residential programs. Residential outdoor education programs offer unique opportunities and benefits related to supporting SEL, including longer program time for students to build relationships with instructors and peers; added contextual challenges and opportunities for self-management; and the residential context of shared meals and cabins. This offers additional opportunities to develop relationship skills, social awareness, and additional time in a new setting, which can deepen students' self-awareness.

research about effective practices. To leverage the unique opportunities for SEL in outdoor education, students need to consciously and consistently practice SEL skills during all program activities, whether they are engaging in habitat restoration, observing nature, sharing a meal, designing a science investigation, participating in a group discussion, offering community service, or navigating a trail.

Toward Intentional, Embedded Opportunities for SEL

Organization leaders can have an intentional approach for embedding SEL throughout all aspects of the program by:

- nurturing a supportive, inclusive learning environment.
- embedding consistent opportunities for students to practice SEL throughout the learning experiences and structures of the program.
- scaffolding those SEL opportunities and engaging students in discussing and reflecting on the SEL learning opportunities.

Connections Between SEL, Inclusion, and Cultural Relevance

“To facilitate student success, adults must understand the broader environmental and social context in which students learn.” –The Aspen Institute

“The development of social emotional skills is informed by context, culture, and students' interaction with different environments. Therefore, it is important that SEL-related activities in the classroom focus on helping students to learn, build, and practice skills that they can also apply at home and in their communities.” –TransformEd

All social and emotional learning happens within a cultural context. The way we present SEL skills to students can either reinforce a dominant culture and the status quo or disrupt it by centering student experiences, offering opportunities for students to build positive cultural identities, and offering scaffolding around inclusive communication skills. Approaches to teaching SEL are most effective when they are rooted in equitable, inclusive, and culturally relevant teaching practices and build on students' existing strengths and cultural identities (rather than reinforcing the idea that there is just one way to be, implying that students don't already have social and emotional competencies, or requiring that students assimilate to dominant cultural norms and expectations).

Addressing equity, inclusion, and cultural relevance is highlighted by thought leaders and research groups as a growing edge for the fields of both SEL and outdoor and environmental education.

To move the field forward, we must address these issues at the levels of systemic change, organizational policies, and individual practices.

This paper shares teaching approaches, design elements, and frameworks that support effective SEL and that support equitable and inclusive learning experiences. Specifically, the practices included here have an explicit focus on developing students' positive cultural identities and their awareness of power dynamics as connected to communication and relationship skills.

Here are some resources and organizations to consult for more learning on the connections between SEL and equity, inclusion, and cultural relevance:

- National Equity Project: Social Emotional Learning & Equity [<https://nationalequityproject.org/about/social-emotional-learning-equity>]
- Learning Policy Institute Webinar: Integrating Social, Emotional, and Academic Learning: Lessons for Educators and School Leaders [<https://learningpolicyinstitute.org/event/webinar-integrating-social-emotional-and-academic-learning-lessons-educators-and-school>]



- CASEL Equity Elaborations: Equity Connections to SEL Competencies [<https://drc.casel.org/sel-as-a-lever-for-equity/equity-connections-to-sel-competencies/>]
- The Aspen Institute: Integrating Social, Emotional, and Academic Development (SEAD): An Action Guide for School Leadership Teams [<https://www.aspeninstitute.org/publications/integrating-social-emotional-and-academic-development-sead-an-action-guide-for-school-leadership-teams/>]
- Frameworks Briefs: Equity & Social and Emotional Learning: A Cultural Analysis [<https://measuringcasel.org/wp-content/uploads/2018/11/Frameworks-Equity.pdf>]

Many environmental and outdoor science organizations already have opportunities for SEL integrated into their academic or content-focused programming, but they may not recognize them as such or frame them this way with students. A science investigation can be a phenomenal team-building exercise if students recognize it as an opportunity to practice their collaboration skills. A discussion about environmental impacts on human communities requires empathy, perspective-taking, and self-awareness, and students can consciously practice those skills within the context of that discussion. Practicing transferable learning behaviors, such as asking questions, weighing evidence, or participating mindfully in a discussion, is a powerful way to build students' confidence and positive identities as learners; this impact is increased when students reflect on how building skills as a learner connects to their social and emotional development.

The next vignette highlights *Social Emotional Learning Routine*, a BEETLES activity that offers a structure for helping students think about and plan for their own social and emotional learning. In this vignette, the instructor guides a conversation around the SEL competencies students could call on during a field experience focused on exploring and learning about nature through a scientific mindset. The routine is meant to be flexible and could highlight different SEL competencies or frame a different kind of outdoor activity such as a habitat restoration project, a discussion about environmental issues, or a science investigation.

Vignette of a Day of Instruction, Part 2: A Routine to Invite Reflection

An instructor gathers students to get ready to spend a day outside learning, thinking, and discovering together. The instructor begins by sharing:

"We're going to be working together as a team to learn about our surroundings and about each other today. We'll be paying attention to how to work well as a team. What is a group you've been a part of that has worked well together? What made this possible? This could be your class at school, your family, a sports team, a music group, a group of friends."

Students share their experiences and perspectives. The instructor emphasizes the value of hearing different perspectives from the group and learning from one another's experiences.

The instructor offers three skills and ways of being for the group to keep in mind throughout the day: **think together, be curious, and stick with challenges**. The instructor shares a bit about each skill and asks students to offer examples of what it could look like to put each skill into practice and why it will be important for their success:

Instructor: "Let's think together about **thinking together**. Everyone in this group has valuable ideas and perspectives to share; the more we hear from everyone in the group, the more we will learn. We want to think as a group, building off one another's ideas and thinking together. What might this look like and why is it important?"

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Students: “We’ll notice different things, so we’ll learn more if we all share what we notice and discover.” “We might all have different ideas about how something works, and if we share the ideas we can learn more.” “I think it looks like listening to everyone’s ideas.”

Instructor: “We also want to be aware of how much we’re sharing in the group. If you’re someone who shares a lot, try to make space for others to share. If it’s more of a challenge for you to share in the group, try to share more.”

This conversation is repeated with the skill **be curious**. The instructor encourages students to be excited to learn about ideas, nature, themselves, and one another. Students share examples of curious behaviors such as asking lots of questions, not being satisfied with the first answer they come to, finding cool things in nature, and thinking about things from different perspectives.

The instructor shares about **sticking with challenges** in terms of hiking and moving across physical terrain; staying engaged socially throughout the day; and sticking with intellectual challenges, such as managing frustration when trying to figure out a complex idea. Students share strategies for dealing with challenges, such as stopping to take a break or some deep breaths, asking friends for support, telling positive jokes, and remembering to be curious and excited to learn. The instructor offers some strategies students can use to manage frustration if it arises.

The instructor offers some thoughts on growth and an invitation for students to choose a skill to focus on:

Instructor: “We all have different strengths we bring to the group. We all also have growth edges, or skills that are newer to us that we can work on. For some, it might be challenging to speak up more in the group; for others, their challenge is to pause and make space for others. We can look for these growth opportunities in any experience and choose something to work on. What do you want to work on today?”

Students: “I will work to be more aware of how much I am sharing relative to others in the group.” “I will practice asking more questions instead of just wanting to find out the answer and move on.” “I usually don’t talk that much in big groups, so I’m going to try to do that more.”

The instructor shows a sign: **Think Together, Be Curious, Stick With Challenges**. The instructor lets students know that they’ll get reminders throughout the day to focus on these skills and invites students to offer reminders to one another as well. Then, the instructor asks students to gather their things and get ready to begin their field studies.

Social Emotional Learning Routine primes students to think about SEL competencies they can work on during a learning experience. Through discussion among peers and with the instructor, the activity also breaks down these SEL competencies into smaller subskills that offer students clear strategies and behaviors that they can work on during the learning experiences—a form of scaffolding SEL competencies. *Social and Emotional Learning Routine* can be especially effective for highlighting opportunities for SEL during academic learning experiences, which are often less obvious to students than the SEL challenges that come up during a physical challenge (e.g., a ropes course). The routine is a way to heighten students’ awareness of SEL opportunities within learning activities in your program. Programs can also be designed to offer consistent opportunities for SEL during science or academic learning experiences, as well as during other program activities.



Using Student-Centered and Nature-Centered Teaching Approaches to Design for SEL

BEETLES Design Principles and Connections to CASEL Framework

BEETLES has five design principles that guide decisions and thinking during design of any learning experience for students or adults. These design principles come from research on how people learn, science practices as described in the Next Generation Science Standards, and culturally responsive pedagogy. These design principles also support SEL and can be used by instructors and program leaders to design or improve learning experiences with the goal of simultaneously supporting both science learning and SEL.

People learn outdoor science best when they:

1. Engage Directly with Nature
2. Participate in Equitable, Inclusive, and Culturally Relevant Learning Experiences
3. Think Like a Scientist
4. Learn Through Discussion
5. Experience Instruction Designed Using the Learning Cycle

The above design principles can be generalized as student-centered and nature-centered.

- **Student-centered (not instructor-centered):** Students learn through discussion and collaboration with one another; have minds-on experiences in which they participate directly in the learning process; and when the teaching approaches reflect what we know about inclusive, effective pedagogy. The instructor asks broad questions; listens to students' ideas and interests; and guides instruction to be centered around the interests, needs, perspectives, and abilities of students.
- **Nature-centered:** Students learn by engaging directly with and making their own firsthand observations of nature. When students build intimacy and connection to the land, water, and organisms around them, they deepen their relationship with nature and grow their capacity for lifelong curiosity and inquiry.

BEETLES design principles support and mutually reinforce CASEL SEL framework. During BEETLES student activities and other activities aligned with BEETLES design principles, students have opportunities to put SEL competencies into practice throughout the student-centered and nature-centered learning experiences.

Following is a brief description of each design principle and how each connects to the CASEL Framework. Additionally, there are two vignettes to show how

How does student-centered and nature-centered teaching support learning? The structure of a learning experience is significant. Outdoor learning focused on instructor-centered teaching puts students in a largely passive role of receiving information; research shows this does not lead to deep learning or understanding of complex ideas and concepts. Instructor-centered teaching also offers very few opportunities for social interaction, student agency and choice within the context of the learning experience, and, consequently, SEL.

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the design principles could be expressed in the context of an environmental education or outdoor science experience. We recommend having a copy of the CASEL Framework (Appendix A on page 26 or <https://casel.org/core-competencies/>) on hand as you read this section, as it will be referenced throughout.

Design Principle 1: Engage Directly With Nature

Being in nature has many benefits. When students learn approaches for making observations, asking questions, and making connections, their wonder and curiosity increase, and they begin to enthusiastically explore their surroundings. Learning, engagement, and enjoyment are multiplied when students make their own firsthand, unmediated, extended observations of the details of nature. Great instructors know how to step aside, guiding only as necessary so students have the profound, often transformative, experience of observing organisms and phenomena.

When students look closely at the veins of a leaf, a filter-feeding barnacle, or a salamander trudging toward water and then ask questions or form explanations from their observations, they understand the natural world a little better. By devoting time and attention to these firsthand observations, students also develop compassion and cultivate a relationship with nature. When students build intimacy and connection to the land, water, and organisms around them, they deepen their sense of place and grow their capacity for lifelong curiosity and inquiry. These universal human experiences throughout history are essential building blocks of present-day environmental literacy.

Note: We're not sure if empathy for land, water, and other-than-human organisms is what CASEL has in mind in their definition of "Social Awareness", but we think that building empathy and respect for humans and other-than-humans can deepen students' awareness of and respect for the many connections between humans and the world around them. Dissolving the boundary between humans and natural systems, represents an expansive approach to developing Social Awareness.

Connection to CASEL Framework	
Core competency	Opportunities for students to develop core competencies
Self-Awareness <i>(Self-Confidence, Self-Efficacy, and Accurate Self-Perception)</i>	Students develop positive identities as learners and build Self-Awareness when they construct their own understanding from their direct experiences in and firsthand observations of nature.
Self-Management <i>(Impulse Control and Self-Discipline)</i>	Students practice Self-Management when they are invited to be mindful of their impact on organisms, landscapes, and human communities as they interact directly with nature.
Social Awareness <i>(Empathy and Respect for Others)</i>	Students can develop Social Awareness through building empathy and respect for the natural world. Students can develop empathy and respect as they engage directly with nature; make firsthand observations of nature; and are invited to be mindful of their impact on organisms, land, water, and human communities.
Relationship Skills <i>(Communication, Social Engagement, and Teamwork)</i>	Students can practice Relationship Skills as they work with peers and adults to explore, engage directly with, and learn collaboratively about nature.



Connection to CASEL Framework	
Responsible Decision-Making <i>(Responsibility)</i>	Students can practice Responsible Decision-Making when they are invited to be mindful of the impact they may have on the organisms, land, water, and human communities they interact with as they engage directly with nature.

This design principle particularly supports building Relationship Skills through the collaborative act of exploring nature within a group of peers and instructors, Self-Awareness through building a positive identity by learning directly from students’ own experiences and observations, and Social Awareness through developing a connection to and sense of place within nature.

Examples from BEETLES activities:

- In *I Notice, I Wonder, It Reminds Me Of*, students build observation and critical thinking skills, learn from and with their peers through firsthand observations, and then reflect on how their learning behaviors have grown, leading to recognized strengths and self-confidence (Self-Awareness). Students also have an opportunity to practice collaboration and social engagement (Relationship Skills).
- In *Discovery Swap*, students gently catch and observe macroinvertebrates and then are instructed to put them back afterward. Students have an opportunity to manage gear, use organizational skills, self-discipline, and are challenged to try out new skills and ways of being (Self-Management).
- In *Interview an Organism*, students spend time observing and wondering about one organism—attempting to understand its experience, survival needs, and sensory world—and building empathy in the process (Social Awareness, Responsible Decision-Making).

**Vignette of a Day of Instruction, Part 3:
Building Observation Skills and Sharing Common Experiences**

The group of students and their instructor begin moving away from the area where they discussed the social-emotional skills and competencies they’d be applying throughout the day.

A short way down the trail, the instructor gathers the group in a circle and shares that students will practice using some tools to explore and observe nature. The instructor offers three prompts, and then students practice using each of the prompts in pairs, focused on leaves they have chosen.

First, students make observations (I notice . . . statements) and then share some observations with the whole group:

- “I notice my leaf has brown spots. And I notice that some brown spots have holes in them.”
- “I notice there are green and yellow parts.”

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- “I notice there are weird white curvy lines on this side.”

Then, students ask questions and make I wonder . . . statements:

- “I wonder if those lines were made by a bug tunneling through the leaf.”
- “I wonder how long ago this leaf fell.”
- “I wonder if the spines on the edge make some animals not want to eat it.”

Students make connections (It reminds me of . . . statements) and share about what their leaves physically look like or share experiences or knowledge they are reminded of:

- “This reminds me of looking at leaves with my grandmother.”
- “My leaf reminds me of watching a nature show about how slugs eat leaves.”
- “The veins on my leaf look like the shape of a tree.”
- “It looks like when you look at rivers and hills from a plane.”
- “The whole shape of it looks kind of like a feather.”

A pair of students is holding leaves up to the light, observing the patterns of the veins. Then, they exclaim:

- “They remind me of the lines on my hand!”
- “Yeah, or of tiny roads on a map!”
- “Whoa, I notice that the veins stick out on the bottom of the leaf!”

After 10 minutes of making and discussing observations in pairs and in the group, the group has learned a LOT about their leaves. Some students are reluctant to leave their leaves behind because they’ve become somewhat attached to them.

The instructor shares: “Look at how much we found out about simple leaves that we walk on everyday! Look at all the leaves around here. Every one of them can be interesting, too, if you use these curiosity tools. Look at all the other stuff: branches, twigs, spiderwebs, insects, plants, rocks, etc. Now you’ll have a chance to move around within these boundaries, checking out whatever you’re interested in, using I notice, I wonder, and It reminds me of.”

Students spread out in pairs and in small groups and eagerly begin studying leaves, spiderwebs, rocks, and other facets of the landscape. One student uses a net to try to catch a butterfly, and two others join in. Another is intrigued with a small branch on a tree and says:

“I wonder why this part is dead, but the other part is alive. What could have killed it, and why didn’t it kill this part?”

A group of three students find what looks like foam on a blade of grass and then discover a tiny green insect living inside it. They start to focus on finding more of the tiny green insects, sharing about what they found and asking nearby students to join them:

“Whoa, can someone help us try to find more plants with foam on them? The foam has bugs inside them! We want to count how many of the plants around here have the foamy bugs on them.”

A few students join in the search for foamy insects, and start sharing ideas:

- “I never noticed these before, but they’re everywhere! It looks like every one of these kinds of leafy plants has foam on it.”
- “I wonder if the foam helps protect the bugs.”

The group of students decides to call themselves “team foamy bug,” and they decide to keep looking for foam on plants for the rest of the day.

In another location, a few other students are peeking underneath logs and observing what they find:

- “Look, there’s a worm under this log!”
- Another student adds:



- “Whoa! I notice it has tiny legs! The legs kind of remind me of tiny tweezers.”

Others join in and add observations and questions to the conversation:

- “I notice it’s wiggling back and forth.”
- “I wonder what it eats?”
- “If it has legs, I don’t think it can’t be a worm then.”
- “I wonder if maybe it eats worms, cause it’s shaped like one, and maybe it can hunt in worm tunnels.”
- “I wonder what might eat it!”
- “Wow, this is cool!”

After students spend time noticing, wondering, and making connections about what they find in the area, the instructor brings them back together and invites students to reflect:

“Think about how much you just learned through your own observations and how many interesting things there were to discover here! Wherever we go, we can use these tools to learn and find interesting, beautiful things in nature.”

The instructor begins a short discussion, asking students: “What was it like to learn about nature from your own observations? What is a skill you feel like you got better at? What was it like to learn based on your own observations?”

Students share:

- “It was amazing to notice so many things all around us!”
- “It was really fun to find and discover cool things together!”
- “It was cool, because it made me realize I can learn things on my own, not just from a teacher or from reading something.”
- “I feel like I got better at noticing lots of little things that I usually would just walk by.”
- “It was fun to get to observe things in nature and to make discoveries as a group. It was so cool when we found all those tiny green insects and then looked and found even more!”
- “I felt like I got better at being curious about what’s around me!”

The instructor thanks students for sharing their reflections and begins to describe the next activity: “Now, we’re going to have the opportunity to continue what you all just started doing—checking out what lives in the area. We will use our observation skills again, this time focused on answering a question: What Lives Here? We will be searching for plants, animals, and evidence of animals in this area. We’ll record in our journals what we find. Later, we will use what we found to help us better understand this place as a whole.”

The instructor engages students in conversation about how they can be mindful of the organisms and not disturb the organisms’ habitats. Then, the instructor describes boundaries for student exploration. The instructor offers journals and field guides for students to record what they find and reminds students to focus on the SEL skills for the day—Think Together, Be Curious, and Stick With Challenges.

Students form pairs and begin to move excitedly around the area, making observations of organisms, looking for evidence of organisms, identifying plants and animals with their field guides, and recording in their journals what they find.

Design Principle 2: Participate in Equitable, Inclusive, and Culturally Relevant Learning Experiences

Students learn in the context of their lived experiences, family histories, and cultural identities—including race, socioeconomic status, gender, and many other factors. Instructors remove barriers to learning when they affirm these elements of students’ identities; show genuine cultural curiosity and humility; and recognize, validate, and make space for students to share their own perspectives, experiences, and expertise. Instructors create inclusive, equitable,

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and culturally relevant learning environments when they reflect on their own lived experiences and unconscious biases that impact how they design learning experiences and interact with learners. Unconscious biases are a normal part of being human, and awareness of them can help avoid potential negative impacts on learners. The other design principles also support the goal of creating inclusive and culturally relevant learning environments by putting students and nature at the center of the experience.

Connection to CASEL Framework	
Core competency	Opportunities for students to develop core competencies
Self-Awareness <i>(Self-Efficacy, Perceived Strengths, and Self-Confidence)</i>	Students build positive Self-Awareness of their cultural identity as they participate in learning experiences that: <ul style="list-style-type: none"> • make space for group members to share their perspectives, lived experiences, and strengths and value these contributions as a source of expertise. • intentionally welcome many ways of putting SEL skills into practice (instead of normalizing one right way to behave).
Social Awareness <i>(Perspective-Taking, Empathy, Appreciating Diversity, and Respect for Others)</i>	Students practice Social Awareness in learning experiences that include discussions and that make time for students to listen to one another's ideas, perspectives, and lived experiences.
Relationship Skills	Instructors frame Relationship Skills in a way that offers students inclusive ways of interacting with one another and that engages students directly in the act of creating an equitable learning context.
Responsible Decision-Making	Surfacing issues related to power, privilege, and environmental justice within a learning space offers students the opportunity to build competencies related to Responsible Decision-Making through an equity lens.

This design principle is particularly effective in creating a context that supports every learner to be successfully engaged. This is the foundation of successful SEL; in a productive, inclusive context, students can focus on learning. They can feel secure enough to share honestly about SEL skills and competencies on which they are working. An inclusive, culturally relevant learning context gives students opportunities to share their lived experiences and ensures that they are seen as an important source of expertise. Focusing on building solid instructor–student relationships is an essential component of culturally responsive teaching that contributes to students feeling supported as they take on challenging learning tasks and develop new SEL skills. SEL competencies can also be framed within the context of equity, inclusion, and cultural relevance—educators can explicitly identify how power and privilege intersect with skills such as Social Awareness or Responsible Decision-Making.

Examples from BEETLES activities:

- In the activity *Group Agreements for Science Discussions*, the instructor asks students to share examples of what it could look



like to put an agreement such as Listen actively into practice and makes room for a broad range of successful behaviors, deliberately providing an alternative to the idea that there is one polite way to listen.

- In the activity *Group Agreements for Science Discussions*, the instructor invites students to be aware of how much they are speaking up in the group in relation to others and encourages students to take an active role in ensuring that ideas from a range of students are heard.
- In the activity *Social and Emotional Learning Routine*, the instructor asks students to share about groups they have been a part of in their lives that have worked well together—including their families, school groups, sports teams, community organizations, or groups of friends—and uses this to inform the group’s set of working agreements.
- In the activity *I Notice, I Wonder, It Reminds Me Of*, students actively make connections to their lived experiences when they answer the final prompt: It reminds me of . . . This often reveals aspects of their culture, unique perspectives and identities, and adds to the learning of the group. The instructor values student responses and includes time for students to share about connections to their lived experiences.
- In every BEETLES activity, students share and discuss ideas with one another in pairs and in the large group, giving students opportunities to share perspectives and to listen to one another’s ideas.

An Inclusive, Equitable Context for Learning

An inclusive and equitable context for learning is a critical piece of supporting any kind of student learning—social emotional or otherwise. This is a nuanced, important, and complex topic and one that requires continual engagement, reflection, and change from organizations and instructors.

We’ve written up some of our current thinking about how BEETLES activities and student-centered and nature-centered approaches connect to support and design equitable, inclusive learning experiences. This content can be found in the Instructor Support section of the *I Notice, I Wonder, It Reminds Me Of* activity [<http://beetlesproject.org/resources/for-field-instructors/notice-wonder-reminds/>]. This is also a topic about which BEETLES as a team is committed to continuing to learn. We expect our thinking to change as we continue to reflect and deepen our understanding, and we’re committed to shifting our practices in response.

If you are looking to grow your understanding of these topics, we recommend looking to the following resources and familiarizing yourself with the work of these organizations:

- *How to Be an Antiracist* by Ibram X. Kendi
- *White Fragility: Why It’s So Hard for White People to Talk About Racism* by Robin DiAngelo
- *Culturally Responsive Teaching & the Brain* by Zaretta Hammond
- Youth Outside (<http://www.youthoutside.org/>)
- The Avarna Group (<https://theavarnagroup.com/>)
- Center for Diversity & the Environment (<https://www.cdeinspires.org/>)

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Design Principle 3: Think Like a Scientist

Students learn science most effectively when they engage in the same practices scientists use. When students make careful observations, ask questions, and attempt to explain mysteries in nature, their wonder and curiosity becomes a source of joy, and their relationship with nature deepens. As they come to understand the importance of evidence and how to engage in respectful exchange of ideas using language of uncertainty, they develop a sense of scientific fairness and humility, open-mindedness, honesty, and integrity. Indigenous people worldwide have engaged in similar practices since long before the word science existed. Curiosity and reasoning help students learn how to learn throughout their lives. Engaging in science practices helps students become critical consumers of information and grow into responsible and engaged decision-makers. Thinking like a scientist involves engaging directly with nature and learning through discussions. Using science language to share observations and ideas builds academic language and disciplinary literacy. It also builds students' positive identities as learners and gives them confidence to continue their explorations.

Connections to CASEL Framework	
Core competency	Opportunities for students to develop core competencies
Self-Awareness <i>(Self-Confidence, Self-Efficacy, Recognizing Strengths, and Accurate Self-Perception)</i>	Students develop positive identities as learners, which is a form of Self-Awareness, as they: <ul style="list-style-type: none"> engage in practices of science—such as making explanations, making observations, and asking questions—that develop learning behaviors related to critical thinking. reflect on how their learning behaviors mirror those of scientists and gain a more inclusive, accessible definition of what science is and who can do science. learn collaboratively and see how their observations and ideas contribute to the group's understanding. Students can engage with an added layer of Self-Awareness if they are invited to apply scientific thinking skills such as distinguishing between their own observations and explanations. Students build Self-Awareness when they have the opportunity to reflect on their own strengths and areas for growth in the context of a collaborative learning experience.
Self-Management <i>(Self-Motivation, Goal-Setting, and Organizational Skills)</i>	Students can develop Self-Management as they manage gear, set goals, and track tasks during collaborative learning experiences such as science investigations or habitat restoration projects..



<p>Social Awareness</p> <p><i>(Empathy, Respect for Others, Perspective-Taking, Appreciating Diversity)</i></p>	<p>Students can build Social Awareness and, specifically, empathy and respect for nonhumans as they develop a connection to nature rooted in their firsthand observations and build awareness of and respect for the needs and experiences of organisms, land, water, and human communities. Engaging in science practices can build their empathy for nature through learning about nature.</p> <p>Students can build Social Awareness as they engage in scientific discussions, listen to others' ideas, pay attention to different participation levels, and attempt to build common understandings rooted in a range of perspectives and ideas.</p>
<p>Relationship Skills</p> <p><i>(Communication, Social Engagement, Teamwork)</i></p>	<p>Students can build Relationship Skills when they participate in student-centered science experiences that invite them to engage collaboratively in science practices such as asking questions, designing investigations, and making explanations.</p>
<p>Responsible Decision-Making</p> <p><i>(Evaluation, Reflection, Ethical Decision-Making, Identifying Problems, Analyzing Solutions, Solving Problems)</i></p>	<p>Students can practice Responsible Decision-Making through a scientific lens when they make observations, ask questions, and use evidence to make informed decisions about their relationship to organisms, land, water, and human communities.</p>

This design principle supports Responsible Decision-Making through engaging students in applying critical thinking skills, such as identifying problems, and evaluating and analyzing situations in the context of using science to improve the health of people and the planet; Self-Awareness and developing a positive identity as a learner through engaging in science practices and through building a connection to nature through observing nature; Relationship Skills through collaboration and teamwork.

Examples in BEETLES activities:

- In *Lichen Exploration*, students in collaboration with their peers observe lichen, ask questions, and make explanations about patterns in nature (Relationship Skills).
- In *Exploratory Investigation*, students design an investigation and stick to a plan for collecting data (Self-Management) in a team (Relationship Skills).
- In *What Scientists Do*, students reflect on how their learning behaviors mirror the practices of scientists, and they develop their identities as learners (Self-Awareness).
- In *Fire Management Discussion*, students have a discussion and use evidence to assess the impacts of different solutions and decisions for managing impacts of fire on human communities (Responsible Decision-Making, Social Awareness, Relationship Skills).

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We're not sure if empathy for land, water, and other-than-human organisms is what CASEL has in mind in their definition of Social Awareness, but we think that building empathy and respect for humans and other-than-humans can deepen students' awareness of and respect for the many connections between humans and the world around them. Dissolving the boundary between humans and natural systems represents an expansive approach to developing Social Awareness.

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- In *I Notice, I Wonder, It Reminds Me Of*, students observe parts of nature they are interested in, building an authentic connection to and care for nature (Self-Awareness, Social Awareness).

Vignette of a Day of Instruction, Part 4: Thinking and Learning Together

It's the afternoon and throughout the day, students have continued to observe and learn about their surroundings. They have traveled over some challenging physical terrain and worked together as a team to stay positive and take care of their physical needs. Students have also had the opportunity to observe organisms in depth in a few different locations. At a small pond, students caught and studied macroinvertebrates. Students also compared plants in an area with trees and an open grassland. All the while, students have considered the question *What Lives Here?*, working in pairs and small groups, engaging in conversation about what they were noticing, and calling on the observation skills they had practiced earlier that day. At several points during the day, the instructor invited students to pause and add notes in their journals about the living things they have found.

After students shared a snack and took a break, the instructor gathered students into a circle to discuss and think about their observations and findings.

First, the instructor invites students to look back at their journals to see a record of all the living things they've observed throughout the day. Then, the instructor offers students time to add nonliving things—such as water and air—they noticed throughout the day to their notes.

Next, the instructor invites students to discuss a variety of ways things might interact in the ecosystem and offers an example: When an animal eats something, it's interacting with it; when a bird flies, it's interacting with the air and wind. Students work in small groups, discussing interactions between living and nonliving things they've observed in the ecosystem. Students add lines in their notes to show connections between parts of the ecosystem that interact.

The instructor shares that students have created an interaction web, which is a kind of model that scientists use to better understand connections between parts of an ecosystem.

Next, students interpret their models and try to better understand how the ecosystem works. They ask questions such as: Which organisms might compete for the same food? How might other organisms in the model be affected if certain organisms decreased? They then look back at their notes from the day and use their observations as evidence to make possible explanations and respond to the questions. The instructor then poses the question: "Which part of the ecosystem has the most interactions with other parts of the ecosystem, and is an important part of this ecosystem?"

Students continue discussing ideas:

Student: "I think water is the most important thing in this ecosystem."

Instructor: "Would anyone like to build on that or disagree with it?"

Student: "There are a lot of lines going to trees, lots of things eat tree leaves or sit in them or eat the fruit of the tree that falls, and we talked about how the tree brings up water, too."

Student: "A lot of animals interact with the wind on the bluffs. So I think wind and air is the most important thing."

Student: "There's a ton more animals that interact with water. Think of all the living things we found in the creek! And every organism needs water!"

Student: "But every organism breathes, too."

Student: "They both sound pretty key to me. Can we have more than one key thing?"

Instructor: "Of course. But for the moment, let's take one of those two and dig a little more deeply into it. Let's think about water. This year has been pretty dry so far, and we might be in a drought. How do you think this ecosystem might be affected by a drought when there's less water?"



- Student:** “A bunch of plants in our yard died when there was a drought, cause there wasn’t enough water.”
- Student:** “I guess a bunch of plants might die here in a drought.”
- Instructor:** “Anyone want to agree, disagree, or build on that?”
- Student:** “I never thought of this before, but I bet droughts are hard on bugs and stuff, cause they won’t have enough to drink.”
- Student:** “Yeah and to add to that, if there are less plants, then there’s less for them to eat.”
- Student:** “And shelter. I bet the shade from plants helps bugs from drying out.”
- Student:** “I bet they’re fine—they just dig down underground and hang out there till the rains come.”
- Student:** “But they can’t live forever like that. I bet they die off if it goes on too long.”
- Student:** “And I bet a lot of them can’t just dig down. Like things with wings can’t tunnel.”
- Instructor:** “Let’s take a quick poll to see what we all think of this idea. Thumbs down if you think a lot of insects could die off here during a drought. Thumbs up if you think they won’t be affected. And thumb somewhere in between if you’re not sure. Can someone look at how we’ve all voted and describe what they’re noticing about our group’s thinking?”
- Student:** “It looks like nobody says they won’t be affected.”
- Student:** “Yeah, a lot are saying a lot could die off, and the others are in between.”
- Instructor:** “Earlier you mentioned that plants died in your yard. Could you say more about that?”
- Student:** “Yeah, things turned brown.”
- Instructor:** “Did you notice if there were less insects and other little critters?”
- Student:** “No, I wasn’t out looking for bugs, I guess. But I bet a lot died off.”
- Instructor:** “How do you all think it might affect an ecosystem if the bugs die off?”
- Student:** “I guess all the other things that eat them would die, too. Like spiders and stuff.”
- Student:** “And frogs.”
- Student:** “And birds.”
- Student:** “But we were watering less cause we were supposed to save water. Should we keep watering?”
- Student:** “Maybe we should water some places, to give them a place to survive.”

The discussion continues and turns toward how human communities are impacted by droughts, how people may be impacted differently by droughts depending on where they live or the resources they have access to, how the health of human communities and ecosystems are intertwined, what actions could support nearby human communities during droughts, and how these actions might impact the place students studied that day. Students share observations from the day and ideas and perspectives from their experiences and communities. The instructor wraps up by reviewing the points students made and inviting students to reflect on how their thinking changed throughout the discussion.

As the group moves in pairs back from the field site, the instructor offers questions for students to think about and discuss with a partner. Students talk about areas near their homes where they could do more learning in the outdoors. They discuss how the group’s discussion about droughts could be used to support human communities and natural spaces near their homes. Students think about a few things they did that day that they are proud of. Students also discuss how they grew their observation skills and how they could keep working on the skills after the hike is over. When they arrive back at the main building, the instructor facilitates the discussion detailed in Vignette of a Day of Instruction, Part 1: How Did We Grow Today?

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The value of discussion in the outdoors. Discussion can be a signature strength of outdoor learning because there's so much to talk about! Students can have discussions while physically surrounded by interesting, inspiring, engaging, and mysterious organisms and phenomena. Learning outdoors promotes student engagement, sense making, and language development, especially among emerging multilingual learners.

Teaching specific SEL skills through discussions. Discussions are an ideal opportunity to focus on teaching students specific social emotional skills related to collaboration and social awareness. The BEETLES activity Group Agreements for Science Discussions offers some specific skills for discussions, such as participating mindfully, making space for others' perspectives, and expressing one's own ideas. It helps students put those skills into practice throughout the rest of the learning experience.

Design Principle 4: Learn Through Discussion

Learning is a social activity, and learning experiences should be rich with discussion about discoveries, ideas, concepts, and perspectives. When students make sense of experiences by putting their ideas into words and comparing their ideas to those of others, they clarify their thinking. When discussions build on prior knowledge and lived experiences and consider the strength of various sources of evidence, students deepen their conceptual understanding of complex ideas. Participating in discussions encourages students to learn from one another (not always from the instructor), and it is an opportunity for Social and Emotional Learning. Engaging in inclusive, respectful, and productive evidence-based discussion prepares students to be constructive participants in society. Student talk is an invaluable window into students' brains, providing a view of their prior knowledge, lived experiences, and current understanding that can guide instructional moves and decision making. Instructors create a culture of talk for productive discussions when they focus learners on engaging phenomena, use broad questions, cultivate a "brave space" for sharing ideas, and value but do not evaluate students' ideas. Discussions are among the most important elements of learning; they model what scientists do and add cultural relevance to understanding science.

Connections to CASEL Framework	
Core competency	Opportunities for students to develop core competencies
Self-Awareness <i>(Identifying Emotions, Self-Confidence)</i>	Students can build Self-Awareness as they engage in discussions, monitor their participation, and decide how and when to contribute.
Self-Management <i>(Impulse Control)</i>	Students can exercise Self-Management and Impulse Control as they engage in discussions, monitor their participation, and decide how and when to contribute.
Social Awareness <i>(Empathy, Perspective-Taking, Respect for Others, Appreciating Diversity)</i>	Students can build Social Awareness as they listen to one another's ideas and lived experiences, consider new perspectives, and appreciate what they learn from one another.
Relationship Skills <i>(Communication, Relationship Building, Social Engagement, and Teamwork)</i>	Students can build Relationship Skills as they work collaboratively, share ideas, figure things out, and deepen understanding of concepts through discussion.
Responsible Decision-Making <i>(Ethical Responsibility, Reflecting, Evaluating, and Analyzing Solutions)</i>	Students can practice Responsible Decision-Making in the context of discussions where they use evidence and reasoning to weigh the impact of various solutions to social or environmental problems.

This design principle particularly emphasizes: Self-Awareness, Social Awareness, and Relationship Skills as students engage in the highly social atmosphere of a discussion; Self-Management as students monitor their own participation; and Responsible Decision-Making if students use science to understand and analyze problems and solutions within their communities.



Examples in BEETLES activities:

- In any learning experience, students can discuss ideas in pairs, practice listening to one another and building on one another's ideas (Relationship Skills, Social Awareness, Self-Awareness).
- In *Thought Swap* (formerly known as Walk & Talk), the instructor scaffolds discussion skills (and Relationship Skills) by sometimes asking students to share what their partners told them and by occasionally shifting from pair discussions to brief large-group discussions; this allows students to build skills of discussion such as listening or perspective-taking incrementally.
- In *Bark Beetle Exploration*, students discuss ideas based on evidence about how to mitigate human impacts on the environment (Responsible Decision-Making).
- In *Fire Management Discussion*, students discuss the merits and drawbacks of different approaches to minimize the harm of wildfires on human and natural communities (Responsible Decision-Making).
- In *Group Agreements for Science Discussions*, students identify key skills related to participating in discussions and discuss what it will be like to put them into practice (Relationship Skills, Self-Awareness, Social Awareness, Self-Management).

Design Principle 5: Experience Instruction Designed Using the Learning Cycle

Research over the last 25 years shows that students learn best when they are authentically engaged, connect new ideas to lived experiences and prior knowledge (Invitation), mess around with ideas and interesting things around them (Exploration), make sense of their experiences and phenomena, figure things out, build understanding of concepts (Concept Invention), apply what they have learned to new contexts (Application), and reflect on what experiences helped them to learn (Reflection). The Learning Cycle is an effective, flexible, research-based model for designing student-centered instruction that includes those elements. Using it to design or improve lessons, lesson sequences, units of study, and programs ensures that students have these authentic opportunities for learning and meaning-making. The five phases of the Learning Cycle (described above) connect with other design principles by engaging students directly with nature and ideas and helping students to think and participate in discussions like scientists. The Learning Cycle can also provide a useful structure that promotes equitable, inclusive, and culturally relevant student-centered learning experiences.

The Learning Cycle: Connections to the CASEL Framework
(Since the Learning Cycle is a framework for designing effective learning experiences, following are some thoughts about how those general design features support SEL, rather than providing a table outlining student actions and experiences.)
This design principle supports instructors to create a learning context that is generally conducive to SEL. The Learning Cycle can be used to support students' SEL by sequencing learning experiences to call on their prior knowledge, appropriately scaffold the process of learning content, build students' self-efficacy through applying knowledge to a new

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context, and offer time for students to reflect on their growth and skill development at the end of the learning experience.

Specifically, this design principle creates a learning context conducive to SEL by:

- including an invitation for students to access prior knowledge and connect the content of the lesson to their lived experiences; this supports culturally responsive teaching practices and shows students that their experiences and perspectives are valued and important to their learning. This also increases student motivation to learn by situating new content within their own social, cultural, and conceptual frameworks.
- including reflection, which is a critical aspect of self-awareness, growth, learning, and emotional development. At the end of every learning experience when instructors ask students, “What did you do that helped you to learn?” “What skills did you get better at?” students reflect on gains they’ve made in learning specific SEL skills, contributing to self-confidence, self-efficacy, and perceived strengths (Self-Awareness).
- being a model that is based on long-standing (and reinforced by current) research about how people learn; using this to sequence learning experiences increases the likelihood for students to be successful and engaged, thereby increasing their positive identities as learners, their self-confidence, and their Self-Awareness.

Examples of BEETLES activities:

- At the beginning of the activity *Group Agreements for Science Discussions*, students discuss the question What is a group you’ve been a part of and what are some ways the group interacted to work well together? (Self-Awareness, Social-Awareness).
- At the end of *Discovery Swap*, the instructor asks students to discuss what helped them to learn during the activity. Students share how talking about ideas with their peers, making their own observations, and reading text helped them to learn. The instructor also asks students to discuss which skills they got better at, and students share whether they felt they improved at making observations, learning from their own discoveries, working together with their peers, and communicating their ideas (Self-Awareness).
- During the activity *Bark Beetle Exploration*, students figure out how to interpret patterns of bark beetle galleries and use this information to design an investigation. Later, they reflect on how figuring out a complex problem helped them feel more prepared to take on learning tasks in the future (Self-Awareness).
- In *Discovery Swap*, students make observations of a range of different organisms (exploring) and then focus on one organism and try to figure out how it survives where it lives based on students’ own observations and information from a field guide. Students then discuss their discoveries with their peers. Finally, students reflect on the skills that helped them to learn during the activity (Relationship Skills, Self-Management).

The reflection conversation in Vignette, Part 1: How Did We Grow Today? offered students the opportunity to reflect on the skills and ways of being they practiced throughout the day.



Implications for Program Design

Research on effective ways to develop students' social and emotional competencies is growing and expanding. A meta-analysis of many research reports, compiled by The Aspen Institute: National Commission on Social, Emotional, and Academic Development established that effective SEL happens when:

- students have equitable access to learning environments that are physically and emotionally safe and that feature meaningful relationships among and between adults and students.
- students are intentionally taught social and emotional skills.
- students are asked to practice those skills as they learn academic content and in interactions with peers and adults

Supporting social and emotional learning and engaging students in science learning (or learning about other topics commonly taught in outdoor environmental education programs) are not mutually exclusive; rather, they are mutually beneficial. Adding SEL doesn't take time away from science or environmental learning, it improves science and environmental learning! Organizations don't need to decide to focus on one goal and let go of the other. Designing learning experiences to be student-centered and nature-centered is also designing for SEL.

We encourage instructors and organization leaders to examine their program activities and learning time and ask the following questions:

- Which SEL competencies could students develop through participating in the activities and features that are already present in our program?
- How can we use student-centered and nature-centered teaching to design even more consistent and intentional opportunities for students to build SEL competencies throughout the program?
- How can we make these SEL opportunities visible to students?
- How does our approach to teaching SEL fit within our organization's larger approaches to supporting equitable, inclusive, and culturally relevant learning experiences?
- How can we use thoughtful sequencing to appropriately scaffold SEL skills and the learning experience in general?

These questions can be used to design experiences that support SEL, offering students opportunities to build on their existing strengths and continue to grow into thriving and engaged learners in an outdoor science program, in their classrooms, and in their home communities.

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Appendix A: CASEL Framework

SOCIAL AND EMOTIONAL LEARNING (SEL) COMPETENCIES

SELF-AWARENESS

The ability to accurately recognize one’s own emotions, thoughts, and values and how they influence behavior. The ability to accurately assess one’s strengths and limitations, with a well-grounded sense of confidence, optimism, and a “growth mindset.”

- ➔ IDENTIFYING EMOTIONS
- ➔ ACCURATE SELF-PERCEPTION
- ➔ RECOGNIZING STRENGTHS
- ➔ SELF-CONFIDENCE
- ➔ SELF-EFFICACY

SELF-MANAGEMENT

The ability to successfully regulate one’s emotions, thoughts, and behaviors in different situations — effectively managing stress, controlling impulses, and motivating oneself. The ability to set and work toward personal and academic goals.

- ➔ IMPULSE CONTROL
- ➔ STRESS MANAGEMENT
- ➔ SELF-DISCIPLINE
- ➔ SELF-MOTIVATION
- ➔ GOAL SETTING
- ➔ ORGANIZATIONAL SKILLS

SOCIAL AWARENESS

The ability to take the perspective of and empathize with others, including those from diverse backgrounds and cultures. The ability to understand social and ethical norms for behavior and to recognize family, school, and community resources and supports.

- ➔ PERSPECTIVE-TAKING
- ➔ EMPATHY
- ➔ APPRECIATING DIVERSITY
- ➔ RESPECT FOR OTHERS

RELATIONSHIP SKILLS

The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. The ability to communicate clearly, listen well, cooperate with others, resist inappropriate social pressure, negotiate conflict constructively, and seek and offer help when needed.

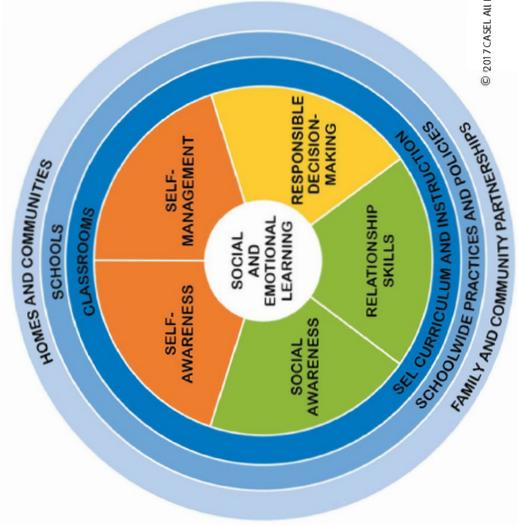
- ➔ COMMUNICATION
- ➔ SOCIAL ENGAGEMENT
- ➔ RELATIONSHIP BUILDING
- ➔ TEAMWORK

RESPONSIBLE DECISION-MAKING

The ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. The realistic evaluation of consequences of various actions, and a consideration of the well-being of oneself and others.

- ➔ IDENTIFYING PROBLEMS
- ➔ ANALYZING SITUATIONS
- ➔ SOLVING PROBLEMS
- ➔ EVALUATING
- ➔ REFLECTING
- ➔ ETHICAL RESPONSIBILITY

Appendices



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Appendix B: Tools and Resources for Implementation

BEEYLES Resources

- *Engaging and Managing Students in Outdoor Science* [<http://beetlesproject.org/engaging-and-managing-students/>]: Create a positive, inclusive learning environment and build relationships with students.
- *Social Emotional Learning Routine* [<http://beetlesproject.org/resources/for-field-instructors/selroutine/>]: Scaffold and highlight specific SEL skills and opportunities to practice them within a learning experience.
- *Group Agreements for Science Discussions* [<http://beetlesproject.org/resources/for-field-instructors/group-agreements/>]: Scaffold SEL competencies and skills specific to participating in discussions.
- *I Notice, I Wonder, It Reminds Me Of* [<http://beetlesproject.org/resources/for-field-instructors/notice-wonder-reminds/>] : Scaffold skills related to Self-Awareness, identifying emotions, and mindfulness; build learning behaviors and critical thinking skills that expand students' positive identities as learners.
- *What Scientists Do?* [<http://beetlesproject.org/resources/for-field-instructors/what-scientists-do-2/>]: Build students' Self-Awareness and positive identities by connecting their learning behaviors to those of scientists.
- *Mind Pie* [<http://beetlesproject.org/resources/for-field-instructors/mind-pie-2/>]: Assessment routine to support students' Self-Awareness as learners and to offer the instructor information related to students' self-perceptions of a range of skills and practices.
- Focused Exploration activities [<http://beetlesproject.org/resources/for-field-instructors/>]: Collaborative student-centered and nature-centered activities that provide consistent opportunities for students to practice SEL competencies while engaging in science learning.
- Investigation Activities [<http://beetlesproject.org/resources/for-field-instructors/>]: Collaborative activities that offer opportunities for students to practice SEL competencies while engaging in a science investigation.
- Discussion Strategy Videos [<http://beetlesproject.org/resources/for-field-instructors/#1452105513095-6b9e796a-4527>]: Resources to build instructor skills in facilitating discussions.

Additional Resource:

- **Grow Outside Toolkit** [grow-outside.org]. A learning toolkit offering strategies for adopting an intentional approach to incorporating SEL within Residential Environmental Learning Centers, with application for program improvement across the field of environmental education and outdoor science.

NOTES

NOTES

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