NatureBridge Teacher Training Program:
Evaluation Report

Submitted by:

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July 2010
Acknowledgments

The evaluation team would like to thank the NatureBridge staff, especially Beverly Chernier, Melissa Meiris, Jason Morris, and Amoreena Treff, for their guidance on and assistance with this project. We are also grateful to our colleagues at environmental and informal science centers in the San Francisco Bay Area for sharing their experiences with teacher professional development. Finally, we truly appreciate the educators and school administrators who participated in the survey and interview portions of this study; their perspectives form the core of this report.
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Executive Summary

The mission of NatureBridge is to “teach science and environmental education in nature’s classroom to inspire a personal connection to the natural world and responsible actions to sustain it.” NatureBridge achieves this by offering programming in national park settings to a range of audiences, including students and educators. The stated goals of NatureBridge’s teacher training programs are to foster both scientific and environmental literacy in teachers and ultimately in students as teachers apply new knowledge and skills in the classroom.

NatureBridge’s identity as a learning organization, commitment to adaptive management, and interest in basing its program on sound research and pedagogy led it to pursue an evaluation of its current teacher-training offerings, examined in light of best practices for teacher professional development in environmental education. To this end, an external consulting team was enlisted to: (1) review Bay Area teacher perceptions about professional development opportunities offered through NatureBridge and, in particular, Headlands Institute; (2) conduct a scan of teacher professional development programs offered by other Bay Area science and environmental education institutions; and (3) situate all of these findings within the broader context of national-scale trends in environmental education professional development.

The findings indicate four primary areas of emphasis to consider when revising NatureBridge’s teacher training offerings. Those areas are as follows:

- **Theoretical Underpinnings and Program Content:** We recommend, first, that NatureBridge link its teacher training programming with its newly adopted Core Educational Framework (CEF) and focus on the theory-to-practice link in professional development offerings. Theories that form the basis of the CEF and are central to the NatureBridge philosophy included social learning theory, constructivism, and principles of multicultural education. These are exemplified through teacher training that emphasizes hands-on and experiential learning; builds a sense of community and camaraderie among teachers; and recognizes the diversity of experience, interest, needs, and audience exemplified by teachers working in multicultural settings and with diverse learners.

- **Programmatic Structure:** We also recommend offering alternative structures to facilitate participation by a range of teachers. Currently the teacher training institutes are five days in length and held onsite at Headlands Institute in Marin County. Based on reviews of other programs as well as findings from our interviews and surveys, we suggest offering several different structures ranging from trainings focused on specific “hot-button” topics, such as climate change, to trainings whose primary emphasis is to demonstrate experiential activities using inner-city parks or schoolyards. Offering a range of program lengths, from one-day non-residential to five-day residential, would attract a greater diversity of
participants, and holding trainings in locations that are more convenient to urban areas would draw educators whose time or transportation options are constrained.

- **Program Follow-up and Outreach:** Research suggests that the post-program follow-up element of any learning experience, whether for youth or adults, is critical to maintaining interest and knowledge as well as motivating and sustaining behavior change. Therefore, we strongly recommend maintaining an alumni network of past training participants; providing training participants with access to updated resources through the NatureBridge website; and offering past participants special access to ongoing short courses (either in-person or web-based). These and other carefully designed activities would encourage maintenance of the spark ignited at the initial program.

- **Evaluation:** Finally, ongoing evaluation is a critical component of adaptive management and continuous programmatic improvement. Our comparative scan—using both national and regional lenses—should provide a helpful platform to develop a more structured, continuous evaluation process for assessing the short- and long-term impact of teacher training offerings.
Introduction

Founded in 1971, the mission of NatureBridge is to “teach science and environmental education in nature’s classroom to inspire a personal connection to the natural world and responsible actions to sustain it.” NatureBridge operates the Headlands Institute in Golden Gate National Recreation Area; Yosemite Institute in Yosemite National Park; and Olympic Park Institute in Washington. In spring 2010, they opened the Santa Monica Mountains Institute, which serves the greater Los Angeles area. The organization serves more than 30,000 people annually in programs that include residential field science education for K-12 students; mentoring and scientific field research programs for high school students; educational summer day camps; teacher training workshops in science and environmental education; and Elder Hostel and other adult and family programs.

In three of its institutes, NatureBridge offers teachers the chance to take part in a unique professional development program—a five-day residential immersion experience in a national park. These experiences are intended to foster a connection to nature and help teachers develop the skills and tools necessary to incorporate science and environmental education into their classrooms, with the aim of reaching Bay Area students of all cultural and economic backgrounds.

Over the past 15 years, NatureBridge’s teacher training programs have been implemented locally and independently without the development of a unified teacher-training strategy. Evaluations of participants in the local programs suggest positive impacts on teacher knowledge and classroom practice, a finding that was supported by a comprehensive evaluation of all campuses in 2002. In the long term, NatureBridge’s vision is to expand into other national parks, thereby reaching greater numbers of educators and youth across the country. A systematic evaluation of current teacher training programs will assist NatureBridge in tracing program development and charting a vision for the future.

In fall 2009, NatureBridge hired an external team to: (1) evaluate its teacher training programs and those of others offered in the San Francisco Bay Area, (2) research best practices in training teachers to deliver effective environmentally themed lessons to Bay Area students of diverse cultural and economic backgrounds; and (3) craft a unified strategy for developing an effective and sustainable teacher training model that can be implemented at its institutes serving the Bay Area and extended to campuses in other national parks as the organization grows.

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1 The evaluation was carried out by Barbara Schneider and J. Myron Atkin, who led a team of external researchers based at Stanford University’s School of Education.
The evaluation\(^2\) approach consisted of the following methods:

- In-depth review of the literature on features of high-quality professional development for teachers in science and environmental education on a national level, and impacts on teacher knowledge and skills, as well as student outcomes.
- Summary of emerging and relevant theoretical perspectives underlying learning and behavior change processes, and ways they translate into practice.
- Review of NatureBridge materials and interviews with NatureBridge staff on the goals, design, and marketing of its teacher trainings.
- Comprehensive marketing scan, through interviews and online research with other San Francisco Bay Area institutions that offer teacher training in environmental and/or informal science education.
- Interviews and an online survey of educators in the San Francisco Bay Area to collect data on their professional development experiences, including motivations, needs, preferences, opportunities and constraints, as well as their previous experience with NatureBridge programs.

This report represents the findings of all evaluation activities and closes with recommendations for NatureBridge’s teacher training programs. Section 1 reports on what the research indicates about high-quality professional development in science and environmental education and the impacts on teacher knowledge and practice, as well as student performance. Section 2 describes theoretical perspectives on learning and behavior change, and provides examples of theory translated into current education practice. Section 3 presents the results of a market analysis of similar teacher-training programs offered in the San Francisco Bay Area. In Section 4, the results of a survey of Bay Area educators (including past and potential participants in NatureBridge training programs) are presented, along with the results of interviews with targeted educators. Finally, Section 5 outlines program recommendations.

It is hoped that this report will provide useful insight for NatureBridge’s programming staff and those who develop and deliver NatureBridge’s teacher training workshops. We also hope that this report will assist NatureBridge in mapping a vision for the future.

**Toward Scientific and Environmental Literacy**

The overarching goals of NatureBridge’s teacher training programs are twofold: (1) to foster scientific and environmental literacy in teachers, and (2) to foster this literacy in students as teachers apply new knowledge and skills in the classroom. The notion of scientific literacy “involves a rich array of conceptual understanding, ways of thinking,  

\(^2\) The study was conducted under Stanford University IRB Exemption #18759.
capacities to use scientific knowledge for personal and social purposes, and an understanding of the meaning and relevance of science to everyday life” (Center for Advancement of Informal Science Education [CAISE] 2010, 18). Similarly, environmental literacy involves an understanding of environmental issues, how human decisions impact environmental quality, and how to use this knowledge to make well-informed choices that also take into account social and political considerations (North American Association for Environmental Education [NAEEE] 2004). The following sections examine strategies for moving teachers, and ultimately students, toward both scientific and environmental literacy through high-quality professional development programs for teachers.

**Effective Science Professional Development**

**Teacher Training: A Major Lever in Science Education Reform**

As we approach a formal review of NatureBridge’s teacher training programs, it is helpful to review trends in professional development practice and research. In recent years, professional development for science teachers has received widespread attention, especially in light of science education reform efforts. The push for educational reform emphasizes the importance of teacher professional development as a means for improving student achievement in science (Supovitz and Turner 2001; Frechtling and Katzenmeyer 2001). Teachers are necessarily at the heart of education reform since they must carry out the demands of the high standards that states and districts have adopted (Cuban 1990). For reform to be implemented successfully, however, Radford (1998, 73) notes that it is “essential to have teachers who are knowledgeable in science content, confident of their ability to guide and conduct science investigations, and well-versed in the pedagogical skills necessary to lead inquiry-based, student-centered learning.” Consequently, teacher professional development is a major focus of systemic educational reform, and teachers are expected to master new knowledge and skills and to change their practice (Corcoran 1995).

Despite teachers’ central role in reform, few are well-equipped to implement teaching practice based on high standards. Cohen and Hill (2001) note that many teachers do not have sufficient content knowledge, pedagogical content knowledge, or knowledge of tools of specific science disciplines. In a national survey of science and mathematics education, Weiss et al. (2001) found that almost two-thirds of elementary and middle school teachers reported a moderate or substantial need for professional development in the use of inquiry–based teaching strategies. Additionally, 67% of middle school science teachers and 71% at the elementary level cited a need to increase their science content knowledge. Most middle and elementary school science teachers also reported needs in
understanding student thinking in science and how to assess student science learning. Thus, effective professional development may be a “major lever” for aligning science teaching practice with national standards (Banilower, Heck and Weiss 2007, 375).

Effective Professional Development: What Research Tells Us

A basic goal of professional development is “to improve, broaden, and deepen the disciplinary and pedagogical knowledge of elementary and secondary teachers employed in the public schools” (Frechtling et al. 1995, n.p.). Ultimately, however, the goal of professional development is student achievement (Mundry and Loucks-Horsley 1999). In the last two decades, a consensus among researchers and educators has emerged about what constitutes effective, high-quality teacher professional development. The literature notes the following key features of best practice in science professional development:

- **Active Learning**: Instructional approaches that emphasize hands-on learning and provide firsthand experience of “inquiry, questioning, and experimentation” (thereby modeling inquiry forms of teaching) (Supovitz and Turner, 2000, 964).

- **Focus on Content Knowledge/Pedagogies**: An emphasis on science content knowledge and/or pedagogical content knowledge that support teaching practice (National Research Council [NRC] 1996; Cohen and Hill 1998; Kennedy 1998; Hill, Rowan, and Ball 2005).

- **Reform-Oriented**: Activities such as teacher study groups, internships, or being mentored or coached, and the collective participation of teachers from the same school, grade level, or department (Garet et al. 2001).

- **Coherence**: A high level of alignment, as perceived by teachers, with other reform activities, standards, and goals that exist in the teachers’ local school contexts (Garet et al. 2001; Penuel et al. 2007).

- **Duration**: Sustained and intensive experiences—i.e., including greater number of contact hours and span over time as well as follow-up when participants return to their schools (Frechtling and Katzenmeyer 2001; Garet et al. 2001; Supovitz and Turner 2000).

- **Context/School Factors**: Support for teachers to make and sustain changes in their classrooms and availability of resources—for example, instructional materials, time for teachers to plan and prepare lessons, science supplies, and technical support (American Association for the Advancement of Science [AAAS] 1998; Frechtling and Katzenmeyer 2001; NRC 1996; Supovitz and Turner 2000; Penuel et al. 2007).

- **Ongoing Evaluation/Assessment**: Tools for continually assessing the efficacy of professional development programs and use of new knowledge and skills—for example, questionnaires and teacher portfolios (Maldonado 2002).
Impacts on Teacher Knowledge and Practice

Although there is a growing consensus about the features of high-quality professional development, there remains a scarcity of empirical evidence to support the selection of those features, particularly regarding their influence on teacher practice and student performance. Policymakers, school and district leaders, and researchers alike recognize the need to improve the quality of measurement of the impacts of professional development efforts on the desired reform outcomes of teacher practice and student performance (Penuel et al. 2007).

In recent years, several large-scale studies have explored the effects of professional development on teachers’ knowledge and practice (Garet et al. 2001; Supovitz and Turner 2000). The advantage of these studies is their use of nationally representative samples of teachers, for whom professional development activities and self-reported outcomes varied widely (Penuel et al. 2007). Furthermore, they represent a move away from the reliance on teacher self-reports of satisfaction with programs, classroom application, and perceived benefits to students as a way to determine the effectiveness of programs (Frechtling et al. 1995). Frechtling and Katzenmeyer (2001, 46) note that while these self-reports are certainly encouraging, direct evidence of change in classroom practice and subsequent improvements in student achievement is “sorely lacking.”

Garet et al. (2001) used a survey to examine how differing characteristics of professional development funded through the Eisenhower Math and Science program affected self-reported changes in teacher knowledge, skills, and practice. Three core professional development features contributed significantly to enhanced knowledge and skills, and changes in teaching practice: (a) focus on content knowledge, (b) hands-on or active learning approaches, and (c) a high level of coherence with other learning activities taking place in the teachers’ local school context. Other valuable structural features include: (a) reform-oriented activities such as teacher study groups, internships, or being mentored or coached (which were more effective than traditional professional development experiences such as workshops or college courses), (b) duration of the activity, both in terms of time span and the total number of contact hours, and (c) the joint participation of teachers from the same school, grade, or subject. Many of the characteristics of effective professional development highlighted in the study were identified previously in the literature from other studies. However, this study is among the first to provide “empirical confirmation on a national probability sample of the assumptions on ‘best practice’ in the literature on professional development” (Garet et al. 2001, 935).
Supovitz and Turner (2000) investigated the impacts of science teaching practice on student achievement in science using data from a teacher enhancement program of the National Science Foundation called the Local Systemic Change initiative. Their findings suggest that the amount of professional development in which science teachers participate is strongly linked with both greater use of inquiry-based teaching and the establishment of an inquiry-oriented culture in the classroom. A focus on content knowledge significantly influences teaching practice and classroom culture at the individual level. School factors also play a major role in teacher practice: Teachers with supportive principals used more reform approaches than those who did not feel supported by their school leaders. Access to resources (for example, instructional materials, time for teachers to plan and prepare lessons, and science supplies) also significantly influenced teachers' investigative practices. Ultimately, school poverty influenced teaching practice more significantly than either principal supportiveness or resources.

The Multi-Agency Study of Teacher Enhancement Programs examined 34 teacher enhancement programs thought to represent best practice in professional development for science teachers (Frechtling and Katzenmeyer 2001). The study points to hands-on activities for classroom use, planning how content can be used in the classroom, developing curriculum units, problem solving, and collaboration with scientists or other staff as the most effective features of teacher enhancement programs (Frechtling and Katzenmeyer 2001). The findings support the value of well-designed professional development programs. A teacher's participation in professional development programs has important impacts on what takes place in the classroom. Programs that provide greater knowledge about, and practice in, the delivery of standards-based science instruction result in increased science pedagogy and greater exposure to science content for students, thereby helping create the conditions under which improved achievement is likely to occur. Once again, context was found to affect outcomes: A supportive environment provided by school or district leaders for the application of learning affects the degree to which change actually occurs in teacher practice.

Effects on Student Outcomes

In the last two decades, a substantial body of research on professional development including best practices, teacher knowledge and teacher practice, has emerged in the literature. This work has been conducted through a mix of large- and small-scale studies. Although these studies provide important evidence of the links between professional development and teacher knowledge and practice, little empirical research has been carried out on the impacts of teacher enhancement programs on student learning outcomes. An exception is a study by Kennedy (1998) that investigated the effects of in-service teacher education on student learning outcomes across several programs. The
study found that the actual content provided to teachers was what mattered most in terms of student learning outcomes (Kennedy 1998). Content that focused on teachers’ “knowledge of the subject, on the curriculum, or on how students learn the subject” had the greatest impact on student learning (Kennedy 1998, 12). In addition, programs that teach teachers to model scientific reasoning appear to have more influence on student achievement than those that teach teachers to use the learning cycle (Kennedy 1998).

Teacher Training and Environmental Education

Needs and Priorities of Environmental Educators

One of the main reasons that teachers may not offer environmental education (EE) to their students or that they provide it infrequently is a perception among teachers that they do not possess adequate information or training (Lane, Wilke, Champeau, and Sivek 1995; Smith-Sebasto and Smith 1997; Wade 1996). A recent study conducted for the Environmental Education and Training Partnership (EETAP) identified specific professional development needs and priorities of environmental educators nationwide in terms of knowledge, skills, and products (Fleming 2009). Using focus groups, interviews, and questionnaires involving hundreds of EE professionals, the study identified 89 professional development topics, grouped under six themes: audiences and partners; EE profession; process of EE; content knowledge; business of EE; and evaluation.3 The study concludes by recommending top priorities for environmental educators during the 2010-2015 period. Those priorities include:

- How to carry out local EE programs that engage all community members
- Opportunities for EE leaders to share effective models, collaborate, and network
- Greater knowledge of research findings about how people connect with and interact with nature; what inspires them to action; how to engage diverse audiences; and how EE can help student learning in other areas
- Content knowledge of environmental sustainability especially in the context of communities, culture, and health
- Basic EE training for a range of educators, including classroom teachers
- Strategies and techniques for teaching thinking skills (e.g., systems thinking, critical thinking, problem solving, and analytic thinking) and inquiry-based teaching

3 In the EETAP study, educators with 1 to 4 years of experience differed from those with 11 to 20 years of experience in their need for professional development around content knowledge topics, including key concepts and how to teach about biodiversity; core concepts; basic understanding about the environment and environmental issues that are the foundation of EE; key concepts; and how to teach about systems, sustainability, and energy. According to the study’s authors, separate reports on findings about the differences in professional development needs based on years in the profession and other factors will be available in 2010.
How to integrate EE into K-12 curricula; Science, Technology, Engineering and Mathematics (STEM) projects; No Child Left Behind; and state standards

Promoting action, citizen participation, and marketing and behavior change targeted to audiences

Communication skills for delivering EE to diverse partners and audiences

Needs assessment, using evaluation to design and develop EE programs/services to meet audience needs, and building evaluation into planning and programs

Core concepts and basic understanding of the environment and environmental issues that are the foundations of EE

Key concepts and how to teach stewardship, sustainability, and climate change

Understanding/application of Guidelines for Excellence in EE standards

Use of technology to improve teaching practice and participant learning

Reducing Nature Deficit Disorder

**Delivery Preferences**

The types of professional development in which environmental educators are most likely to participate include in-person or face-to-face workshops, and local or regional meetings (Fleming 2009). The most popular way to deliver professional development is through full-day, hands-on, local or regional events in the winter with a single topic or limited theme meeting or seminar.

**Length of Professional Development:**

- 58% of respondents selected a full-day program as the most appealing option for professional development length, followed closely by one-half day programs (45%).
- Among respondents in the Pacific region, which includes California, 77% indicated they prefer to do a full day of professional development, followed by one-half day (60%).
- Fifty-five percent of respondents in the pre-K-12th grade school system selected full-day programs as the preferred length of professional development, followed closely by one-half day (47%). Only 21% preferred a weeklong program.
- Most respondents preferred programs in winter (39%), had no preference (37%), or preferred summer programs (33%).

Although respondents in the EETAP reported a preference for shorter professional development experiences, the findings of several studies suggest that duration (both in

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terms of time span and total number of contact hours) of professional development experiences greatly influences effective development of teacher knowledge and skills (Frechtling and Katzenmeyer 2001; Garet et al. 2001; Supovitz and Turner 2000; Banilower, Heck, and Weiss 2007). The direction of influence is such that longer programs and more contact hours produce more lasting results.

**Design of Professional Development**

In the EETAP study, most educators opted for professional development that includes a hands-on or experiential component (94%), particularly when combined with face-to-face options (64%), while 22% and 28% reported they would like to have professional development that included online, lecture, and self-directed components.

**Environmental Literacy**

EE encompasses a wide range of goals and definitions. According to NAAEE, the ultimate goal of EE is the development of environmentally literate citizens who understand environmental issues and how human decisions impact environmental quality. Those citizens use this knowledge to make well-thought-out choices that also take into account social and political considerations.

To implement EE programs successfully and guide learners toward environmental literacy, environmental educators must possess a combination of knowledge and abilities (NAAEE 2004). An emerging framework for environmental literacy includes the following learner attributes and outcomes (Disinger and Roth 1992; Marcinkowski 2003; Roth 1992; Simmons 1995; Volk and McBeth 1997):

- **Ecological knowledge** refers to the knowledge of major ecological concepts and knowledge and understanding of how natural systems work and interface with social systems.
- **Socio-political knowledge** includes an understanding of the relationship between beliefs, political systems, and environmental values of various cultures, and how human cultural activities (for example, religious, economic, political, and social, among others) affect the environment from an ecological perspective. It also involves knowledge related to citizen participation in resolving issues.
- **Knowledge of environmental problems/issues** includes an understanding of environmental problems and issues caused by human-environment interactions. Knowledge related to alternative solutions to issues is also included within this category.
Affect refers to factors within individuals that allow them to reflect on environmental problems and issues at the interpersonal level and to act on them if they judge the issue or problem warrants action.

Cognitive skills are those abilities required to analyze, synthesize, and evaluate information about environmental problem and issues and to evaluate a select problem or issue on the basis of evidence and personal values. Abilities necessary for selecting appropriate action strategies and for developing, implementing, and evaluating action plans are also important.

Additional determinants of environmentally responsible behavior include perceived ability to influence outcomes or events (locus of control) and the assumption of personal responsibility.

Environmentally responsible behaviors include active and well-thought-out participation aimed at addressing problems and resolving issues.

High-Quality Teacher Training for Environmental Educators

Quality EE professional development programs should equip teachers with the knowledge and skills they need to implement EE into their classrooms and develop environmentally literature students (Shepardson et al. 2002). NatureBridge’s major teacher training program involves an extended residential EE experience, which takes place in a national park setting. This section provides an overview of characteristics of effective EE professional development, as well as those specifically related to this model of EE, often called place-based or environment-based.

As with science teacher training, there is a scarcity of empirical evidence in the literature on the effectiveness of residential EE and professional development experiences on teacher knowledge and practice, and student outcomes. Various small-scale studies have looked at teachers’ motivations for participating in residential EE programs (e.g., see Smith-Sebasto 2007; Simmons 1988); effects of EE professional development on teachers’ environmental knowledge and attitudes (e.g., see Shepardson et al. 2002), and influences on teachers’ implementation and perceptions of an EE model (e.g., see Paul and Volk 2002). Other scholars have examined findings on the research, practice, and theory of environmental learning in general (e.g., see Meyers 2006; Rickinson 2001).

Based on a review of the literature, recommended approaches to professional development include the following:

Constructivist Learning: Semi-structured learning experiences—such as inquiry-based or guided inquiry (e.g., through participatory research, action research, critical reflection, or issue investigation)—that engage learners in the process of building knowledge and skills through research that is meaningful to them (Meyers 2006; NAAEE 2004).
Focus on Interdisciplinary Content Knowledge, Attitudes, and Action Competence Skills: Emphasis on ecological knowledge (ecosystem fragility, how ecosystems meet human needs, human impact on ecosystems); understandings of sociopolitical systems that affect human beliefs and actions toward the environment; the development of skills (critical thinking and problem solving skills) and dispositions for engaging these systems (Hungerford and Volk 1990; Meyers 2006); opportunities for developing environmental sensitivity (Ernst 2009); and “consideration of the environmental in its totality” (Ernst 2009, 72).

Place/Environment-Based: Comprehensive use of the environment as an integrating context across disciplines with an emphasis on local or community-based environmental issues (Ernst 2009; Powers 2004). Other features include focus on issue and action skill development (Powers 2004); use of external expertise and community-based experts (Bouillion and Gomez 2001; Niesenbaum and Gorka 2001); built-in time for reflection on learning (Clark 1994; Meichtry 1998; Rhoton et al. 1999); experiential learning (Chawla, 1998, 1999; Meichtry and Smith 2007); and sustained support for participants (AAAS 1998; NRC 1996; Powers 2004; Rhoton et al. 1999; Ernst 2009).

Modeling of EE Teaching Practice: Model sound environmental education approaches (pedagogical content knowledge) that support teaching practice (Shepardson et al. 2002; Meichtry and Smith 2007), including a balanced approach to instruction (NAAEE 2004), use of interdisciplinary, project- or issue-based pedagogy (Ernst 2009, Ernst and Monroe 2004; National Environmental Education and Training Foundation 2002), and environmental research techniques (Shepardson et al. 2002).

Coherence: Closely linked to classroom teaching, state standards, and school curriculum in teachers’ local school settings (Meichtry and Smith 2007; Shepardson et al. 2002).

Duration: Duration of training experiences, in terms of both length and quantity of contact hours, and including follow-up (Meichtry and Smith 2007; Paul and Volk 2002).

Support: Administrative support during and following EE professional development to ensure effective EE implementation in the classroom (Paul and Volk 2002)—for example, site visits by trainers, communication network of trainers/participants, time to plan (and reflect) on curricula, availability of equipment and materials, and so on.

Assessment and Evaluation: Assessment built into instruction (e.g., clear objectives set, performance-based assessments implemented, learners’ baseline knowledge and skills assessed, and formative and summative tools developed) and program evaluation plans developed and carried out (NAAEE 2004).
Theoretical Perspectives

General Learning Theory

Learning theory attempts to explain how people learn and come to know across settings and through time. Understanding how people learn is critical when thinking about the purpose and design of learning activities such as teacher training programs.

Learning theories are not necessarily the same as teaching theories, although learning theories offer implications for how to teach and design learning environments. The learning theory perspectives described in Table 1 are broadly defined and based predominantly on a categorization provided by Greeno, Collins, and Resnick (1996). This categorization is based on general trends in educational and psychological research and an evolving understanding of how learning takes place. In addition, while these perspectives are based in different views of knowledge, they are also complementary.

When designing any learning experience (for students or for teachers) it is important to start by asking: How do we, as educators, think about how people learn? (Or what theory/theories of learning do we, as educators, espouse?) What goals do we have for learning? Examples of learning goals may include behavioral objectives, content goals, process goals, attitude goals, or community goals. Activities should then match these learning goals. The learning experience also needs to be designed so that it captures evidence that these goals are met, which may be accomplished through formative and summative assessments. (See Section 6 for recommendations on evaluation.)


Behaviorism

In designing learning environments:
- Create routine activity for effective transmission of knowledge
- Provide clear goals, feedback, and reinforcement
- Use technologies that support individualized training and practice sequences

In designing curricula:
- Create a sequence of instruction that proceeds from simpler components to more complex components

Constructivism

In designing learning environments:
- Create interactive environments for construction of understanding
- Engage learners’ interest, prior knowledge, and general reasoning skills
In formulating curricula:
- Create a sequence of learning activities that proceed from problems that are within learners’ reasoning abilities and prior understandings to problems that extend learners’ capabilities and prior understandings. Focus on conceptual growth.

Sociocultural

In designing learning environments:
- Foster environments that allow for participation in social activities of inquiry and learning and that support development of learners’ identities as capable and confident learners.
- Create learning environments that complement and reinforce differences in social interactions and expertise of students of differing cultural backgrounds.

In designing curricula:
- Foster development of discipline-based talk and representation with learning activities that attend to learners’ development of reasoning, cooperation, communication, and subject-matter understanding.
- Create learning activities that focus on problematic situations that are meaningful to learners’ everyday experiences and in which subject matter concepts are embedded.
- Create collective problem-solving opportunities.

Table 1: Main Perspectives in Learning Theory

<table>
<thead>
<tr>
<th>Behaviorism</th>
<th>Cognitive Theory (Constructivism)</th>
<th>Sociocultural Theory (Situlative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Learning occurs through reinforcement</td>
<td>➢ Learning occurs by connecting information and concepts</td>
<td>➢ Learning occurs through people participating in activity</td>
</tr>
<tr>
<td>➢ Learning is acquisition of skills</td>
<td>➢ Learning is a constructive process</td>
<td>➢ Learning is a social process</td>
</tr>
<tr>
<td>➢ Learning is based on observable behavior</td>
<td>➢ Learning takes place in mind of learner</td>
<td>➢ Learning happens in context</td>
</tr>
<tr>
<td>➢ Learner receives information</td>
<td>➢ Learner builds cognitive understandings</td>
<td>➢ Cognition not universally similar, but shaped by culture, identity, social context</td>
</tr>
<tr>
<td>➢ Knowledge is transmitted to the learner</td>
<td>➢ Knowledge is constructed by the learner</td>
<td>➢ Knowledge is constructed in social practices</td>
</tr>
<tr>
<td>➢ Motivation focuses on rewards</td>
<td>➢ Motivation focuses on learner’s interest</td>
<td>➢ Motivation focuses on learner’s engagement with goals of the community</td>
</tr>
<tr>
<td>➢ Teacher shapes learning and behavior</td>
<td>➢ Curriculum as spiral, where learner revisits concepts in increasing more complexity</td>
<td>➢ Curriculum as sequenced, interdependent apprenticeship and guided social opportunities</td>
</tr>
<tr>
<td>➢ Curriculum as linear progression of facts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Idea: Behaving
Key Idea: Thinking
Key Idea: Interacting in Context

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*Table developed by Brad Olsen (2005, University of California, Santa Cruz; rights reserved) and adapted using Greeno, J. G., A. M. Collins, and L. B. Resnick. 1996. Cognition and learning: Handbook of Educational Psychology: 15-46.*
Learning in Informal Environments

In addition to general theories of learning that can be applied to understand how learning takes place in any setting, there are theories that focus specifically on learning in informal environments. These theories draw on general learning theories. The Contextual Model of Learning is especially relevant to NatureBridge’s efforts to ensure high-quality teacher training experiences, which take place in informal settings.

Contextual Model of Learning

Based on an extensive review of the literature, Falk and Dierking (2000, 135-148) proposed the Contextual Model of Learning, which includes eight key suites of factors they considered fundamental to informal or free-choice learning experiences. This model provides a framework for thinking about how learning might occur for participants in teacher training programs, and how to understand and influence learning in this setting.

Personal Context

1. Motivation and expectations: Attracting and reinforcing intrinsically motivated individuals offers the greatest chance for successful learning.
2. Prior knowledge, interest, and beliefs: Learning is highly personal and learners’ prior knowledge, interest, and beliefs affect the meaningfulness of a learning experience.
3. Choice and control: The most effective learning occurs when individuals feel they control their own learning and can exercise choice over what they learn and when.

Sociocultural Context

4. Within-group sociocultural mediation: Teachers usually participate in professional development with other teachers, thereby forming communities of learners that use each other as vehicles for making sense of information, reinforcing shared beliefs, and making meaning.
5. Facilitated mediation by others: Mediated learning also occurs through others perceived as “experts,” for example, skilled program staff, such as practicing scientists and environmental educators, can significantly facilitate learning.

Physical Context

6. Advance organizers and orientation: People learn better and construct meaning from experiences when they feel oriented, know what is expected of them, and are provided with “conceptual advance organizers”.
7. Design: Learning is influenced by design. The natural environment is arguably one of the best designed education mediums for facilitating concrete understanding of scientific phenomena and ecology.
8. Reinforcing events and experiences outside the informal setting: People learn over time, from many sources in many different ways. Knowledge and experience
gained from a science teacher training institute, for example, is incomplete and requires “enabling contexts”—for example, within the school/district context (and can occur at any time after the initial learning takes place)—to become whole. These reinforcing events and experiences occur away from the residential program but are just as critical to learning, and illustrate the continuous and seamless nature of learning.

Motivating Behavior: Theories from Behavioral Science

Theories about how to motivate and sustain pro-social behaviors—and in the case of NatureBridge, environmentally friendly behaviors—can inform the development and delivery of programs that aim to foster stewardship. The abundance of competing theories and models of behavior change exemplifies the fact that no one model or theory of human behavior fits or explains all environmental action. A myriad of factors are at play in an individual’s behavioral choices, such as identity, knowledge, attitudes, values, skills, resolve, and sociocultural context, among others; therefore changing behavior requires tailoring programs to the audience, context, and desired actions (Ardoin et al. forthcoming). With this in mind, this section briefly describes three behavioral theories applicable to NatureBridge programming goals: (1) The Theory of Reasoned Action, (2) Social Learning/Cognitive Theory, and (3) the Responsible Environmental Behavior Model.

**Theory of Reasoned Action**

The theory of reasoned action, developed by Ajzen and Fishbein (1980), is one of the most frequently cited and used theories in natural resource management, including environmental education. According to the theory, individual performance of a given behavior is determined mainly by a person’s intention to perform the behavior. This intention is determined by: (1) the individual’s attitude toward a behavior, and (2) the influence of the individual’s social environment or the subjective norm. A person’s attitude consists of beliefs about the outcomes of the behavior, and the value of these outcomes. If an individual perceives an outcome as beneficial, this may lead to intent to act or actual adoption of a particular behavior. An individual’s attitude toward a behavior is influenced by the concept of the subjective norm, i.e., perceptions about what others around them believe the person should do, as well as the person’s motivations to comply with others’ opinions.

**Social Learning/Cognitive Theory**

Bandura’s Social Learning Theory (2001), later renamed Social Cognitive Theory, proposes that behavior is affected by environmental influences, personal factors, and attributes of the behavior itself. A central tenet of Social Cognitive Theory is the concept
of self-efficacy, i.e., a person’s belief in his or her ability to perform the behavior. A person must also perceive an incentive to perform a given behavior (i.e., the perceived benefits from performing the behavior must outweigh the drawbacks) and value the perceived outcomes or consequences of that behavior.

The theory emphasizes that people learn from one another—through observing others’ behavior, attitudes, and outcomes of those behaviors, as well as imitation and modeling. The emphasis on the importance of learning from others makes this theory particularly relevant to group learning environments and when contemplating collective action. Cherry (n.d.) notes that the following steps are involved in the observational learning and modeling process:

- **Attention:** In order to learn, learners must pay attention, which is more likely to occur when the model is interesting or there is a novel aspect to the situation.
- **Retention:** The ability to store and retrieve information later is another important part of the observational learning process.
- **Reproduction:** Practice (“reproduction”) of the learned behavior results in improvement and skill advancement.
- **Motivation:** For observational learning to be successful, learners must be motivated to imitate the modeled behavior. Depending on the situation, positive reinforcement (such as rewards) and negative reinforcement (such as punishment) may be effective motivators, whether a learner experiences them personally or observes another individual experiencing some type of positive or negative reinforcement.

**Model of Responsible Environmental Behavior**

Hines et al. (1987) first proposed the model of Responsible Environmental Behavior, which included the variables (from strongest to weakest level of influence) of intention, locus of control, attitudes, personal responsibility, and knowledge. Hungerford and Volk (1990) built on the initial model using research on predictor variables in formal education settings. Their model identifies three corresponding categories of variables that contribute to behavior: entry level, ownership, and empowerment variables.

Entry level variables—sensitivity, ecological knowledge, androgyny, and attitudes—are prerequisite variables for action. Environmental sensitivity is the major variable in this category, which is defined as “an empathetic perspective toward the environment” (McDuff et al. 2006, 65).

Ownership variables are environmental issues that are important at a personal level or impact individuals directly, such as a local issue in the community. The two strongest
variables in this category are in-depth knowledge of the issues and personal investment. Minor variables include knowledge of consequences and commitment.

Empowerment variables strengthen individuals’ perceptions that they can solve environmental problems. Knowledge and skill in using environmental action strategies is the best predictor of pro-environmental behavior because it builds self-efficacy to tackle environmental problems. Locus of control refers to a person’s perceived ability to influence events. Intention to act is also related to empowerment: If an individual has the intent to take action, the chances of that action occurring are greater.

Theory into Practice

The following section links specific aspects of NatureBridge’s Core Education Framework (Appendix A)—namely the core themes of sense of place, interconnections, and stewardship—to pertinent learning theories and approaches as well as behavior change theory. A brief discussion of the goals and use of multicultural education in environmental education is also presented to support NatureBridge’s goal of increasing access and opportunities for participation by more students from more diverse communities in its programs.

Place-Based Learning

The Rural School and Community Trust defines place-based learning as follows:

‘‘Place-based’’ education is learning that is rooted in what is local—the unique history, environment, culture, economy, literature, and art of a particular place. The community provides the context for learning, student work focuses on community needs and interests, and community members serve as resources and partners in teaching and learning. We have discovered that this local focus has the power to engage students academically, pairing real-world relevance with intellectual rigor, while promoting genuine citizenship and preparing people to respect and live well in any community they choose (Colchado et al. 2003).

The process of place-based learning connects “learners and their teachers through direct experience, reflection, and action to the geographically specific cultural and ecological dimensions of community life” (Gruenwald 2005, 263). Education grounded in the local community helps learners see the direct relevance of what they are learning which can lead to greater engagement in the learning process (Powers 2004). Learning becomes meaningful as learners focus on real-world issues related to environmental and human systems that directly impact learners and other community members (Meichtry and Smith 2007).
The practices and purposes of place-conscious education can be linked to different approaches including experiential learning, reflective learning, problem-based learning, contextual learning, constructivism, and “other approaches that are concerned with the context and the value of learning from and nurturing specific places, communities, or regions” (Gruenwald 2008, 309). Although place-based education may take many different forms, (Smith 2002) identifies several core characteristics:

- Use of surrounding environment as the base for curriculum development
- Learning experiences that allow learners to become knowledge creators and not simply consumers of knowledge created by others
- Questions and concerns of learners play a key role in determining what is studied
- Teacher as co-learners, guides, and “brokers” of community resources and learning possibilities
- Increased community and school interaction
- Assessment based on learners’ contributions to community well-being and sustainability.

Tenets of place-based learning—e.g. experiential learning, reflective learning, use of local settings and community experts, and ongoing support for participants—can be used to develop effective teacher professional development programs (Meichtry and Smith 2007). To increase the likelihood that teachers will implement place-based education approaches in their classroom, Meichtry and Smith (2007) also recommend that place-based education programs be targeted to teachers:

- Develop clearly stated objectives linked to the standards that teachers must fulfill
- Conduct program evaluations directly aligned to program objectives
- Link program learning to classroom teaching, state standards, and school curriculum
- Connect program requirements to teacher practice by requiring curriculum units to be developed by teachers for classroom use
- Model effective teaching strategies for use with K–12 learners
- Ensure relevancy by using local environmental experts and investigation protocols and equipment used by the state or local government and citizen groups
- Conduct training programs that are sustained over time
Multicultural Education and Environmental Education

Nordström (2008, 140) posits that “students must develop attitudes, skills, and behaviors that are both environmentally and culturally sustainable” in order to “become knowledgeable, caring and active global citizens in the twenty-first century” (2008, 140). Research highlights that students often have a “fragmented view of the world” (Nordström 2008, 141) and that there is a need to strengthen the connections among people, society, and environment (Nordström 2008; Payne 1998; Fien 2002). To this end, Nordström (2008) outlined shared characteristics of environmental education and multicultural education. These characteristics provide a useful foundation for thinking about the complementary relationship between environmental education and multicultural education. The highlighted characteristics include: (1) Treasuring Diversity; (2) Sense of Belonging; (3) Respect and Compassion; (4) Justice and Equality; (5) Empowerment and Active Citizenship; (6) Societal Reform; and (7) Global Perspective.

NatureBridge currently has guidelines for multicultural environmental education (MCEE), which include these four main points:

- MCEE encourages us to examine our personal lens for viewing the world.
- MCEE employs curriculum and teaching strategies that reflect the diverse experiences of our students.
- MCEE strives to build and sustain respect in diverse student communities.
- MCEE is committed to social justice and action through student involvement.

These guidelines cover a broad range of important aspects of multicultural education and should continue to direct NatureBridge’s programs. The challenge is to ensure that each of these guidelines is actually met on a daily basis and throughout the organization. Proponents of multicultural education and anti-racist education suggest that the process is not usually easy, simple, or comfortable, especially as people start to examine their own lives, privileges, and prejudices (Tatum 1997). In addition, the attempt by many educators to be “colorblind” actually hinders rather than promotes multicultural education (Delphit 1990).

At the core of multicultural education is the acknowledgement that people are members of diverse and multiple cultural communities that are situated in different social histories (Gutiérrez and Rogoff 2003). Cultural diversity represents more than just ethnic diversity; it also includes economics, gender, level of education, religion, and age. Multicultural environmental education needs to support all the dimensions of culture (Marouli 2002).

Multicultural Pedagogy

Culturally relevant pedagogy is a teaching framework that embraces and sustains cultural diversity. Culturally relevant pedagogy posits that educational practices need to help
students to “accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate” (Ladson-Billings 1995, 469).

In her study of successful teachers of low-income African-American youth, Ladson-Billings (1995) found that the teachers all possessed the following qualities (478).

**In terms of conceptions of themselves and others:**
- Believed that all the students were capable of academic success
- Saw their pedagogy as art—unpredictable, always in the process of becoming
- Saw themselves as members of the community
- Saw teaching as a way to give back to the community
- Believed in a Freirean notion of “teaching as mining” (1974, 76) or pulling knowledge out

**In terms of social relations:**
- Maintained fluid student-teacher relationships
- Demonstrated a connectedness with all of the students
- Developed a community of learners
- Encouraged students to learn collaboratively and be responsible for another

**In terms of conceptions of knowledge:**
- Knowledge is not static; it is shared, recycled, and constructed
- Knowledge must be viewed critically
- Teachers must be passionate about knowledge and learning
- Teachers must scaffold, or build bridges, to facilitate learning
- Assessment must be multifaceted, incorporating multiple forms of excellence

While Ladson-Billing’s study was conducted with classroom teachers, the pedagogical practices for multicultural education are applicable to all teaching settings, and are essential to multicultural environmental education. In addition, since multicultural environmental education upholds respect for all cultural groups, it is important for all students, whether they are from marginalized or dominant groups (Marouli 2002).

**Theory to Practice: Principles of Multicultural Education at Work in NatureBridge**

Based on the principles of multicultural education, as well as NatureBridge’s commitment to becoming a more culturally inclusive organization, several critical questions must be asked organizationally before multicultural education can be truly integrated either into teacher training programs specifically or NatureBridge’s work more broadly. Key questions include:

- What steps can all NatureBridge employees take to examine their personal lens of viewing the world and their experiences of privilege or oppression?

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7 Ladson-Billings is Professor of Curriculum and Instruction at University of Wisconsin-Madison. She is one of the leading scholars in culturally relevant pedagogy and critical race theory in education.

NatureBridge Teacher Training Program: Evaluation Report
- What resources or external support can be drawn upon for facilitating purposeful discussions within the organization?
- What steps ensure that teachers and students’ experiences and prior knowledge are incorporated into the learning process?
- What steps ensure that curriculum and teaching strategies are culturally relevant, but not culturally stereotypical?
- What steps ensure that positive connections exist with community organizations, schools, and families?
- How does NatureBridge define social justice for its programs and enact it within the organization? How do its educational programs attend explicitly to environmental racism and environmental inequities?

Another crucial element of moving toward a more authentic enactment of multicultural education is to continue to recognize and change deficit models of thinking about student learning. Instead of seeing students as lacking resources, such as if they come from an impoverished community or they are limited in English language proficiency, highlight and build upon the resources (everyday knowledge, skills, cultural practices, and language) that students do bring to the environmental education program or classroom (Moll et al. 1994; Banks et al. 2007). For example, if a student’s family has a garden plot at their home, the student’s knowledge or experience with the garden can become a resource for students’ understanding of botany, interconnections, or ecology.

It is also important to emphasize that cultural differences in learning are not static “learning styles” associated with any one cultural group or individual (Gutiérrez and Rogoff 2003). Gutiérrez and Rogoff (2003) make the case that thinking of learning as “styles” can sometimes lead to generalizations about cultural groups and to the assumption that “styles” are traits that are constant over time, which does not account for change or variety in the individual or learning setting. In addition, they assert that the association of “learning styles” to particular ethnic or cultural groups also assumes that there is a single, prescriptive way of teaching. The focus, instead, should be on how student learning is derived, in part, by how students participate in important activities of their cultural communities. It is critical to know and understand students’ involvement in various cultural activities and history of a community (Gutiérrez and Rogoff 2003).

Cultural observations of students should be grounded in the history and ongoing change of communities (Gutiérrez and Rogoff 2003). The use of narrative descriptors of students’ backgrounds (for example, working class, of Mexican-descent, Jewish, agricultural) is often more accurate than broad categorization of students, such as “students of color” or “underresourced” (Gutiérrez and Rogoff 2003).
NatureBridge could make significant strides toward culturally inclusive and multicultural education by, first, developing resources for English Learners instruction and environmental education and, second, sharing those resources with teachers and providing complementary training.

**Landscape of Teacher Trainings and Experiences**

**Market Scan of Teacher Training Programs in San Francisco Bay Area**

**Data Collection**

We contacted ten informal science institutions in the San Francisco Bay Area that provided teacher professional development in environmental education and/or science inquiry. In regards to our inquiry, we conducted telephone interviews with program directors at five institutions, received email responses from two, and received no response from three. We collected information additionally from programs’ websites. Data collection focused on the following topics.

1. Focus (environmental education, science inquiry)
2. Goals or Objectives
3. Partnerships
4. Length
5. Fee
6. Stipend or Other Incentives
7. Funding Type (foundation, government, and/or in-house)
8. Marketing Type (internet, school visits, flyers)
9. Teacher Materials
10. Continuing Education Credits
11. Number of Teachers Served
12. Grade Level of Teachers
13. Standards Focus
14. Multicultural Education Focus
15. Cross-subject Integration

**Key Findings**

The following section summarizes key points from the Bay Area scan.

**Length**

The teacher training programs vary in length from three days to two years. About half of the programs are similar in length to the SEED program. Some of the institutions also
offer half-day or one-day teacher trainings, in addition to week-long teacher institutes. Two of the institutions offered residential programs.

**Fee or Stipend**

Most of the programs are free and include a stipend for participating teachers. One of the programs requests a small upfront fee but then refunds the fee, plus an additional stipend, at the end of the program. Stipends vary widely. Another program offers a stipend to teachers who come from schools with 50% or more underserved students. One program had difficulty recruiting a sufficient number of teachers until they offered a stipend.

**Funding Type**

Program funding varies widely from external grants to internal funding. Some of the teacher training directors reported that funding varies from year to year based on where they can obtain grants.

**Marketing Type**

The institutions advertise through similar means: direct mailings to teachers and principals, email blasts, online applications, teacher listservs and at conferences. One institution reported that they had success with organizing meetings with principals to increase attendance from culturally and ethnically diverse schools. Two institutions noted that it was sometimes challenging for teachers from low-performing schools or underserved communities to gain support for attending the program from principals because of the need to focus on testing and standards.

**Resources for Teachers**

All of the programs provide resources and materials, such as curricula, to their participants. One organization reported that they provide a resource list of other people or organizations, such as Master Gardeners, which may be helpful to teachers who conduct environmental projects with their students. Two of the institutions also loan out specialized equipment, such as GPS units, to teachers during the school year.

**Teachers Served**

The majority of the teacher training programs average between 20 and 30 teachers per program cohort. Several of the institutions had waitlists for their programs. Another institution reported that their new residential program for a national audience had a large number of applicants (100 applicants for 30 spaces) although the cohort size for their local teacher trainings has been dwindling. Several program directors postulated that this may be because of saturation of the market at the local level. Three of the programs enroll teachers at both the local and national level, with only one program covering the
costs of lodging. The majority of the programs are targeted to school teachers, but some of the programs also accept informal educators or student teachers.

**Teacher Grade Level**

The programs vary in terms of the grade levels for participating teachers. Some of the institutions offer different content for teachers at different grade levels. One program that focuses on conservation reported that they offer programming on a diversity of topics and a range of skills that are developmentally appropriate.

**Standards**

All the programs indicate that they focus on standards, with some programs being more directly aligned than others. One program found that focusing on one standard deeply was more effective than focusing on several standards.

**Multicultural Education**

Programs have different approaches to multicultural science education. While all of the programs expressed desire and intention to serve ethnically and culturally diverse clients, some still serve predominantly Caucasian teachers. One director surmised that more culturally diverse communities often have lower-resourced and lower performing schools, and the teachers at these schools have mandated professional development programs in mathematics and language. Two directors reported encouraging teachers to learn from each other and to share their stories during the program. Several programs offered instructional techniques for teaching English language learners.

One organization reported that they specifically discuss environmental justice in their teacher and student programs and they place high value on diversity, which is reflected in their staff as well as their curricula. Additionally, they provide a multi-day professional development workshop for its staff on the topic of diversity and multicultural education.

**Cross-subject Integration**

Most of the programs that serve elementary school teachers provide some cross-subject integration in their curriculum. One institution that serves both elementary and high school teachers reported that elementary school teachers wanted cross-subject integration, while the high school teachers wanted to focus predominantly on the sciences.

**Other Salient Findings**

**Teacher Teams**

Several of the programs reported that they encourage teachers to apply to their training programs as a team, and one institution reported that giving preference in the application process to teams of teachers. Institutions found that teachers were more likely to teach the
curriculum in their classrooms and conduct project-based environmental education if they had support from other teachers in their schools.

**Science Inquiry**

Programs vary in their approach to inquiry. Some programs focus more on teacher-guided inquiry while other programs focus more on student-generated inquiry. One organization offers a one-day workshop that differentiates types of “hands-on” teaching and helps teachers become more aware of their pedagogy and how to match different “hands-on” approaches to learning goals. The curriculum for this workshop is free and available online.

**Technology**

Two of the institutions reported that they were attempting to add more technology into their teacher training and student programs. One institution reported using mobile technologies, such as cell phones with GPS ability for data collection purposes, although the teachers required a lot of support in order to be able to use the technologies in their classrooms.

**Teacher Preparation for Teacher Training Program**

One of the organizations requires that teachers do assignments before attending the training institute. The assignments help prepare teachers for a “team project” that they conduct during the program.

**Survey of Bay Area Educators**

**Methods**

A combination of approaches producing quantitative and qualitative data were used to evaluate the teacher training program offered by NatureBridge and to gather information on professional development experiences in science and environmental education among Bay Area educators. This study employed two principal methods: (1) semi-structured interviews, and (2) an online survey. The combination of methods helped ensure that data were collected from a diversity of respondents working in a range of positions in the education field.

The online survey consisted of 57 questions with close-ended items that elicited educators’ views and feelings about environmental education; their motivations; opportunities and constraints related to attending professional development workshops; and their teaching background. Several of these questions also included space for open-ended responses to allow for further elaboration.
The survey instrument was pretested iteratively with NatureBridge staff, members of the evaluation team, and several colleagues to ensure clarity and flow and also to confirm timing. Based on feedback, changes were made to the survey and it was shortened so that the average completion time did not exceed 20 minutes.

Targeting a population sample of K-12 Bay Area educators, the survey was distributed to approximately 500 individuals through e-mail, with a 20% response rate. The recruitment list mainly included educators who had some previous contact with NatureBridge through e-mail, direct mail, attendance at a NatureBridge program, or other personal contact such as an interaction with NatureBridge staff at a conference or environmental education fair. In addition, the list included several educators who had no previous contact with NatureBridge in order to understand how the organization might reach a more expanded and diverse audience.

The survey was open for a period of 40 days and administered using the online survey tool SurveyMonkey. Of the 99 individuals who clicked on the survey link, 98 continued past the first question (“Do you agree to participate in this survey?”) and 78 individuals for a completion rate of 78.8%. (See Appendix C for a copy of the survey instrument.)

Following an initial review of the survey data, we interviewed several education professionals to provide additional qualitative data. We conducted semi-structured telephone interviews with people who had specific roles in education, including: an early career teacher, a mid-career teacher, and a retired teacher; a former principal; a district supervisor; a science teacher; and an art teacher. The interviewees represented public school, private school, and charter school backgrounds. Understanding thoughts on environmental education from these diverse individuals seemed especially critical when contemplating how to improve the effectiveness of teacher training strategies in science and environmental education, and how to help NatureBridge reach a broader diversity of educators.

We pretested the interview questions to ensure flow, timing, and clarity of wording. We also were concerned with validity—in other words, ensuring that the series of questions addressed concepts of interest to this study. Lasting between 20 minutes and 1 hour, we conducted the interviews via telephone and we recorded notes immediately following each call. We analyzed the interviews thematically to identify key patterns and themes, similarities, differences, and emergent concepts to help illuminate answers to the research questions.
Participant Profiles

**Highlights**

- Total number of respondents: 99 (78.8% completion rate)
- 57 female; 21 male (21 declined to state)
- 88.7% of the survey respondents reported being Caucasian.
- The majority of the survey respondents (46.4%) were over the age of 40.
- 37% of the survey respondents had previously attended a teacher training workshop at the Headlands Institute; 63% had not.
- The most frequently cited grade taught was fifth, although the combined number of respondents that reported teaching high school represented the largest group.
- The highest number of respondents reported teaching science, although English, mathematics and social studies were also highly represented among respondents.
- In addition to teaching, most survey respondents were also involved in school committees and extra-curricular activities.
- On average, survey respondents had 14.2 years of teaching experience.

**Age, Gender, and Ethnicity of Participants**

Of the respondents (n=78) who reported their gender, 73.1% (n=57) stated their gender as female and 26.9% (n=21) as male. Of those who reported on ethnicity (n=72), 88.7% reported being Caucasian, with 11.3% reporting to be non-Caucasian or “other” (see Figure 1). The majority of the respondents who reported on age (n=74) were over age 40 (n=45), representing 46.4% of the respondents, followed by 20.6% of the respondents who reported being 30 to 39 years old (n=20) with the minority of 6.2% who reported being under age 30 (n=6).
Several people (n=74) reported teaching multiple grades, with the highest number reporting that they teach fifth grade (n=28), although most of the survey respondents overall reported being high school teachers (n=55) (see Figure 2.)

Sixty of the respondents (n=73) reported teaching science, with the remaining respondents (n=17) reporting that they taught English, mathematics, social studies, art, music, foreign language, and physical education, in addition to several categorized as “Other.” Among those who replied (n=74), the mean years of teaching experience was 14.2 years.
Figure 2: Grade Levels Taught

If you are a classroom teacher what age(s) do you teach?

Bar chart showing the percentage of teachers who teach at different grade levels:
- Pre-K: 5.4% (4)
- Kindergarten: 8.1% (6)
- 1st grade: 13.5% (14)
- 3rd grade: 14.9% (15)
- 4th grade: 37.5% (26)
- 5th grade: 28.4% (21)
- 6th grade: 20.3% (15)
- 7th grade: 17.6% (13)
- 8th grade: 18.0% (55)

Other: 18.0% (55)
Extracurricular Involvement

The survey respondents were a highly experienced group of educators with 73.4% of respondents (n=64) reporting involvement in a wide variety of committees at their schools including the school improvement committee, school leadership committee, a department committee, the Parent Teacher Association, the school site council leader, and teacher’s union representative, school sustainability committee, among other activities. In addition, 72.7% of the respondents (n=66) reported being involved in the following extracurricular activities: coaching a sport, leading an after-school club or student activity, organizing a faculty event, managing a fundraiser, and being part of a professional learning community, among other extracurricular activities.

Participation in NatureBridge Teacher Workshops

Out of the 96 people who took the survey, 37% (n=20) had attended a workshop at the Headlands Institute. Of those, 12.5% (n=12) had attended the five-day summer institute.
Key Findings: Program Ratings by Past Participants

Highlights

- Respondents gave high ratings to their experiences with NatureBridge teacher training programs. Specifically, they noted the program’s effectiveness in the following areas: **relevance and applicability of workshop material; personal satisfaction or relaxation; quality of workshop trainers; gaining new curriculum material; and networking.**

- The main recommended areas for improvement by past workshop attendees were: **more hands-on activities, more group activities, more interdisciplinary programs, offering more updated and online resources to previous participants, and more emphasis on high school students.**

Successes of Headlands Institute Program: Participant Ratings

Past attendees in the teacher training workshops at Headlands Institute rated their experience very highly. Overall, they felt supported by the organization and staff, felt that the lessons and skills offered by workshops were applicable to their teaching experience, and appreciated the networking opportunities they gained with other professionals and workshop leaders. Of people who responded “yes” when asked if they previously attended programs at the Headlands Institute (n=20), the majority of them found the programs to be a very positive experience. Most respondents reported that the programs were “very useful,” “fabulous,” “wonderful,” or “extremely useful.” Just three respondents said that the programs were “somewhat useful,” “moderate(ly) useful,” or “fairly useful.” The majority (n=13; 68.4%) of these respondents (n=19) found that the workshop material was relevant to their teaching experience and skills and that it “transferred well to their classroom.”

Qualitative data from interviews supported these findings. Attendees reported their perceptions in the following general areas: **relevance and applicability of workshop material, personal satisfaction or relaxation, quality of workshop trainers, gaining new curriculum material, and networking.**

Headlands Institute Program: Areas for Improvement

Those respondents who reported being past participants in programs at the Headlands Institute (n=20), suggested the following key areas for improvements:

- Offer more interdisciplinary programs, not just based on science.
- Include programs that are focused on high-school students.

NatureBridge Teacher Training Program: Evaluation Report
Host more trainings more often in more locations.
Help teachers develop lesson plans that meet curriculum standards.
Provide more hands-on activities.
Provide more group activities.
Offer more take-home tools and projects that could be replicated in the classroom.

Key Findings Relevant to Teacher Training Among Non-Participants

**Highlights**

- The majority of respondents attended more than two teacher training workshops per year and most had a great deal of choice in deciding which workshops to attend.
- Those who did not attend NatureBridge teacher trainings listed the following barriers: **scheduling, financial constraints, distance to the site of the workshop, and other obligations such as family.**
- The one-day workshop format was highly favored among survey respondents.
- Survey respondents and interviewees favored workshops on specific topics versus more general workshops.
- Survey respondents and interviewees recommended offering more lesson plans that meet curriculum standards.
- Survey respondents and interviewees supported hosting training workshops in locations other than the Marin Headlands, particularly in urban and alpine settings.
- Several recommendations were made for outreach to an expanded audience.

**Landscape of Teacher Training Offerings**

Although most of the teachers who took this survey did not attend workshops at the Headlands Institute, they did report having attended workshops elsewhere. Over a third of the total respondents (n=85) indicated that they attended training workshops more than twice a year, followed by 18.8% who indicated that they attended workshops twice a year and 22.4% who reported attending workshops once a year. Only 4.7% of the respondents to that question reported never attending teacher-training workshops. (See Figure 4.)

Most respondents indicated that they had a great deal of choice in determining which workshops they could attend. Almost 63% of the respondents that answered the question on choice reported that they had “complete choice” over the subject matter, and 33.3 percent of the respondents reported having “some choice,” leaving just 3.8% of the respondents who reported having “no choice at all.”
When asked to select “all of the subjects that have been the focus of prior workshops you have attended,” 80.5% of the survey respondents chose science. Language arts placed second at 39.7%; mathematics followed closely at 37%; followed by art and music at 17.8%. Individual responses also indicated that respondents had attended workshops in the following areas: Professional learning communities, classroom management, youth development, English language development, and culturally responsive teaching strategies, among others.

Teachers were also asked to respond to the question: “What have been the most useful and fulfilling aspects of past workshops you have attended?” The largest percentage (82.3%) reported a “renewal of enthusiasm,” followed closely by 81% who reported “increased content knowledge,” 78.5% who reported “new teaching skills learned,” and 59.5% who reported that they had gained “networking” opportunities.
Incentives for Workshop Participation

Survey respondents listed the following areas as factors or incentives that might prompt them to attend future teacher training workshops: financial support, curriculum development, continuing education credits, ongoing support from the Headlands Institute to implement curriculum after the training workshop, and developing an ongoing network with other educators. The majority of respondents listed some form of financial support as their top incentive, either through a stipend from their school or district, followed closely by the opportunity for curriculum development. (See Figure 6.)
Survey respondents (n=80) reported an interest in the following subject matter for future workshops. (See Figure 7.)

**Figure 6: Incentives for Participation**

What incentives might be important in encouraging you to attend a teacher training workshop (n=80)?

Survey respondents (n=80) reported an interest in the following subject matter for future workshops. (See Figure 7.)

**Figure 7: Preferences for Workshop Subject Matter**

Which of the following environmentally related topics would most interest you as the theme for a teacher-training workshop (N=77)?
Most respondents reported a preference for teaching approaches that are inquiry-based (85.7%) followed closely by problem-solving approaches (74%).

**Figure 8: Preferences for Education Methodologies**

![Preference Bar Chart]

**Delivery Preferences**

A number of the people we interviewed expressed interest in shorter one-day programs that were focused on a particular topic. In addition, the following factors influenced teachers’ decisions to attend training workshops:

**Workshop Duration and Timing:** The majority of the respondents said that they would not prefer a workshop that allowed them to return home at the end of the day. Most of the respondents (n=74), however, reported that they would prefer shorter workshop sessions (than the five-day session that is currently offered) and would choose one-day training programs (n=64). 31.1% of the respondents reported that they would prefer two workshop sessions per month. Similarly, 59.8% of the survey respondents (n=87) reported that one-day workshops would “best fit their schedule” with 37.9% choosing two-day workshops as their top choice, and 29.3% choosing three-day workshops. In the individual comments section, however, a number of respondents replied that they enjoyed the five-day training format. Qualitative data from interviews supported this notion. Most
respondents agreed that summer is the best season to offer teacher trainings. Of the summer months, the top choice (62.2%) was for workshops in July.

- **Workshop Location:** The majority of the survey respondents (n=87) said that they would prefer workshops in settings other than the Marin Headlands. Of those who answered yes to the question (n=43), 72.1 percent reported that “another setting would be more convenient”; 39.5 percent reported that “another setting would be more relevant to my school”; and 53.5 percent reported that “another setting would be less expensive in terms of transportation.” In the individual comments section, a number of people stated that the Marin Headlands Institute is too far from where they live and that closer to home locations would be “more green.” Another respondent wrote, “I would like to see more site specific choices that use the surrounding Bay Area as a place-based science exploration. For example, how (can I do) place based science in a park or a city?” Still, many survey respondents and interviewees expressed continued support for the Marin Headlands setting. As one respondent noted, “Part of the greatness of [Headlands] Institute is that the place makes it special and that encourages enthusiasm”.

- **Alternative Settings:** Offering programs in more urban, as well as more remote alpine environments, appealed to most survey respondents who thought that programs should be offered in locations other the Marin Headlands Institute. Additional suggestions from individual comments included programs based in Monterey, Big Sur, Point Lobos, Mendocino, Olympic National Park, Bear Valley (the Tamarack Lodge was cited as having space for large groups), Sacramento (including the American River Parkway System), the South Peninsula, Los Angeles, Henry Coe Park, Portola State Park, Big Basin, and Mount Diablo State Park.
Barriers to Participation in Teacher Training

Barriers to attending teacher training workshops included: lack of financial resources, lack of time, distance to workshop location, family obligations, and conflict with other training workshops or summer plans.

Lack of Compensation: Overall, survey respondents reported that compensation to attend teacher-training workshops is very limited or simply not available. (See Figure 10.) Only 14 or 17.3% of those who responded to the question on compensation (n=81), reported that their place of employment covered workshop fees and 39 people reported that they “sometimes” receive compensation. Several people commented that this opportunity had been hindered by recent budget constraints. Funding sources varied significantly among those respondents (n=43) who reported receiving funding and included some of the following sources: professional development budgets within a particular school or district, general district funds, the principal’s general account, grants, categorical funds, a parent guild or PTA, donor funding, and SIP or GATE funds. For the majority of respondents (73.4%), this compensation did not come in addition to their regular salary.
Interviewees also noted the need for more available funding:

- With the budget crunch, getting teachers to go is very difficult.
- Teachers are not paid enough to attend. A stipend is offered only if the district requires the training. If you attend a training for a pay raise you are on your own. It may take two to three years before you are able to bring in new income.

Lack of Time: Many respondents and interviewees also suggested that they did not have time to attend teacher training workshops. One interviewee from a charter school in Oakland spoke of the challenges involved for teachers at low-income schools, noting that time was an issue: I know none of teachers at my school have been able to sign up. We see great programs like this but then think when will we have time to do that?

Additional Factors Affecting Participation in Teacher Training

- Teaching Culture: Another teacher suggested that the culture of those who choose a career in teaching has changed, making the new generation of teachers less inclined to attend workshops: Teachers wanted to teach when I first taught. The great majority of them teach [today] because they get the summer off; they can leave at 3 pm and not work on weekends. If that doesn’t work they feel like they can get another job. At least in the pre-recession era that was the case. They felt they could go into high-tech. instead. Teachers today want nothing that infringes on their free time. Most contracts now state how long you need to be on campus. If it is not during “duty day” they will not do it.
Alignment with Standards: Another interviewee who is involved in the California Curriculum Commission stated: Teachers don’t want to learn new material in public school system unless they can use it, i.e., unless meets state standards.

Renewal of Credentials: In addition, according to one interviewee the requirement for renewing teaching credentials in the California public school system has changed. In the past you needed 120 hours of teaching credential training. They eliminated this [requirement] three years ago. Now you can go online to renew.

Enhancing Diversity

When asked how the Headlands Institute could better diversify its teacher training programs, many interviewees were tentative in their responses, acknowledging that this is a very challenging area, particularly for environmental education. “There is much more need for what Headlands offers in public schools,” one interviewee said. The following suggestions were offered:

- Get to principals of schools with underserved populations of students.
- Teachers, especially in low-income areas, are hard pressed to meet curriculum standards. Offer more programs that meet curriculum standards.
- Offering transportation to teachers who live far away will encourage them to attend.

Program Outreach

When respondents (n=96) were asked how familiar they are with Headlands Institute programs, the majority of them reported that they were “very familiar” (52.1 %) with the programs (see Figure 11).

Of the 32 people who reported reasons for not attending teacher-training sessions at the Headlands Institute, the top reasons for not attending were time, distance, and the cost of attending workshops, as well as scheduling, conflict with other professional development workshops, and family obligations.

A few respondents wrote, however, that they did not attend because “I teach English and history,” “the subject I teach is not related,” “(I) don’t need it,” “(I) didn’t find it necessary,” or “my core subjects are not science related.” This suggests that NatureBridge could better emphasize the interdisciplinary nature of the teacher training workshops they offer in their recruitment efforts.
In response to open-ended questions, interviewees had a number of suggestions for improving outreach about the teacher training programs NatureBridge offers:

- Getting e-mails and flyers and postings on bulletin boards in my opinion is not very effective unless a teacher is looking for something specific.
- The incentive for teachers at my school would be to hear from other teachers who have already attended. They need to know it is possible.
- Faculty meetings are an excellent time to promote programs. I think it would be great if the organization had a representative that did a slide show in staff meeting (lasting no longer than five to ten minutes).
- Have someone [from NatureBridge] come in and speak to classes that may be interested.
- Through osmosis: Put teachers in contact with those already inspired.
- Bring hands on activities.
- Lots of workshops come to schools. This could replace a staff meeting. Staff meetings often become combined with professional development.
- Bring in a brief video.
If they had more outreach to schools [that] may have never heard of program that would really help.

Offer teachers something. Go to the district office to get program(s) approved.

Provide lesson plans that go along with standards. They need to tell teachers they will have something to bring back to classroom.

E-mail is good as long as there is a visual that goes along with it. You have a great website.

Outlook/Perspectives on Environmental Education

A high percentage (87.2%) of the survey respondents (n=78) said that they incorporate environmental themes in their teaching. All of the survey respondents (n=76) reported that environmental education fits with science, however, when allowed to check several categories, the next largest group, or 60.5% of the respondents said that environmental education fits with History and Social Sciences, followed by Language Arts reported by 39.5% of respondents. A smaller, but still significant group of 25% said Environmental Education it fits with Art or Music. The interdisciplinary and widely applicable nature of environmental education was strongly supported by a number of the interviewees. As one educator stated, I infuse EE in everything I teach, [which includes] science and social studies.

Overall Recommendations

Based on our data, collected from a range of perspectives—including a national-level scan, Bay Area scan, and interviews and surveys with educators—we are pleased to offer the following recommendations for further consideration by NatureBridge directors and staff. Our recommendations focus on several key areas: theoretical underpinnings and program content; programmatic structure; follow-up and outreach; and evaluation.

Theoretical Underpinnings and Program Content

We recommend, first, that NatureBridge align its teacher-training curriculum with its newly adopted Core Educational Framework (CEF) (see Appendix A) and focus on the theory-to-practice link in professional development offerings. As described in both the “best practices” and theoretical review section of this report, initiatives structured on principles of social learning/cognitive theory, constructivism, and behavior theory will help lay the groundwork for achieving the desired outcomes indicated in the CEF.

Putting theory into practice will involve considering principles of place-based education and multicultural education, both of which exemplify the NatureBridge philosophy. Place-based education is applicable not only to NatureBridge campus settings, but also
provides useful guidance for learning in other locations such as urban parks or schoolyards. (See further consideration of other teacher-training locations under the “Programmatic Structure” section of the recommendations.)

Truly embracing principles of multicultural education would move NatureBridge along the continuum of being responsive to and relevant for diverse audiences, requiring reflexivity not only for the teacher-training initiatives but also on the part of entire organization. Building on the multicultural education literature, NatureBridge’s shift to a more culturally inclusive organization would include asking challenging questions and redesigning programs in ways that may initially be uncomfortable. (See section on “Principles of Multicultural Education at Work in NatureBridge” for detailed recommendations.)

Designing effective teacher training opportunities will rely on creating programming that emphasizes hands-on and experiential learning, with an eye toward building a sense of community and camaraderie among teachers. Moreover, in recognition of NatureBridge’s interest in and commitment to teachers from urban schools and students from underserved areas, the principles of multicultural education will be particularly important to employ, honoring the diversity of experience, interest, needs, and audience exemplified by teachers working in multicultural settings and with diverse learners.

To implement models of place-based and multicultural education, we encourage NatureBridge staff to carefully review each element of the current teacher training curricula through a process similar to the analysis of the M&M-ology lesson, provided in this report. Such an exercise, linking practice with the underlying theories and models, would help to ensure that the programs are based in sound pedagogy and consistent with best practices suggested by leading researchers.

**Programmatic Structure**

One of the most straightforward adaptations that could result in the substantial impacts on the teacher training efforts would be to revise the programmatic structure with regard to length and location. Teachers who have participated in the five-day, on-site (at Headlands) training institute report enjoying that format and location. Certainly, important benefits accrue from a lengthy program, which allows for in-depth engagement with content as well as skills-based curricula. Moreover, being on site in a beautiful location, separated from daily stress and distractions, allows teachers to focus on the tasks at hand.
However, data collected through surveys and interviews as well as the Bay Area and national-scale scan all suggest that the current format—five days, on-site at Headlands Institute in Marin County—may have an element of “preaching to the choir.” In other words, teachers who are attracted to such workshops likely are predisposed to enjoy such settings and may already have an interest and expertise in environmental education. To reach broader, more diverse audiences, we recommend offering alternative structures that would facilitate participation by more teachers, including those who may not have the means, flexible schedule, interest, or comfort level to spend five days at Headlands. Our study’s findings suggest that offering several different structures, varying in both length and location, would be well-received.

Additionally, survey and interview participants were less likely to indicate interest in general “environmental education” or “inquiry science” training and more interest in focused trainings that address specific “hot-button” topics, such as climate change, or demonstrate experiential activities using inner-city parks or schoolyards. Moreover, the scan of other Bay Area programs suggests that a number of other sites possess expertise in inquiry science and offer teacher trainings in that subject; therefore, pursuing a unique angle, such as inquiry science in a vacant lot or inquiry science to learn about urban water quality, may help NatureBridge differentiate its programming.

Finally, another aspect that appeared to be a barrier to participation in NatureBridge programs is financial. Based on our scan, it appears that a majority of programs offering environmental education or science-inquiry teacher training not only do not charge participants but they actually provide teachers with stipends to attend. NatureBridge might consider revising its price structure, particularly for teachers from underserved communities, to reduce this barrier.

In sum, offering a range of program lengths, from one-day non-residential to five-day residential, would attract a greater diversity of participants. Similarly, holding trainings in locations that are more convenient to urban areas would draw educators whose time or transportation options are constrained and would also offer creative opportunities for linking training with participants’ home environments. Additionally, offering targeted trainings on innovative pedagogies and teaching techniques as well as cutting-edge topics—particularly if the trainings are built on research and the CEF—would differentiate NatureBridge training from other Bay Area sites. And finally, reconsidering the pricing structure so that teachers actually receive a stipend for participation might quickly boost participant interest.
Program Outreach and Follow-up

Research suggests that the pre-program preparation and post-program follow-up elements of any learning experience, whether for youth or adults, are critical to developing and maintaining interest and knowledge as well as motivating and sustaining behavior change. Therefore, we strongly recommend extending the teacher training experience by, first, providing pre-training preparation and, second, maintaining post-program contact.

With regard to pre-training, this provides an opportunity for outreach to desired audiences who may not currently be connected with NatureBridge. In order to achieve its goal of serving teachers and students of all backgrounds, NatureBridge staff will need to actively pursue work with urban schools with diverse student bodies. This could be done perhaps by providing in-school trainings or “preview” workshops to pique the curiosity of teachers (potential training clients) and spur development of activities that are directly relevant to student participants’ home settings. Offering “Open House” nights not only for teachers but also principals and school administrators might help create more district-wide support for teachers to attend training sessions offered by NatureBridge.

Related to post-program follow-up, providing teachers with tried-and-true, step-by-step lesson plans; videos demonstrating high-quality science inquiry teaching; and moral support in the form of NatureBridge school liaisons would go a long way toward ensuring effective implementation of NatureBridge principles and curricula in classrooms. Other important opportunities to extend the learning could be leveraged through the creation of an alumni network of past participants; providing training participants with access to updated resources through the NatureBridge website; and offering special access to ongoing short courses (either in-person or web-based). These and other carefully designed activities would encourage maintenance of the spark ignited at the initial program.

Evaluation

Finally, ongoing evaluation is a critical component of adaptive management and continuous programmatic improvement. Our comparative scan—using both national and regional lenses—should provide a platform to develop a more structured, continuous evaluation process for assessing the short- and long-term impact of teacher training offerings. Not only will NatureBridge want to evaluate its efforts with teachers, but they also will want to look at the impact of teachers on students in classrooms.
To that end, we recommend development of a comprehensive evaluation system using multiple methods for collecting qualitative and quantitative data. And we also recommend tying any and all evaluation efforts of the SEED program with the broader Core Education Framework as well as the empowerment evaluation work being done at the Headlands campus. For example, we suggest that the evaluation be built on the outcomes of interest as articulated in the CEF: academic impact, interpersonal skills, scientific understanding and, unifying all of these, stewardship behaviors. Tracking these outcomes through teachers in the training programs and then looking at the impact of teachers on these students in these same areas would provide a sophisticated, holistic perspective on the success of the program. Doing so consistently and in a systematic manner would provide NatureBridge directors and staff members with a robust understanding of programmatic strengths, weaknesses, and opportunities for defining its unique niche in the Bay Area teacher training arena.

**Conclusion**

In summary, our programmatic scan and educator survey indicate that NatureBridge teacher training programs are already operating with a high level of success. Yet our national scan and review of learning theory also suggest that there is enormous potential for NatureBridge to expand and improve its existing programs, both at Headlands Institute as well as throughout the other NatureBridge sites.

Building on the recently approved Core Education Framework and designing programs based on “best practices” in teacher training, NatureBridge has an exciting opportunity to capitalize on its time-tested programming, unique locations in multiple national parks and recreation areas, and more than 30 years of experience with environmental education and inquiry-based science. NatureBridge’s commitment to building programming—for both teachers and students—on cutting-edge research and robust evaluation make its efforts outstanding among similar programs in the Bay Area as well as nationally. We recommend leveraging this research-based approach, the national parks location, and the extensive commitment and experience of NatureBridge staff to offer innovative teacher professional development that will help advance the field of environmental education in formal and informal settings for students from a range of backgrounds. These efforts have the potential to benefit both human communities and the natural world, now and for generations to come.
References


Appendix A: NatureBridge Core Educational Framework (Board-Approved Version, May 2010)

### Inputs
- Student Developmental Level
- Student Experiences: Social, Cultural, Economic, Outdoor, & Geographic
- Student Prior Knowledge & Curriculum Exposure
- NatureBridge Educators' Backgrounds, Demographics, Cultural Sensitivity
- Institute Capacities and Site Constraints
- Teacher's Background and Participation

### Program Design
- Crafted for each group
- Capitalizes on capacities of the particular natural setting of the campus
- Matches group "inputs" with "instructional methods" to tailor a meaningful educational experience for students
- Maintains high expectation for student performance

### Program Implementation
- **Themes**
  - Sense of Place
  - Stewardship
  - Inter-connections
- **Instructional Methods**
  - Inquiry science & place-based content in national parks
  - Active personal & social learning
  - Thematic teaching
  - Team building & learning through cooperative group work
  - Appropriate challenging physical activities
  - Giving responsibility to individuals & groups
  - Links field-based education to students' home community

### Outcomes
- Personal Growth
- Interpersonal Skills
- Responsible Environmental Behavior
- Academic Impact

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NatureBridge Teacher Training Program: Evaluation Report
Appendix B: Survey Instrument

Best Practices in Teacher Training in Environmental Education

Dear educator:

We invite you to participate in a study to explore the most effective ways to structure teacher training opportunities related to environmental education. This study is being conducted in collaboration with the Bay Area nonprofit organization NatureBridge, which runs the Headlands Institute in Marin County, as well as three other field-based environmental education institutes. The questions in the following survey will specifically focus on Headlands Institute, although we expect that the findings will apply more broadly.

Before you begin, there are a few important things we’d like you to know about the study:

1. Your participation consists of completing a survey that takes between 10 and 16 minutes to complete.

2. Although this study will not benefit you personally, the results will add to the knowledge about how best to provide high-quality, effective training in environmental education for classroom teachers.

3. All of your responses will be confidential. Only the researcher conducting this study and a trained research assistant will have access to the information you provide. At no time will your name or identifying information be linked with responses you provide. In addition, the majority of survey responses will be reported in aggregate.

4. Participation in this study is completely voluntary. You are free to decline to participate, to end participation at any time for any reason, or to refuse to answer any individual question. Such a decline will not affect you in any way.

If you have any questions about this study, please contact the lead investigator, Nicole Ardoin, at 650.721.2231 or nmandin@stanford.edu. And if you have any questions about your rights as a
If you agree to participate, please click "yes" to proceed to the survey.

- Yes
- No

Thank you for your consideration. If you would like to continue with the survey please scroll back to the previous page and click "yes."

To what extent are you familiar with Headlands Institute programs?

- Not familiar
- Somewhat familiar
- Very familiar

Have you been invited to attend a Headlands Institute teacher training workshop in the past?

- Yes
- No
- I do not remember

Did you attend a workshop at the Headlands Institute?

- Yes
- No
If yes to the above question, how many times in total have you attended programs at the Headlands Institute?

- once
- twice
- three times
- four times
- more than four times

What type of workshop did you attend?

- one-day open house
- five-day summer institute

How useful was the workshop you attended?

Did the workshop content and materials transfer well to your classroom?

What improvements would you make to the program?

Would you be interested in attending a Headlands Institute training in the future?

Why did you decide not to attend a Headlands Institute workshop?

Currently, most of the Headlands Institute workshops are five days and four nights in length, and educators stay on site at the Headlands Institute for that period of time. Is the residency aspect of Headlands Institute workshops appealing?

- Yes
- No

Please add any additional comments here:

Would you prefer a workshop format that allowed you to return home at the end of the day?

- Yes
- No

Please add any additional comments here:
When is the most convenient time of year for you to attend training workshops? (Please click all that apply.)

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December
- Winter (December to February)
- Spring (March to May)
- Summer (June to August)
- Fall (September to November)

Would you prefer shorter teacher workshop series? Please mark all that you might be interested in, or feel free to suggest another:

- six weekly three-hour sessions
- two sessions in a month
- four sessions in a month
- one-day training programs
- half-day training programs
- other (please specify)
Which of the following workshop time frames would best fit your schedule? (Please check all that apply.)

- half day
- full day
- day-and-a-half
- two days
- three days
- four days
- five days
- a week or longer
- other (please specify)

Would you be interested in attending teacher training workshops run by the Headlands Institute in settings other than the Marin Headlands, (the site for current workshops?)

[ ] Yes
[ ] No

If yes, why? (Please check all that apply.)

- Another setting would be more convenient
- Another setting would be more relevant to my school(s)
- Another setting would be less expensive in terms of transportation
- other (please specify)

If yes, which of the following settings appeal to you?

- Golden Gate Park
- Tilden Park
- A more urban environment in the East Bay or San Francisco
- Yosemite National Park
- Other? (please name the place)
During your teaching career, approximately how often have you attended teaching workshops?

- Less than every two years
- Once every two years
- Once a year
- Twice a year
- More than twice a year
- Never

Other (please specify):_

Please tell us some specifics about other teacher training workshop(s) you have attended in the last three years.

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Does your place of employment pay your usual wages while you attend teacher training workshops?

- Yes
- No
- Sometimes

Please provide details here:

Does your place of employment cover the fees associated with attending teacher training workshops?

- Yes
- No
- Sometimes

Please provide details here:

If yes, what is the source of that funding?

If yes, is this compensation an addition to your regular salary?

- Yes
- No

If yes, how much does your employer pay you (in addition to your regular salary) to attend teacher training workshops?

How much would you be willing to pay to attend the following workshops in environmental education?

- Half day (non-residential)
- One-day (residential)
- One-day (non-residential)
- Three-day (residential)
- Three-day (non-residential)
- Five-day (residential)
What are your current roles at school this year? Please check all that apply.

- Classroom teacher
- Specialist teacher
- Academic adviser
- Department chair
- Team leader
- PTA representative
- Principal
- School site council representative
- None
- Other (please provide details here)

If you are a classroom teacher what age(s) do you teach?

- Pre-K
- Kindergarten
- 1st grade
- 2nd grade
- 3rd grade
- 4th grade
- 5th grade
- 6th grade
- 7th grade
- 8th grade
- 9th grade
- 10th grade
- 11th grade
- 12th grade
What subject(s) do you teach?

- English
- Math
- Science
- Social Studies
- Foreign Language
- Art
- Music
- Physical Education
- Computers/IT
- Business
- Health
- Environment
- Other (please specify)

On what committees do you serve at school this year? (Please check all that apply.)

- School Improvement Committee
- Leadership Committee
- Department Committee
- Student Advocacy Committee
- Parent Teacher Association
- School Site Council Leader
- Teacher’s Union Representative
- None
- Other (please specify)
Outside of your teaching responsibilities, what extracurricular activities do you lead at school this year? (Please check all that apply.)

- Coach a sport
- Lead an after-school club/student activity
- Organize a faculty event
- Manage a fundraiser
- Teacher book club
- Professional learning community
- None

other (please specify)

How many years have you been teaching at your current school? (If this is your first year, put "1.")

Including this year, how many years have you been teaching overall? (If this is your first year, put "1.")

What incentives might be important in encouraging you to attend a teacher training workshop?

- Stipend (if yes, how much? Indicate amount in the "Other" box below.)
- Curriculum materials
- Continuing education credits
- Ongoing support from Headlands Institute to implement curriculum throughout school year
- Financial support from school or district to attend
- Developing a network among other environmental educators

other (please specify)
Which of the following education methodologies would interest you while attending a teacher training workshop in environmental education? (Please mark all that apply.)

- participatory action research
- inquiry-based learning
- place-based learning
- constructivism
- problem solving
- none

Others (please specify)

Would you be interested in helping to design the curriculum for Headlands Institute teacher training programs?

- Yes
- No

What subjects have been the focus of prior workshops you have attended? (Select all that apply.)

- Science
- Mathematics
- History/Social Studies
- Language Arts
- Foreign Language
- Art and Music

Other (please specify)

How much choice have you had in determining which workshops you have attended?

- No choice at all
- Some choice
- Complete choice
Which of the following environmentally related topics would most interest you as the theme for a teacher-training workshop?

- Climate change
- Endangered species
- Incorporating environmental science in the classroom
- Learning how to teach science in a hands-on way
- Bay Area ecology
- Watersheds
- Scientific inquiry
- Designing cross-content curriculum
- Marine ecology
- Cultural history
- Land use in the Bay Area
- Multicultural environmental education

Other (please specify)

In which subject area(s) are your students in greatest need of improvement? (Select all that apply.)

- Sciences
- Mathematics
- History/Social Studies
- Language Arts
- Foreign Language
- Art and Music
- I don't know

Other (please specify)
<table>
<thead>
<tr>
<th>With which subject area do you think environmental education best fits? (Select all that apply.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scienes</td>
</tr>
<tr>
<td>Mathematics</td>
</tr>
<tr>
<td>History/Social Studies</td>
</tr>
<tr>
<td>Language Arts</td>
</tr>
<tr>
<td>Foreign Language</td>
</tr>
<tr>
<td>Art and Music</td>
</tr>
<tr>
<td>I don't know</td>
</tr>
<tr>
<td><strong>other (please specify)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you currently incorporate environmental themes into your teaching?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If yes, as part of which subjects? (Select all that apply.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
</tr>
<tr>
<td>Mathematics</td>
</tr>
<tr>
<td>Social Studies</td>
</tr>
<tr>
<td>Language Arts</td>
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<tr>
<td>Foreign Language</td>
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<tr>
<td>Fine Art</td>
</tr>
<tr>
<td>Physical Education</td>
</tr>
<tr>
<td>Computer Science</td>
</tr>
<tr>
<td><strong>other (please specify)</strong></td>
</tr>
</tbody>
</table>
If no, why not? (select all that apply)

6. I don't have the time in my classroom scheduling.
6. I don't have the time to learn about a new area or subject.
6. It's not my area of expertise.
6. It doesn't fit within the state standards.
6. It doesn't fit with the subject I teach.
6. I don't have access to training.
6. I don't have access to resources that would allow me to incorporate environmental topics.
6. I haven't thought about it.
6. I'm not interested.

Other (please specify)

Thank you for all of your responses so far. You're almost finished! We'd just like to ask you a few demographic questions to allow us to better understand our audience.

Are you:

- Male
- Female

What year were you born?

Do you live within a 75-mile radius of San Francisco?

- Yes
- No

What is your zip code?