Core Educational Framework

Approved October 2019

Introduction to NatureBridge

NatureBridge's mission is *to connect young people to the wonder and science of the natural world, igniting self-discovery and inspiring stewardship of our planet*. Through overnight, immersive environmental science programs at awe-inspiring national park campuses, our participants explore the outdoors, connect with their peers, discover themselves and develop lasting relationships with the environment. With the world's changing climate; threats to our plants, animals and the wild places they live; declines in civic engagement and science in the classroom; and a generation bound mostly to textbooks and technology—NatureBridge's mission has never been more urgent.

NatureBridge's multi-day environmental science education programs are one in a constellation of student environmental education experiences—occurring within K-12 schools, through programs provided by non-formal science and environmental education organizations, and in everyday interactions with knowledgeable others. Together, these experiences advance students toward the goal of environmental literacy. NatureBridge aligns its understanding of environmental literacy with that of the North American Association for Environmental Education (NAAEE), which defines environmentally literacy as:

> knowledge and understanding of environmental concepts and issues; a set of cognitive and affective dispositions; a set of cognitive skills and abilities; and the appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts (Holweg et al., 2011, p. 2-3 - 2-4).

That is, an environmentally literate person has the know-how, capacity and motivation to make decisions and take actions, alone and with others, that support the health of natural and social environments. NatureBridge provides students with intentionally designed opportunities to connect with nature, with science, and with themselves and others in support of developing environmental literacy.

NatureBridge works in partnership with the National Park Service, conducting environmental science programs in national parks throughout the United States.[1] Each of our national park campuses offers unique features and affordances as outdoor classrooms, and each of our educators brings a unique background and set of experiences. Our students span the grade spectrum, from kindergarten through high school, and they come to us with different levels of experience in science, different levels of comfort in the outdoors, different home environments and life experiences. Taken together, these variables—in our campuses, our educators and our student groups—make it imperative that our environmental science programs are firmly grounded in a strong educational framework. While every NatureBridge environmental science program is unique, based on the factors listed above, they should all share commonalities that make them recognizable as a NatureBridge environmental science program.

[1] NatureBridge currently has campuses in four national parks: Yosemite National Park, Golden Gate National Recreation Area, Olympic National Park and Prince William Forest Park.

Introduction to the Core Educational Framework

The Core Educational Framework (CEF) presents the vision for commonalities across NatureBridge education programming and affirms our commitment to maintain the highest possible standards within the field of environmental education. The CEF is (1) based on our grounded understanding of what constitutes a NatureBridge environmental science program; (2) reflective of what we value and what we believe we have the potential to achieve in our programs, with the recognition that it will not be appropriate or possible to include *all* of these elements in every program; and (3) supported by relevant bodies of literature in fields including, but not limited to: learning sciences, science education, environmental education, non-formal learning, place-based education, culturally relevant education and youth development.

NatureBridge's educational philosophy stems from constructivist and sociocultural learning theories (Piaget, 1970; Vygotsky, 1978; Cole & Wertsch, 1996). Learning is an active process that is contextual and social in nature. Learners enter every new learning environment with a constellation of past experiences, prior understanding and cultural backgrounds, and each learning opportunity builds on and from others. Learning happens over time and through social interactions. Our understanding of how people learn, based on learning sciences and educational research, informs this CEF.

The CEF is intended to:

1. guide *education program policy* to ensure mission alignment;
2. provide a *common lens* to help leadership develop and manage the environmental science programs;
3. *outline our approach* to teaching and learning and the scope of NatureBridge programs; and
4. *connect to relevant research*.

Within our multi-campus structure, the CEF allows for substantial innovation in program design, while describing key elements that remain consistent across programs and campuses. It is not a comprehensive guide to program design, nor it is intended to encompass all of the complexities inherent in delivering high-quality programming. There are several resources available and under development that are intended to support educators in program design and delivery, to guide education leaders in providing educators with the training and professional development necessary for maintaining program quality, and to guide program evaluation and continuous improvement.

Elements of the Core Educational Framework

NatureBridge's mission of sparking students' self-discovery and environmental stewardship through connection to the natural world drives our practice. Rooting everything we do in a strong commitment to equity, inclusion and diversity (EI&D); science; and social and emotional learning (SEL), we design our environmental science education programs with the aim of maximizing student advancement toward three near-term outcomes: *Connection to Self and Others, Connection to Nature* and *Connection to Science*. Programs are designed with these outcomes in mind, along with the unique needs of student groups, learning goals of teachers, affordances of campus locations and educator interest, skills and experience. Programs are based on a learning structure of interwoven threads—*Sense of Place,*

Interconnections and *Stewardship*—and educators implement programs employing a core set of pedagogical practices and instructional methods and provide students with a core set of experiences. We elaborate on each of these elements below. The NatureBridge Theory of Change (Figure 1) provides a visual representation of how our environmental science programs support our intended outcomes.[2]

Commitments

NatureBridge's environmental science program stands on three foundational pillars: equity, inclusion and diversity; science; and social and emotional learning. These three "commitments" are the undercurrents that guide our programming, providing the values in which our environmental science program is grounded. These commitments drive what and how NatureBridge educators teach. In integrating principles of the three throughout a program, while connecting young people with nature, educators provide students with opportunities to participate in meaningful activities that promote their increasingly sophisticated accessing and use of resources—information, social capital, practiced skills, identities—that will help them make and enact environmentally and socially sound decisions.

Commitment to Equity, Inclusion and Diversity

Equity, inclusion and diversity (EI&D) are core values of NatureBridge, fundamental to the organization at all levels and essential in planning and implementing all education programs. Our society is becoming increasingly racially, ethnically and linguistically diverse (Colby & Ortman, 2015; Department of Education, 2015), and we take concrete actions to diversify our participants served, our staff and our programming to more closely reflect this. We believe we have a responsibility to provide all participants equitable and inclusive experiences in our national park classrooms and to connect participants of all backgrounds to each other and to the natural world through a welcoming and culturally relevant experience.

At NatureBridge, we actively seek to expand the image of who belongs in the outdoors, who is a scientist and who enacts environmental stewardship. We aim to do this, in part, by employing a diverse group of educators who can serve as role models to diverse groups of students, with whom students share similar backgrounds. While not every student may see themselves in their educator, NatureBridge educators are trained in culturally responsive and equitable teaching practices.

NatureBridge's educational programs serve students from a wide range of backgrounds—academically, developmentally, geographically and demographically (e.g. with respect to gender, race, ethnicity, religion, culture and social and economic backgrounds). We explicitly acknowledge the importance of personal lenses, which comprise the sum of an individual's life experiences and perspectives, and influence the way a person interacts with and interprets the world. We teach respect and care for diversity and strive to promote in our programs the richness brought by individuals (students, teachers, educators) from diverse linguistic, ethnic, racial, cultural and socio-economic backgrounds. This requires that we design and deliver programs that are inclusive to diverse ways of speaking, knowing, thinking, believing, valuing, acting and reacting (Boyd et al., 2006). We must also work to ensure that

[2] NatureBridge's theory of change does not explicitly include the pedagogical practices and instructional methods described in this document.

the experiences we provide and the messages we communicate are aligned with students' lived realities (Tzou, Scalone, & Bell, 2010).

Environmental education shares underlying core values with multicultural education. These include empowering individuals and promoting active citizenship. In addition, both treasure diversity and promote respect and compassion. Multicultural education and environmental education emphasize global perspectives and promote active personal and societal change. In sum, environmental education and multicultural education complement each other in striving for a more equitable, sustainable world (Nordström, 2008). We adhere to five key principles put forth by the National Association for Multicultural Education (NAME, n.d.), described in the following curricular guidelines:

- **Inclusiveness,** which includes representing, acknowledging and promoting the varied experiences lived by groups of people historically and contemporarily.
- **Diverse perspectives,** which includes representing multiple points of view and facilitating an understanding of (competing) cultural constructions.
- **Accommodating alternative epistemologies** (ways of knowing) and the social construction of knowledge, including providing ways to understand how knowledge is socially constructed, and encouraging an appreciation for and examination of multiple ways of knowing.[3]
- **Self-knowledge,** which consists of developing a sense of one's identity and understanding that identities may change over time.
- **Social justice,** which emphasizes the rights of all people and advances opportunities for students to be engaged critically in social action and in building a just society.[4]

NatureBridge embraces these principles of multicultural education and applies them to environmental education programming. NatureBridge educators create inclusive learning environments where all students feel welcome, and they make programs relevant to each group of students. Through problem-solving and group projects, NatureBridge students practice perspective-taking and experience the benefits of individuals contributing different viewpoints and collaborating toward a goal (Councill & Weigel, 2014). As part of the content of a NatureBridge program, an educator might discuss issues of environmental justice with students, teach cultural history of the park, celebrate traditional ecological knowledge and illuminate contributions to science and the environmental movement from members of underrepresented groups.

We believe that incorporating principles of diversity, equity and inclusion is paramount (Running Grass, 1996; Marouli, 2002, Nordström, 2008). A commitment to EI&D, coupled with principles of culturally responsive education, provide an anchor for how NatureBridge programs connect students to the natural environment and each other; these also enable students to reflect on their home communities and to make connections across them and the NatureBridge context.

[3] Accommodating alternative epistemologies supports students in understanding that knowledge is socially constructed; it does not accommodate ideas that are incompatible with science.
[4] NatureBridge curriculum focuses more specifically on environmental justice.

Commitment to Science

NatureBridge is committed to providing students with opportunities to practice science in our national park settings. This commitment stems from our belief that science is instrumental in understanding and addressing the pressing environmental (and other) problems and challenges society currently faces and will face in the future (National Research Council, 2012). Environmental literacy depends, in part, on knowledge of scientific concepts and competency in and understanding of science practices (Hollweg et al., 2011).

Children are natural investigators, and, recognizing this, NatureBridge educators encourage students to explore the natural environment in our national park settings, follow their curiosities and ask questions about what they observe. These experiences provide an introduction and invitation for students to engage with science that is collaborative, real-world and field-based, which often differs from their experiences in science classrooms. NatureBridge educators use scientific investigations to help students build their conceptual science understanding by actually engaging in the practices of asking questions, collecting and analyzing data and constructing explanations (National Research Council, 2012).

In addition to building their understanding of science concepts, NatureBridge's fun and engaging approach expands students' understanding of what science is and what scientists do (National Research Council, 2009). Students experience first-hand that science doesn't only occur in laboratories, and it is not practiced in isolation. At NatureBridge, students work together, in the outdoors, using tools that scientists use to answer questions that their own observations of natural phenomena inspire. NatureBridge educators also engage students in discussions about science, sharing their own experiences and those of practicing, professional scientists that students may not hear in their classrooms. Together, these experiences and conversations can increase students' interest in science and their conceptualization of themselves as scientists.

Finally, at NatureBridge, science investigations are collaborative. Engaging in scientific investigations in teams helps students understand that science is a human endeavor that requires collaboration (Duschl, 2008; Ford, 2008; National Research Council, 2012). Collaborative engagement in scientific practices helps students understand that science is dialogic. In other words, it is not about answers that are definitively right or wrong, but about engaging in conversation and making arguments from evidence to explain natural phenomena. In an ideal science investigation at NatureBridge, students engage with their peers in scientific arguments about evidence, which helps them to better understand how evidence supports ideas in science and how we come to know about the world around us—the discipline of *epistemology*. Many science education researchers have discussed the importance of students learning about epistemology within the context of engaging in scientific practices (Driver et al., 2004; Osborne, 1996).

Commitment to Social and Emotional Learning

Critical to the success of our environmental science program is the incorporation of teaching practices that support students' social and emotional learning (SEL). SEL is "the process through which children and adults acquire and effectively apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible

decisions" (CASEL, 2015). These skills are crucial for lifelong success (Durlak et al., 2011); when students develop these skills, they are better able to engage fully in the learning process.

Quality SEL relies on three key elements: (1) intentionally teaching social and emotional skills, (2) embedding opportunities to practice social and emotional skills throughout a learning experience, and (3) providing equitable access to physically and emotionally safe learning environments where meaningful relationships are present (National Commission on Social, Emotional, and Academic Development, 2019). NatureBridge strives to meet these criteria in its environmental science programs, facilitating opportunities for all students to develop, practice and hone these competencies during our programs.

CASEL's (2017) competency areas include:

- **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 (Dweck, 2008).
- **Self-Management:** The ability to successfully regulate one's emotions, thoughts and behaviors in different situations and, in the process, effectively managing stress, controlling impulses and motivating oneself; the ability to set and work toward personal and academic goals.
- **Social Awareness:** The ability to take the perspective of and empathize with others, including those from diverse backgrounds, communities and cultures. The ability to understand social and ethical norms for behavior and recognize family, school and community resources and supports.
- **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.
- **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.

NatureBridge educators represent an essential component in advancing students' social and emotional learning. Educators create a group dynamic that helps students develop and practice SEL skills throughout the program. Educators continually model SEL through mentoring, coaching, scaffolding and reinforcing positive and effective strategies and interactions. They also develop warm and supportive relationships with their students (Moroney, 2016; Yoder, 2014).

NatureBridge program elements, in combination with its pedagogical practices, create positive learning spaces that promote students' social and emotional growth. Such learning environments have several features: they are supportive spaces where students feel physically, socially and emotionally safe, such that students are willing to try new activities, share ideas and feelings and take on appropriate challenges (Moroney, 2016).

Program Design

We recognize that students, teachers and chaperones participating in NatureBridge programs come from a diverse array of communities, with varied cultural and social norms, and have different academic experiences and different goals for their NatureBridge programs. In designing each environmental science program, educators consider these inputs and contextual factors. Acknowledging these and other inputs in our overarching educational framework helps ensure that our education programs consider the particular strengths, prior content knowledge, cultural contributions, community demographics and participants' previous nature and environmentally related experiences in creating learning opportunities. Of equal importance is the ability of our environmental science educators to contribute and leverage their unique content knowledge, interests, cultural diversity and teaching competencies to support program outcomes.

NatureBridge educators tailor programs to each group attending our campuses, considering the factors described above, to provide meaningful educational experiences for participants. Program design appropriately matches an array of possible educational experiences with the diversity of needs and characteristics of students, the desired outcomes of participating classroom teachers, incorporation of state and federal standards, the unique capacities and possible constraints of the campus setting, program length and the strengths of our educators. This requires NatureBridge to balance characteristics of students, teachers and schools on the one hand with the capacities of the local site and its educators on the other hand. Appendix A presents a list of considerations that may be factored into the development of a NatureBridge Program.

Educators also balance the relative emphasis on outcomes, recognizing that, in a limited period of time, program design may not maximize growth for every outcome. All educational programming, however, attempts to support each outcome to some extent, providing opportunities for students to practice a set of skills and develop attitudes and knowledge that connect them with nature, science, themselves and others. We believe these connections support the ultimate goal of fostering lifelong environmental stewardship, evident in changes in students' thinking and behavior, not only in the national parks but also at home, in their schools and in their local communities.

In designing programs, NatureBridge educators' innovation and creativity are integral. However, in order to improve outcomes, it is critical that program design reflects core features in educational programming across our campuses. A NatureBridge environmental science program should be recognized as such, regardless of the campus, the educator or the participants. The program implementation section that follows here is intended to provide the vision of what constitutes that commonality.

Program Implementation

Thematic Learning Structure: Threads

Three core threads (Sense of place, Interconnections and Stewardship) weave a common foundation for NatureBridge environmental science programs. The threads are intentionally broad, incorporating a variety of concepts and subjects applicable at any campus. An environmental science program should be structured so that these threads flow in an

overlapping sequential progression, such that students: first, develop a sense of place; next, understand and experience interconnections; and, finally, value environmental stewardship. Throughout a multi-day program, educators build on and interweave the threads and experiences from day to day and encourage students to reflect on the threads of the prior days.

Sense of Place

At NatureBridge, students connect with the place where their NatureBridge experience occurs and the people with whom they are sharing the experience. This creates a safe and comfortable environment that is conducive to learning and makes the experience relevant to students.

NatureBridge's national park settings make us uniquely suited to teach students both *through* and *about* these places. The features of our awe-inspiring natural classrooms provide inspiration and opportunities for students' curiosity-driven learning and connection to place. NatureBridge educators help students to develop an awareness of place within the context of NatureBridge's national park campuses. Students learn about the natural and cultural features of the parks to develop an awareness of place. These place connections include a focus on natural as well as cultural history, including the effects of humans on the natural environment over time (Gruenewald, 2003; Clayton & Opotow, 2003). The physical characteristics of place include components such as climate, landforms, vegetation and wildlife (Stedman, 2003). The cultural characteristics of place include, but are not limited to, settlement history, resource use and the emotional and spiritual relationships humans have developed with the landscape over time (Ardoin, 2006; Smith, 2007).

Interconnections

At NatureBridge, students come to understand that all things within each place are connected and that change in any one part of a system has effects on other parts of the system—that their actions have impacts on one another and on the environment, at NatureBridge and beyond.

Elements related to interconnections underpin many aspects of NatureBridge programs. We strive to support students in connecting emotionally with each other as well as with the natural world (Kals et al., 1999; Ballantyne et al., 2001; Milton, 2002; Kahn & Kellert, 2002). We support their understanding that change in any one part of a system has effects on other parts of the system, as all physical, geological, biological and cultural aspects of places are related. Especially important to the interconnections theme is helping students relate their prior knowledge and experiences to what they learn and do in the national park settings where NatureBridge programs occur, and helping students connect their new perspectives and understandings back to their urban, suburban or rural home environments. In this way, connecting with place on NatureBridge campuses supports a fuller comprehension of students' own place and role in the natural world on a local, regional and sometimes global scale (Bell et al., 2009; Thomashow, 1996; Capra, 1996; Ardoin, 2009; Center for EcoLiteracy, 2011).

Understanding interconnections is central to understanding environmental and social sciences. A main component of the Next Generation Science Standards (NGSS), for instance,

is crosscutting concepts, which help students understand links across the different domains of science. Examples include patterns of change, cause and effect and complex systems, which all highlight connections and interrelationships among natural phenomena (National Research Council, 2012). The understanding of interconnections encompasses a range of scientific and cultural topics, including but not limited to natural cycles, the flow of energy and matter through an ecosystem, the interactions of human communities with natural systems and the social interactions that occur within human communities that may affect the natural world.

Stewardship

At NatureBridge, students come to value environmental stewardship. They learn to care for the place where their NatureBridge experience occurs, the environment and each other. Students practice actions they can take to continue forward as stewards of the environment.

By developing a sense of place and an understanding of interconnections, students come to identify reasons that humans should take responsibility for their environment. Students are better prepared to make informed decisions about what constitutes a healthy relationship between natural and human communities, their role in that relationship and appropriate actions they can take to sustain that relationship. This knowledge may impact their lifestyles and consumer habits, careers and volunteer service and involvement in the democratic process (Frick et al., 2004). Put another way, student engagement in stewardship should help develop a sense of empowerment to take concrete and positive action on behalf of natural and human communities (Hungerford & Volk, 1990; Chawla & Cushing, 2007). NatureBridge thus works to inspire and encourage students to adopt a respectful, long-term perspective in their decisions; live, individually and collectively, in a way that sustains a healthy environment; and serve as stewards of the environment for current and future generations.

Pedagogical Practices and Instructional Methods

NatureBridge educators play a key role in guiding the learning process, providing the structure, scaffolding and skills that allow students to be open to, responsible for, and successful in their learning. Educators facilitate the learning experience in order to advance students in their connections to self and others, nature and science. NatureBridge educators employ a wide range of pedagogical practices that are widely used in formal and nonformal education settings. The Core Educational Framework focuses on pedagogical practices and instructional methods that are particularly relevant to and effective in an outdoor environmental education setting that occurs over multiple days.

Positive Climate

NatureBridge educators create a positive learning climate for their students. Within positive learning spaces, students build relationships and develop a sense of belonging through personal interactions, establishing shared daily norms to accomplish program goals (Moroney, 2016; Yoder, 2014). This supportive setting enables students to explore their interests, engage in a set of activities that allow them to practice SEL and science skills and reflect on their actions and interactions (Durlak, Weissberg, & Pachan, 2010; Moroney, 2016; Nagaoka et al., 2015).

A positive learning climate is also one that promotes inclusion for all students. NatureBridge educators use inclusive language and engage in positive interactions with students. Educators work to ensure that *all* students feel a sense of belonging and feel that their cultural and linguistic backgrounds are respected (National Commission on Social, Emotional, and Academic Development, 2019; Jagers, Rivas-Drake, & Borowski, 2018; Yoder, 2014). To support this, educators mix groups and intentionally pair students, breaking up cliques and encouraging students to interact with classmates they might not typically talk with. Educators also share stories about their own backgrounds and encourage students to do the same. Educators step in to address microaggressions and other disrespectful language and interactions, and they employ restorative rather than punitive disciplinary strategies (Darling-Hammond et al., 2019).

Student-Centered

NatureBridge educators, acting as guides and facilitators, encourage students to be inquisitive about nature and notice the varied natural phenomena occurring around them. Student curiosity and engagement with their surroundings leads them to suggest questions and explorations that further motivate their learning. Educators also ask students to observe group behavior and reflect on those dynamics and on their own behavior in relation to others in their group. Educators support student voice and choice, encouraging students to take on individual and group responsibility for learning about nature, one another and themselves during the course of field experiences (James & Bixler, 2008).

Place-Based

NatureBridge instruction is place-based (Gruenewald, 2003), drawing on the unique capacities of each campus setting. Nature serves as the classroom for the development of scientific understanding of the natural world, as students make observations, ask questions, collect and analyze data, construct explanations and examine beliefs about the natural world with that evidence (National Research Council, 2012). Place-based instruction at NatureBridge also affords students opportunities to learn about and discuss social, cultural and historical aspects of the settings where the programs take place. Such discussions enable students not only to learn this content, but to practice perspective-taking and critical thinking when, for example, discussing historic settlement practices of national park lands.

Thematic

Thematic teaching organizes instruction, science investigations and interdisciplinary activities around a central concept in such a way that the activities inform and build upon one another during the program. Educators systematically support and build on students' successive experiences while they are gaining new knowledge and learning new skills. Thematic instruction is based on the idea that learning is most powerful and motivating when connected to a coherent "whole" and when it is related to the real world (Kovalik, 1994).

Interdisciplinary

Although environmental science is NatureBridge's strength and emphasis, most NatureBridge programs also incorporate learning across multiple content areas. In exploring broad subjects such as watersheds, plant and animal communities and marine or forest ecology, educators integrate disciplines such as social studies, language arts, mathematics and the performing

arts. Intertwining and integrating multiple subject areas can deepen the learning experience and make our programming more relevant and accessible to students.

Relevant

NatureBridge educators help students consider meaningful connections between their experiences in the national park and their personal lives, in school and within their home communities. Making these connections, and focusing on relationships between these places, is intended to reinforce lessons learned, provide practical applications and action strategies and increase the likelihood that the NatureBridge experiences extend beyond the days spent in our programs.

Multiple Modalities of Learning

NatureBridge recognizes the importance of multimodal learning in creating a more varied, exciting and engaging learning experience in which students have opportunities to communicate and interact in multiple ways (Kress, 2009). We provide learning opportunities through a range of practices, approaches and strategies. Educators present and create knowledge with students using discussion, reflection, art, multimedia, movement, music, observation and exploration, among others.

Collaborative Learning

Group work is central to NatureBridge instruction. Through activities that encourage group cooperation, problem solving and negotiated interactions, students build knowledge, interpersonal skills, cultural sensitivity and personal growth. At NatureBridge, students work collaboratively in team-building activities and scientific investigations alike. This collaborative group work supports students' social and emotional learning as well as appreciation for diversity (Larson, 2007; Councill & Weigel, 2014). At the same time, the collaborative work deepens their understanding of scientific concepts. Language is inextricably related to learning (Lemke, 1990), and when students speak to one another about concepts, such as scientific ideas, they are better able to learn those concepts.

Every group's progression through a NatureBridge program looks different, dependent on a number of factors, as discussed earlier. However, each NatureBridge environmental science program is facilitated by an educator employing the above practices and methods. Each program, too, incorporates a series of standard student experiences, as presented in the next section.

Student Experiences

Program design is translated into action through the implementation of student experiences that are well suited for a multi-day, overnight environmental education program in a national park setting. While NatureBridge programs vary widely based on the context and environmental conditions described above, there are certain types of activities that are common across NatureBridge campuses. What follows is a set of student experiences that can be found in nearly every environmental science program and which, when delivered with sound pedagogical practices coupled with intentional focus on program outcomes, provides students with opportunities to practice and develop the skills, attitudes, and knowledge that comprise our short-term outcomes.

Teamwork

At NatureBridge, students have opportunities to practice teamwork in nearly everything they do. Through science investigations, team-building challenges, stewardship projects and long hikes, to name a few, students work together toward common goals. This teamwork supports students' social and emotional learning as well as appreciation for diversity (Larson, 2007; Councill & Weigel, 2014). Through teamwork, students practice a number of skills, including communication, perspective-taking and empathy, they support one another, and they think critically about their interactions and how to meet their goals. NatureBridge educators scaffold opportunities to practice teamwork, such that the level of difficulty and complexity increase over the course of a program. Educators also guide students to reflect on the specific skills they practice through teamwork and how they might apply these skills in other situations.

Challenging Physical Activity

The national park settings in which NatureBridge programs occur offer numerous opportunities for students to engage in challenging physical activities. For some students, this might take the form of a long hike or canoe, while for others simply sitting on the ground can pose a challenge. Educators assess students' comfort levels and encourage them to stretch to the edge of, and at times slightly beyond, their comfort zones, as appropriate. Challenging physical activities provide opportunities for social and emotional learning and connection to nature (Moroney, 2016). Facing and overcoming challenges requires students to practice perseverance and can build self-confidence. Often, students support one another through physical challenges at NatureBridge, which builds community and trust among the group (Ardoin, DiGiano, O'Connor, & Podkul, 2016). Overcoming physical challenges in natural places may also increase a young person's comfort in the natural world (D'Amato & Krasny, 2011).

Science

At NatureBridge, students engage in the process of science through collaboratively investigating the natural world. Through place-based science investigations, students explore local phenomena and develop conceptual understanding of patterns, cause and effect, systems and other crosscutting concepts (National Research Council, 2012). This approach helps students to deepen their environmental literacy by developing their knowledge of science content and encouraging them to think critically. Students and educators collaborate to produce questions and attempt to address those questions through observations, data collection and analysis and construction of explanations. They might participate in an established citizen science project (sometimes referred to as community science or eCitizen science to refer to global citizenship, acknowledging the range of U.S. citizenship status of program participants) or create a research project of their own design. They discuss the process, as well as the findings, with peers, working to apply both to settings outside the park, including their home communities.

In addition to applying the practices of science through scientific investigations, students engage with science topics through a variety of methods, such as: each-one-teach-one activities, "I Notice/I Wonder/It Reminds Me Of," direct instruction and kinesthetic modeling of ecological systems. Engaging with science practices and concepts in a fun and collaborative way in the outdoors helps students to build their appreciation of the beauty and

wonder of natural phenomena, their interest in science and identity as scientists (National Research Council, 2012).

Individual Reflection

Opportunities for individual reflection, in which students process their experience, their emotions and their surroundings, are a powerful component of the NatureBridge experience and can include activities such as spaced walks, solo sits or journaling. These activities serve to provide students with opportunities to practice self-awareness and self-management, leading to progression in all program outcome areas, depending on the prompts used and structure provided by the educator. In addition to individual reflection activities, educators incorporate opportunities for students to reflect on their experiences through wait time, pair shares, group discussions and debriefs. Reflection is a critical component of learning and development, allowing students to make connections across topics and experiences and to understand how they learned or how they made progress toward goals (Farrington et al., 2012; Yoder, 2014; Stern, Powell, & Hill, 2014).

Responsible Environmental Behavior

At NatureBridge, students engage in responsible environmental behavior by working together to take actions that improve and protect the immediate environment and/or contribute to the sustainability of the planet. This takes a number of forms, including stewardship projects designed in collaboration with the National Park Service (such as planting native species or removing illegal fire rings), food waste reduction efforts in the dining hall and practicing Leave No Trace ethics on the trail. In conjunction with these activities, educators lead discussions about human impact on the environment and about ways that students can engage in responsible environmental practices once they return home. These activities, therefore, encourage students to think critically about the impacts of their own actions, to make responsible decisions in relation to the environment and to feel empowered to take positive action to care for the natural world and their communities (Hungerford & Volk, 1990; Chawla & Cushing, 2007).

Exploration

NatureBridge programs use physical exploration of natural places as a springboard for education as well as personal and interpersonal growth (James & Bixler, 2008; Watson, 2006). Students play in and interact with the park environment in an active, self-driven way. While such exploration is led by students, educators encourage them to make observations and ask questions of the natural world around them. Self-driven exploration, therefore, can spark curiosity and lead to the questions that drive a science investigation. Through exploration of the natural world, students practice responsible independence, thinking critically and making responsible decisions about their safety. Some students come to NatureBridge as experienced explorers of the natural world, while for others this experience is novel. Therefore, for some students, exploration can build connection to nature, leading to increased comfort and self-confidence in the natural world, an interest in spending more time outdoors when they return home and, perhaps, a more developed care for the natural world (O'Connor, 2016).

For optimal student growth during any of the experiences described above, educators thoughtfully frame the activity, offer the appropriate level of support and encouragement and

provide opportunities for students to reflect on the experience both individually as well as through guided debriefs with the group.

Outcomes of Interest

Ultimately, NatureBridge endeavors to support students in developing the knowledge, attitudes and skills necessary to act as environmental stewards. As one touch point in a student's vast array of experiences and learning opportunities, a NatureBridge program advances students along their path to environmental literacy. We do this by providing students opportunities to develop in three main areas: *Connection to Self and Others, Connection to Nature* and *Connection to Science*. All programming strives to advance each outcome, with recognition that no single program will achieve progress toward all outcomes equally. Variation depends on a range of factors such as program duration, the age and grade level of students, the background and prior experiences of individual students, and the specific program requests of the teacher or school group leader, among other elements. Below, we elaborate on each outcome area.

Connection to Self and Others

Through the instructional methods and student experience described above, NatureBridge programs provide students with opportunities to connect with their classmates and to practice a number of social and emotional skills, growing personally and interpersonally. Over the course of a program, students may practice and develop:

- Empowerment (self-confidence and perseverance);
- Personal and Social Responsibility (perspective-taking, empathy, appreciating diversity and responsible decision-making); and
- Relationship Skills (effective communication, active listening, respect for others).

Connection to Nature

During a NatureBridge program, the vast majority of student learning takes place outdoors in the natural world. Students may demonstrate improved or enhanced capacity to:

- Demonstrate comfort and confidence while exploring the natural world;
- Exhibit a connection to and caring for the natural environment (this may include explaining the potential impact of decisions and actions by people and governments on the natural environment); and
- Appreciate the benefits of nature (this may include explaining the value of national parks, national recreation areas and locally protected nature preserves as important places to be sustained in a healthy state for use by all people).

Connection to Science

NatureBridge programs are designed and implemented so that students will develop knowledge, skills and attitudes to connect with science. During a program students may have opportunities to practice:

- Critical thinking (through identifying, analyzing, evaluating and solving problems) and
- Scientific practices (including asking questions, planning and carrying out investigations, analyzing and interpreting data and constructing explanations)

Students may also demonstrate increases in:

- Curiosity;
- Content-specific knowledge (this may include increased understanding of environmental and human systems and interactions within and between systems); and
- Appreciation for and interest in science.

Program Evaluation and Continuous Improvement

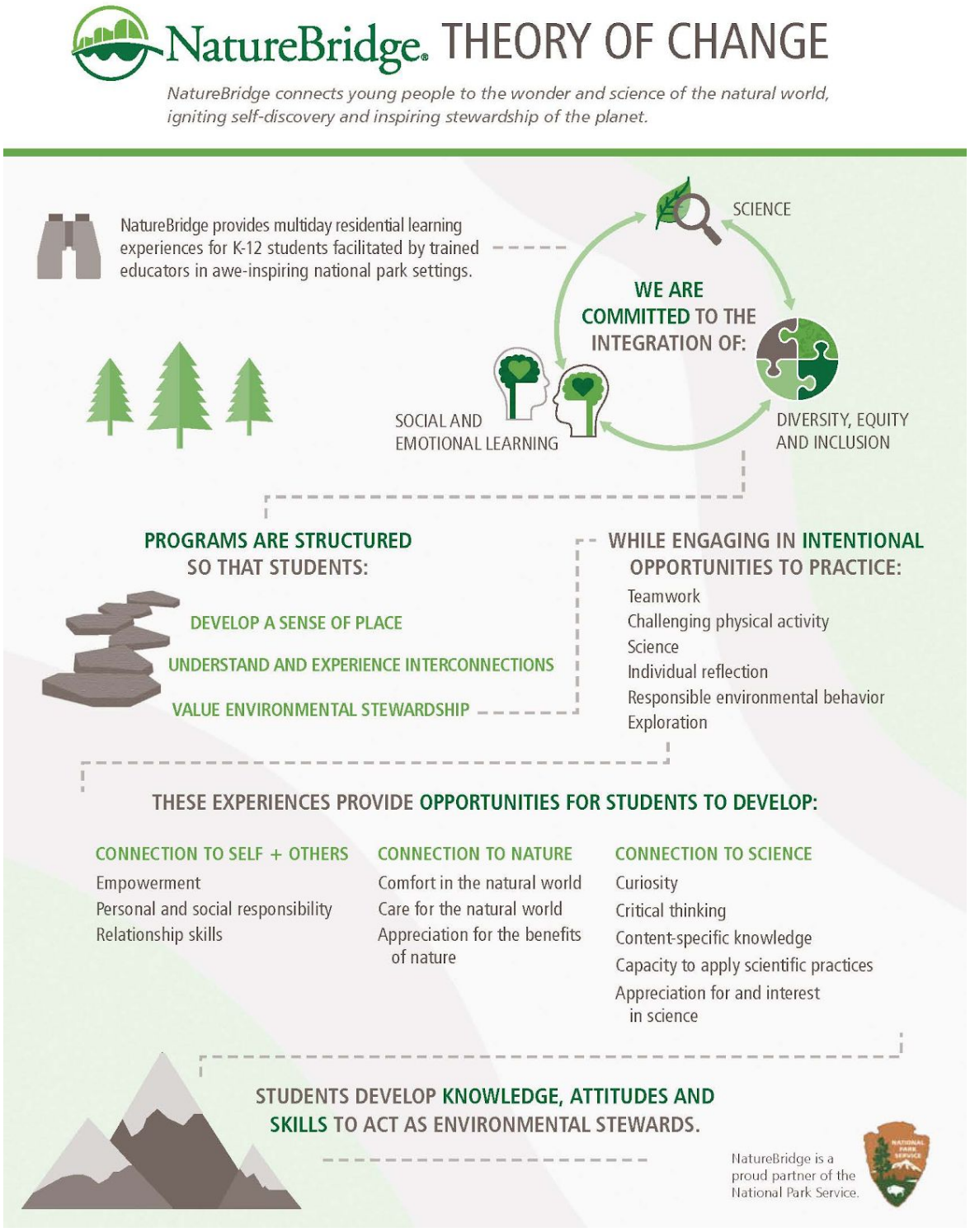
Evaluation is a process of systematically collecting data about activities, outputs and outcomes with the intention of using that evidence to improve education programs (Patton, 1997). NatureBridge is committed to ongoing, formative evaluation and assessment, believing that reflecting on our activities and programs allows us to develop and maintain high-quality standards to meet our mission, goals and objectives as described. To that end, NatureBridge conducts ongoing internal and periodic external evaluations to consider the ways in which our programs succeed in addressing our core threads of sense of place, interconnections and stewardship; in delivering quality programs that align with this Core Educational Framework; and in achieving our intended outcomes (Ernst et al., 2009; Camargo, & Shavelson, 2009; Zint et al., 2011). Formative assessments of educator teaching and student learning are essential components in understanding the impact of our programs (Wals & van der Leij, 1997; Marcinkowski, 1998; Pellegrino, 2002; Duschl, 2003; Shavelson, 2006; Bell et al., 2009).

Conclusion

NatureBridge's environmental science programs are driven by our mission to *connect young people to the wonder and science of the natural world, igniting self-discovery and inspiring stewardship of our planet*. This is particularly critical today, at a time when young people have fewer opportunities than ever before to interact with the natural world (Kellert, 2002; Pyle, 2002) and when the environmental challenges we face as a society are increasingly complex. NatureBridge strives to meet its mission through high quality environmental science programs, structured so that students spend multiple days at our awe-inspiring national park campuses, exploring the outdoors, connecting with their peers, discovering themselves and developing lasting relationships with the natural world.

Our environmental science programs are intentionally designed to provide students with opportunities to use the practices of science in the field, make meaningful connections with nature, themselves and others, all in support of developing knowledge, attitudes and skills that will enable them to take actions to support the health of the natural ecosystems. The core educational framework that has been presented in this document provides the consistent foundation on which these programs are built.

Figure 1: NatureBridge Theory of Change



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Appendix A: Program Design Indicators

The following "inputs" list suggests characteristics or indicators that [may] be used in the development of educational programming and program assessment and evaluation.

Students' Development Level:

- Age & Grade Level (Piaget, 1970; Sobel, 1997; Kahn, 2003)[i]
- Language background, specifically with regard to English learners (Fredrickson, 1999; Lee, 2005; Bunch, 2006; Stoddart et al., 2010)[ii]
- Psychosocial indicators (for example, physical disability, attention deficit disorder, hyperactivity) (Palincsar et al., 2001; Powers, 2004)[iii]

Students' Experiences:

- School location (urban, suburban, rural) (Fan & Chen, 1998; Rickinson, 2001; Shepardson et al., 2007)[iv]
- Time in school year (for example, early autumn, late spring)
- Student demographics including race, ethnicity, and economic level (for example, percentage of students on free or reduced-lunch program) (Rickinson, 2001, Quimby et al., 2007)[v]
- Other social and cultural factors, including home environment, parental participation in child's education, and funds of knowledge, ex. Family work in agriculture or home gardens, (Moll et al., 1992; Hoover-Dempsey & Sander, 1995; Fisman, 2005; Chawla & Cushing, 2007; Bell et al., 2009)[vi]
- Level of comfort with outdoors, physical fitness, and prior experiences in the outdoors and natural settings. (Dillon et al., 2006; Chawla & Cushing, 2007)
- Students prior knowledge, interests, and identity (Barton et al., 2003; Bell et al., 2009)
- State education standards (California, DOE, 2000; California EPA, 2011)
- Teacher's curriculum plan (Lousley, 1999)[vii]
- Student vocabulary, reading, and writing skills
- Level of comfort with science; science content knowledge (Aikenhead, 1996; Warren et al., 2001; Bell et al., 2009)[viii]
- Interest in environment and environmental issues

NatureBridge Educators' Background:

- Length of service at NatureBridge
- Prior work experience
- Prior educational experience (Rusell & Martin, 2007; Olsen, 2008)[ix]
- Prior research experience
- Demographic characteristics (for example, ethnicity and cultural background, gender) (Au & Kawakami, 1994; Lee & Fraud, 1998; Nieto, 2003; Lee, 2005; Howard, 2006; Tobin, 2006)[x]
- Social and emotional competencies
- Language skills
- Personality
- Personal lens and cultural sensitivity (Ladson-Billings, 1994; Lee, 2002; Nieto, 2003; Olsen, 2008; Ball & Tyson, 2011)[xi]
- Teaching beliefs (Taylor & Caldarelli, 2004)

- Pedagogical knowledge and skills
- Formative environmental experiences (Palmer, 1993; Chawla, 1998b; Corcoran, 2006) and ecological identity (Thomashow, 1996; Payne, 2001)

Campus Capacities:

- Physical characteristics of the natural and built environment (Kellert, 2005)
- Cultural and historic aspects of the site (Tilden, 1977; Moscardo, 1996; Corbin, 2010?)
- Opportunities to participate in research
- Seasonal climate during programming
- Resources (buildings, teaching materials, transportation)
- Site-specific partners and collaborations (National Park Service and other non-profit groups, such as the Marine Mammal Center at Golden Gate)
- Institutional history (Loomis, 2009)[xii]

Classroom Teacher:[xiii]

- Teaching philosophy and style (pedagogical practices) (Lee, 2002; 2003)
- Prior participation in NatureBridge programs
- Degree of active engagement with NatureBridge
- Comfort with scientific and environmental concepts and issues (Moseley et al., 2002)[xiv]
- Teacher's overall educational goals and objectives for the class
- Level of comfort in the outdoors

[i] Piaget's theories of cognitive development align with theories of constructivism and structural development. Piaget focused on age and stage cognitive development, such that at different age stages, (i.e. 4-7 yrs., 7-11 ó yrs.) children's intellectual structures change and grow. There is a particular, universal, and hierarchical order in the way that children become increasingly capable of formal thought and problem-solving. It is important to note that not all learning theorists ascribe to the concept of a universal, "stage" development of cognition.

Kahn (2002, 2003) is a structural development theorist who has focused on children's moral reasoning in regards to the environment. He suggests that environmental moral reasoning may be hierarchical, in that children develop increasingly complex ways to reason morally about the
environment. A more advanced reasoning about the environment may lead to a more generalized construction of "care" for the environment.

[ii] Fredrickson (1999) provides overview of English language development as well as pedagogical strategies for environmental educators. Although some of the discussion regarding
conversational (or everyday) language versus academic language for ELL language development is outdated or misconstrued as there are no definitive definitions of these concepts (e.g. Valdés, 2004; Bunch, 2006), the pedagogical strategies offered may be valuable for organizing NatureBridge's curriculum with English Language Learners. Specifically, it is important that science curriculum for ELLs is culturally, linguistically, and socially relevant and incorporates scientific inquiry, science discourse, and language and literacy development (see Stoddart et al., 2010). In addition, when working with ELLs, science educators need to value and consider students' home environments and the linguistics and cultural experiences

that students bring to their schooling (Lee, 2005). Additional resources to support ELL learning are also critical (Lee, 2005).

[iii] Palincsar and colleagues (2001) argue that it is important for educators and specialists (who work with special education children) to jointly focus on the specific subject matter to be taught,
such as science inquiry, instead of only general strategies for special needs children. They also
suggest that educators pay attention to the social setting, both in large and small groups. Powers (2004) found that place-based programs that included hands-on and sustainability-related work had positive impact on special needs children in that the children appeared more engaged and focused.

[iv] Fan and Chen (1998) found that students from rural schools performed equally as well as their
peers from urban schools. In his review, Rickinson (2001) found that studies showed inconsistent findings regarding geographical location as an influence on environmental knowledge. However, Rickinson also reported that Wals' (1994 a,b) studies showed that socio-economic location, namely a poor urban community versus a middle income suburban community influenced students' perceptions of nature. Shepardson and colleagues (2007) found that students' conceptualizations of the environment varied between urban and rural areas. Urban students who were surrounded by built environments more often considered these places as part of the environment, while rural students considered the environment as places with plants and animals. There are many considerations when analyzing school location, such as SES, ethnicity, community participation, cultural practices within the community, and environmental concerns within the community.

[v] There is a variety of research that examines SES and ethnicity in science education. Fewer studies attend specifically to this topic in environmental education. Rickinson's (2001) comprehensive review of research in environmental education learning suggested that there were some differences in students' environmental factual knowledge, level of concern, and behaviors between socio-economic groups. The most prominent difference occurred in regard to behaviors with two studies suggesting that students from more "disadvantaged" communities were more likely to participate in environmental behaviors when they were cost advantageous. It is important to note that there were methodological issues with some of the studies reviewed by
Rickinson.

As reviewed by Quimby and colleagues (2007) ethnic minority students are less represented in the field of environmental science. Quimby and colleagues (2007) findings suggested that ethnic minority students perceived more barriers to pursuing environmental careers than did white students. In addition, important to these students' interest in pursuing environmental professions was a "level of perceived social support" (such as from family or peers). The researchers suggested that environmental educators pay heed to students' social supports in terms of students' career choices. Similarly, in their review education for environmental behaviors, Chawla & Cushing (2007) report that role models are important for young people's participation in environmental action.

[vi] Fisman (2005) studied the effects of the environmental education program, Open Spaces as Learning Places, on 3rd and 5th graders in low-income and high-income communities. She concluded that the children who appeared to feel unsafe in their neighborhood (due to aspects like crime, appearance, and noise) less frequently related their environmental learning from the program to their neighborhood. She suggested that environmental educators be conscious of how children's perspectives of their home neighborhoods may affect their connections to the environment. Related to issues of safety, place, and learning, Suárez-Orozco and colleagues (2009) proposed that immigrant youth who perceive their schools as unsafe or aggressive may be more susceptible to academic difficulties.

There are many studies that examine parental involvement in children's learning and academic achievement. Hoover-Dempsey and Sander's (1995) model showed the multi-dimensionality of parent involvement, such as decisions as to why parents become involved, involvement types, mechanisms for involvement, and mediating variables affecting involvement. Fan and Chen's (2001) meta-analysis of quantitative research in regard to parental involvement showed a modest relationship between parental involvement and student academic achievement. Several researchers have discussed parental involvement or parental expectations in schooling focusing on immigrant families or on ethnic groups (e.g. Coll et al., 2002; Suárez-Orozco et al., 2009; Yamamoto & Holloway, 2010). Although there is a persistent myth that some immigrant or low-SES parents' do not value their children's education (Valencia & Black, 2002), immigrant parents may not feel comfortable participating in school culture because of differences in language and cultural knowledge (Delgado, 1991).

Moll and colleagues (1992) research examines families' "funds of knowledge" ("culturally developed bodies of knowledge and skills essential for household or individual functioning" p. 133) and suggests that educators may want to tap into students' funds of knowledge in order to better connect homes and schools.

In terms of significant life experiences and environmentalism, some research has suggested that family members were key to developing one's environmental interest, concern, or action (Chawla & Cushing, 2007).

[vii] From her ethnographic analysis of four school environmental clubs, Lousley (1999) found that the "culture of schooling" and school authorities, such as teachers and principals, played an important role in bounding the environmental actions discussed and supported in the clubs. This led to a specific type of environmentalism that did not attend to social critique or real change in students' actions.

[viii] Research has suggested that students will align differently with science depending on how much congruence there is between the culture of school science and the culture of their everyday lives, with family, friends, and community (e.g. indigenous cultures' views of the natural world in comparison to Western science) (Costa, 1995; Aikenhead, 1996; Lee and Fraud, 1998). Aikenhead (1996) described this transition as "border crossing." Bell and colleagues (2009) suggest that educators take into account students' cultural ways of knowing about science or natural phenomena. Other researchers (Warren et al., 2001) argue that students' everyday ways of talking and questioning about the world are congruent with some of those of practicing scientists and that science educators need to view students' diverse and complex ways of knowing about the world as resources for understanding science.

[ix] Teachers' prior experiences and beliefs about learning and teaching are powerful influences on their future teaching. Olsen (2008) found that new teachers' prior conceptions do not necessarily change easily, even with professional development of pre-service teaching programs.

[x] Although some researchers have found that cultural congruence (shared cultural experiences,
language, or backgrounds) may benefit instruction, student participation and performance, and
teacher- student relationships (Au & Kawakami, 1994; Nieto 2003, Lee, 2002), other researchers in science education, while noting the importance of cultural awareness, have argued that cultural congruence alone may not lead to better science instruction or understanding (Lee & Fradd, 1998; Tobin 2006). Many scholars emphasize that a shared demographic background between students and teachers is not nearly as important as becoming knowledgeable and respectful in regard to students' social and cultural history and realities, ways of talking and interacting, and ways of viewing the world.

[xi] Ladson-Billings (1995) argues that culturally relevant teaching must incorporate three features:
an ability to develop students academically, a willingness to nurture and support cultural competence, and the development of a sociopolitical or critical consciousness" (p. 483). (See NatureBridge Teacher Training Program: Evaluation Report Ardoin et al., (2010) for expanded discussion in regard to culturally relevant teaching. In addition, in We can't teach what we don't
know: White teachers, Multiracial schools, Howard (2006) further argues that personal transformation work is critical for White educators (and has been "the missing piece" in teacher
education) and that White educators must be part of the process of tearing down White "dominance" (p. 6-7). This is also echoed by Running Grass in regard to Multicultural Environmental Education (MCEE) (1996). (Running Grass' four key principles of MCEE are also outlined in NatureBridge's SEED Binder under Teaching Philosophy).

[xii] In her study about the assumptions of science learning at the Exploratorium, Loomis (2009) found tensions between the institution's development in regard to science authority and the goal

for supporting visitor. She suggests that informal science institutions think carefully and critically about their audiences, specifically in regard to what types of visitors attend their institution, how their institution serves those visitors, and for what end.

[xiii] Much of what was referenced earlier in regard to NatureBridge educators is relevant for classroom teachers.

[xiv] Several studies have found that school teachers do not feel as if they have the training, ability,
or skills to teach environmental education (both in and outdoors) (review in Moseley et al., 2002)