

# **Compassion: A Hearts-on Paradigm for Transiting Native American Students into a STEM University Environment**

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## **Abstract**

While many studies report dismal American Indian/Alaska Native dropout rates, this paper provides insights from American Indian/Alaska Native teachers, Shoshone-Bannock Tribal members, and University staff on a successful education paradigm for Shoshone-Bannock students. Our students are finding success in projects that join traditional knowledge and respect of the Shoshone-Bannock people with scientific guidance from a local university. Our goal is to strengthen the links between science and math programs at the Shoshone-Bannock High School and Idaho State University, and to use this relationship to draw students from secondary schools into the university setting. The newly established Portneuf River Ecosystem Project (PREP) is but one example of a research focus for the component of this partnership. In 1998, two Shoshone-Bannock students were interested in higher education. In the years (2003, 2004), ten students applied to institutions of higher education. A question was asked by an Elder from the Shoshone-Bannock Indian Reservation located in Southern Idaho, "Of all the things you are teaching in science and math, are you teaching the most important subject of all...compassion for all that live on and with Mother Earth?"

This paper uses the following terms to describe Native American people: American Indian/Alaska Natives/Native. These are terms that are used to talk about Native American people as a group of Indigenous people with respect.

## **Indian Summer**

The dropout rate of American Indian/Alaska Native students (30.4 percent) is the highest of all the United States ethnic groups (Bigfoot, D.S. 2008). Hands-on and hearts-on activities are a successful way to draw American Indian/Alaska Native students into educational projects, particularly when these efforts focus on local environmental issues. In Idaho, we have initiated a

program called Indian Summer to teach students about real problems that affect the Shoshone-Bannock Nation. The Shoshone-Bannock are Indigenous people who traditionally inhabited the mountains and meadows of what is now northern Utah, central and southern Idaho, central and eastern Oregon and western Wyoming for the past 14,000 years. Today, they are a humorous, compassionate and successful people that are concerned about issues in education as well as the environment.

The Elder's question about teaching compassion is a good question. We know high school teachers focus on the "work" of teaching science and mathematics to students with the objective of No Child Left Behind and research scientists focus at the university level on research publications and course work, but do educators know that education is not limited to perfect test scores, publications, and successful data collection? Perhaps education is a more basic human understanding of the students and the teacher relationship; an understanding that comes from the heart, compassion. Is compassion compatible with science and mathematics instruction? Is it important? This was the basis of the Shoshone-Bannock Elder's question. The authors are reminded of another quote about compassion from another "Elder," Albert Einstein: "Our task must be to free ourselves—by widening our circle of compassion to embrace all living creatures and the whole of nature and its beauty."

Indian Summer projects sponsor a variety of activities, which use science and mathematical skills such as PREP (Portneuf River Ecosystem Project), replanting vegetation after fire to protect stream banks, beaver reintroduction, and streamside incubation of salmon fry to enhance salmon recovery efforts. A critical aspect of these projects is that they have addressed issues that are closely tied to concerns of the local Shoshone-Bannock Tribes. A second key to the success is that we have adopted the view that multiple educational platforms, including those

that encourage community and tribal involvement, are necessary to stimulate student interest and persistence. A third issue is that the authors have a true “heart” interest and high expectation for all the students’ success, but particularly Native American students. Between 1998 and 2005, Indian Summer has involved more than 350 students from 15 Tribes in the western United States. Respect and understanding mixed with high expectations for the students (basis of compassion and pride for the student) is extremely important for a successful program that involves Native American students and, these authors feel, all students.

Traditional knowledge and wisdom of elders, community members, and tribal mentors are important avenues of learning and reinforcement for our students. For example, a Shoshone-Bannock tribal mentor Mr. Lavern Broncho tells students why water is such a sacred item to all people and how water can be used to heal the land as well as the people. Mr. Broncho weaves a nice Native American story for the students about the sacredness of water for Mother Earth and of all her inhabitants. He tells a story of how the earth was created from a tribal viewpoint, and how we need to respect the water in order to live. The University community tells a different story about water, a story of chemistry, bacteria and ecology. Native students begin to appreciate two important perspectives. One is of culture and one of pure science. Both are equally important stories to know. Water is indeed sacred and water knowledge (and how to take care of it) is important to all that live on this planet.

We are expanding our program by drawing in science faculty from Idaho State University to add a significant research and training component to our activities. High school students are paired with faculty and student mentors on local environmental studies to create a framework in which research scientists combine their perspectives and tools with traditional American Indian/Alaska Native approaches to learning. By building this partnership around

issues that are relevant to both the Native and non-Native communities, and by building relationships between the Shoshone-Bannock High School and scientists at Idaho State University, Indian Summer is creating a mechanism to transition a significantly underrepresented minority group into the university setting. For example, the PREP program focuses on a local river that has origins in the mountains of the Shoshone-Bannock Reservation and meanders through many communities in southeastern Idaho, eventually terminating back in a reservoir on the reservation. We ask the students the question “how has the river changed since it began on the reservation?” Sacredness of water and scientific methods (the chemistry of water) are given equal consideration and respect. Native students do not have to choose and give up part of their belief system. Both stories about water are important to know: clean water is essential for everyone’s health not just our students, but all who live on this planet.

### **Using Traditional Ecological Knowledge and Wisdom of the Shoshone-Bannock People**

A primary goal of the National Science and Education Standards is to develop programs that will improve K-12 student achievement by ensuring that all students have access to, are preparing for, and are encouraged to participate and succeed in advanced mathematics and science courses (Math and Science Partnership program 2002). The Indian Summer pedagogical model uses multiple methods of education to reach this goal.

How does one motivate students to achieve the level of excellence they will need to succeed? We addressed this problem by drawing on the wisdom and support, traditional knowledge, of Shoshone-Bannock Tribal members, by focusing on local environmental problems, and by formulating goals to help students reach their full potential.

What is Traditional knowledge? Traditional knowledge is defined as knowledge or stories that the people have always known, stories that explain how and why the world functions

from the viewpoint of a Native American, such as knowledge of the use of certain plants or knowledge of why certain animals act the way they do. Traditional knowledge is not only about stories, but also the wisdom and compassion of the elders, community members, and tribal mentors that encouraging students to become life-long learners. Traditional knowledge can be used to guide students as they begin to focus on local environmental issues as an example, water, salmon, or plants.

## **The Environmental Problems**

### **The Finned Ones**

In many watersheds of the Pacific Northwest, the decline of migratory or anadromous salmonid fish populations is a well-documented problem (Federal Caucus 2000, NMFS 2000). Stocks of salmonid fish that once numbered in the millions of kilograms in biomass are now extinct in many watersheds or persist at only a small fraction of their historical size (Nehlsen et al. 1991, Federal Caucus 2000, NMFS 2000). Despite many years of effort and hundreds of millions of dollars in funding, salmonid populations continue to be threatened with extinction. Unlike past recovery programs that often relied on extensive use of fish hatcheries, more recent evaluations suggest that hatcheries will not recover populations to self-sustaining levels. Recent studies have suggested that a new emphasis be placed on expanding opportunities for providing natural rearing conditions for artificially produced fish (NMFS 2000).

The Streamside Incubation Program (Indian Summer) was started in 1995 by a collaboration of organizations including the Idaho Model Watershed Program, the Shoshone-Bannock Tribe (Fisheries and High School Program), U. S. Department of Agriculture-Forest Service, and the Idaho Department of Fish and Game. The concept behind a streamside incubation program is to allow embryos of salmonid fish to experience as near a natural incubation regime as possible,

within or close to the rearing stream, and then allow emerging fish to feed and grow naturally within the rearing stream. Students and staff members build the incubator boxes from old refrigerators, or plywood structures, which are made with teams of students and mentors.



**Figure 1 Students placing salmon incubation boxes they made in place (Mountains of Idaho)**

Students count the dead fry, and by using simple mathematical percentage can calculate live hatch rates. In nine years of this project, students' live hatch rates average is over 95 percent. This is significantly higher than natural or hatchery method and the students receive “hands-on-hearts-on” learning.

Many of the problems associated with hatchery-based rearing programs are thought to begin with behavioral conditioning that the fish receive while being fed in high-density hatchery ponds and troughs. Hatchery-reared fish often exhibit a diminished tendency for predator vigilance or increased levels of aggressiveness (Swain and Riddell 1990, Johnson and Abrahams 1991). When released into natural environments, this behavioral conditioning is thought to produce

individuals that have little chance for survival (Meffe 1992). In contrast, individuals that rear in natural streams have higher levels of predator vigilance and often have greater rates of survival than hatchery fish (Reisenbichler and McIntyre 1977). Hence, while insufficient numbers of adult fish may currently return to some spawning areas to fully saturate rearing streams, out-planting embryos for natural incubation and rearing may offer an opportunity to increase the number of out-migrating salmonids that will return as fully mature salmon.

A streamside incubation program offers an ideal method of saturating natural rearing habitat with juvenile fish. Unlike hatchery programs that require a physical infrastructure to operate, stream-side incubation requires no investment in permanent facilities because it is designed to mimic natural rearing conditions as closely as possible. In Idaho, where populations of migratory salmonids have been severely depressed, stream-side incubation has shown some promising results. For instance, survival rates for steelhead trout embryos raised in stream-side incubators often average between 90 to 95%, surpassing survival rates for even naturally spawned fish (Galindo and Rinehart 2001). Despite these successes, few areas outside of Idaho have attempted to employ stream-side incubation as a means of re-establishing extinct or depressed salmonid fish populations.



**Figure 2 Students placing fish box in stream (Mountains of Idaho)**

By participating in streamside incubation programs, students are exposed to the life cycle of the salmon and are taught about the ecological requirements that fish populations need to survive. Students also learn that there is another way to think about how to raise fish. By using a disregarded refrigerator or building a plywood box students can monitor what Broncho calls “sacred life forms”. In addition, students are also afforded the chance to learn about the cultural connections that American Indian/Alaska Native communities have had with salmon for thousands of years. Given the dramatic declines in salmon numbers over the past few decades, many American Indian/Alaska Native communities are in danger of losing their collective memory and association with this magnificent animal that have had such strong influences on their culture. This program is a focal point for a discussion of many American Indian/Alaska Native values and traditions. Some may call this traditional knowledge. Western scientific knowledge at times is very concerned with very compartmental specific items. For example,

specific mathematical numerical questions that pertain to concepts of water chemistry, what is the pH number of the water (acid or base number from range from 1-10), or what is the DO (dissolved oxygen number range from 1-15)? This is important information for fish survival, but this is not all the story.

An Elder at our outdoor classroom talks to the students about respect of the “finned ones.” The Elder then leads the students and mentors in a traditional prayer for the survival of not only the finned ones, but the four-legged ones, winged ones, small and large animals of the world as well as the plants. The “finned ones” is a story about survival and respect. Traditional knowledge is about a way of life, wisdom that uses the head and heart. The Elder ends this prayer in a very humble way of asking good things for all that live on Mother Earth. The traditional knowledge lesson being taught is one of respect. Let’s think about this concept, what if science, mathematics and our western knowledge subjects were taught with respect and compassion? What if nature was viewed as our “relatives” and not only resources to be dissected, bought, sold, or fought over? Students learn about environmental science and about why we must respect what so many of us so freely take for granted. Students are learning about why the relationships between all things are important. This is an important lesson for all of us to learn.

### **The Plant People**

Forests in Idaho, and in much of the western U.S., have been devastated by large and intense forest fires in recent years, and the aftermath of such fires can have serious impacts on fisheries. For example, the 2000 forest fire in Sawtooth National Forest in Idaho occurred in very steep terrain that had been logged and mined over the past century and it was feared that spring runoff might jeopardize salmon and steelhead eggs. From a Shoshone-Bannock Tribal viewpoint, fire is a natural occurrence between the earth and its inhabitants (Broncho, 2004) but, because of a

decline in salmonid fisheries, the Shoshone-Bannock school was concerned about efforts needed to rehabilitate burned areas. Tribal hunting and fishing in the Sawtooth Mountains likely would be impacted by the fires and habitat rehabilitation. We used this potential threat to culturally important natural resources as an opportunity to involve our students in rehabilitation efforts. These efforts were consistent with Shoshone-Bannock Tribal values of giving back to Mother Earth (by planting trees) and our efforts included partnerships with the Forest Service and local institutions of higher education.



**Figure 3 Before-Burn Area (Mountain Area)**



**Figure 4 After-burn area with plant rehab (Mountains of Idaho)**

The Science Department at Shoshone-Bannock High School partnered with the USDA Forest Service in rehabilitation efforts with four goals:

1. Build on traditional environmental knowledge and wisdom of the Tribe. (Why is fire needed to “help” a forest?)
2. Encourage application of scientific methods by Tribal members to environmental problems. (Why do we plant Mt. Ash in the riparian zone of a burn area?).
3. Encourage life-long learning by extending teaching and research experiences beyond the high school classroom. (Students each year measure “their” trees that they planted in the burn/rehabilitation zone).
4. Create a research-based educational model that can be shared with others interested in “outdoor classrooms” (Share our story with others that may want to know).

## **Compassion and STEM**

In the summer of 2001, 45 students met with staff from the Challis National Forest. Shoshone-Bannock elders taught that the planting of new life by the streams would help heal the mountain stream ecosystem. Tribal members held a ceremony to bless the site and the people who would be working to “replenish the earth.” The Forest Service staff then instructed the students how and where to plant the new life forms. The replanting exercise was fun, hard work, and exciting. Our invitation to other Tribes to send their students was accepted, and 65 Native American students representing the Shoshone-Bannock, and 15 other Western Tribes collaborated on this project. Each year staff and students measure our plants for growth. Prayers are said for both the plants and the people that take care of plants. Students are taught scientific knowledge, but also ecological knowledge that is traditional in nature. For example, Native mentors explain why students need to know about the relationship with the land, plants and animals. Native ecological knowledge is a holistic view of knowledge of the land and their families, families in this case are the plants and animals. From a Western science perspective, planting in a burn area is good for the riparian zone. It helps to stabilize the stream bank and provides food and homes for many plants and animals. The Native view is much the same. In steep mountain terrain without plants to help hold the soil in place when the heavy mountain rains and snow run off occurs, mud fills the stream. If the salmon are raising their young in the stream in egg form called redds, the heavy runoff could cover the salmon eggs and kill the young life forms. Students begin to understand why traditional knowledge (prayers for plants and people) with the scientific reasons (ecology methodologies) to replant grass and trees, is valid. Many kinds of knowledge are needed to help “replenish the earth”.

## **Philosophy and Worldview**

Traditional ecological knowledge and wisdom teaches American Indian/Alaska Native Americans that the environment is not a collection of independent segments, but instead is a unified whole. All parts are interconnected in a seamless web of cause and effect, actions and outcomes, behaviors and consequences (Peacock and Turner, 2000). In this view, people, animals, plants, natural objects, and supernatural entities are not separate and distinct. Rather, they are all linked to each other and to the places where they reside through cultural-- in many cases, oral--traditions (Turner et al., 2000). For example, Broncho explains why praying for fish and water and all that support the life of fish (incubation program) is as important as doing the scientific research for helping the fish. Both become one idea, one story, a story that prayer (faith) and science can be used to explain how and why things work in the world.

Recognition of this connectivity is still important and parallels many central ecological paradigms (Molles, 2002). Tribal use of natural resources relies on ecological knowledge and wisdom that may take many forms (Turner, 1997). Knowledge of life cycles is extremely important. For example, seasonal signals such as position and size of snow patches on the mountains, the arrival of the first snow in the fall, relative numbers of particular birds in a given location, flowering of particular plants, and production of certain berries all serve as indicators of when to expect a salmon run or when particular roots are ready for harvesting (Turner, 1996, Broncho, 2004). Traditional knowledge is knowledge that has been used by the people for hundreds of years. It has passed the test of time, as the people have survived by using the specific knowledge they have learned. "Traditional knowledge does not have to be validated, tested and

proven, we are here today and alive this is enough proof” (Broncho, personal communication 2004).

### **Incorporating a University-Based Research Approach**

Rehabilitation of the burn area was an early example of a class project. To expand those efforts, Indian Summer is now partnering with Idaho State University, located 12 kilometers from the Reservation. The Department of Biological Sciences is assisting with experimental design to determine the kinds of environmental data we should collect and then how to analyze and interpret those data. This new relationship serves two purposes. First, students become acquainted with professors and interact in projects that generate enthusiasm for the scientific process. Second, academics provide additional perspective on traditional ecological knowledge and wisdom that the students previously have learned from the elders of the Tribe such as knowledge of salmon, water or fire ecology from two perspectives, scientific and tribal.

According to Turner, Ignace, and Ignace (2000), the concepts most often expressed by American Indian/Alaska Native Americans are that ancient relationships tie all beings together into communities, and that respect for all life forms and the land itself is fundamental. Ignace (2000) further explains that American Indian/Alaska Native American resource management was carried out through a value system that enforced practices of sustainability, expressed respect for all life forms, and sanctioned individuals who were wasteful. Specific practices of resource management expressed the respect that humans must show for all living things. An example of respect for the Shoshone-Bannock Tribe is the American Indian/Alaska Native American relationship to salmon. Respect for the salmon is offered in prayer and a special ceremony. By thanking and respecting the fish for returning to the mountains, an important part of the great circle of life is acknowledged and confers respect for all life (Broncho, 2004). Traditionally,

lack of respect was viewed as resulting in spiritual sanctions from nature itself. Ransom (2000) discussed the importance of drawing on traditional knowledge and reported that an American Indian/Alaska Native student in Manitoba wrote:

Respect aboriginal people, their knowledge systems, world views, values and ethics and regard them as equal to their Western counterparts. This means using Indigenous knowledge, including Indigenous values and ethics to make decisions, developing co-jurisdiction and co-management arrangements that are based on Indigenous environmental philosophies.

These are not easy tasks, and this paradigm will require that teachers receive help from the Native American tribal community and institutions of higher education. With strong, positive mentors that show and are shown respect, the American Indian/Alaska Native American student can achieve the same goals as mainstream science students.

When we initiated Indian Summer in 1998 we had two Shoshone-Bannock students interested in higher education. For the years (2003, 2004), we had ten students apply to institutions of higher education. We anticipate even more students in the coming years with our mentoring project.

### **Future Directions**

Our goal is to strengthen the links between science programs at the Shoshone-Bannock High School, other interested Native American Tribes and Idaho State University (ISU), and to use this relationship to draw students from secondary schools into the university setting.

The newly established Portneuf River Ecosystem Project (PREP) is a focus for the research component of this partnership. The Portneuf River begins and ends on Shoshone-Bannock tribal lands, but much of its course is through non-tribal lands where it is influenced by agricultural, recreational, and urban land uses. We plan to use the Portneuf River to draw Native American students into a scientific research program where they will interact with mentors from

ISU and develop solutions to problems that threaten the health of the Portneuf River ecosystem. Native American students are working with faculty at ISU, learning scientific techniques and developing personal relationships that will hopefully lead many Native students to successful opportunities in higher education. At the same time, PREP will serve all of the surrounding communities, Tribal and non-Tribal, by providing critical information on the condition of the Portneuf River and by developing strategies for improving water quality. In addition, PREP will support existing work of the Native American Science Research and Education Program focused on riparian habitat restoration and use of streamside incubators to enhance salmon recovery in the Columbia River Basin.

PREP provides a plethora of opportunities for environmental, mathematical statistics and measurements, including GIS-based land use measurements, water quality assessments, as well as floral and faunal surveys that are easily related to traditional uses of natural resources. Our objectives are to:

- characterize water quality at key points on the Portneuf River
- identify how various land uses are impacting water quality in the Portneuf River
- develop recommendations to protect and improve water quality in the Portneuf River

PREP also creates additional partnership opportunities with local, state, and federal resource management agencies, which will in turn open new opportunities for Tribal members after they have completed professional training. This is a very circular thinking idea of giving back and learning.

### **Student Success through Collaboration**

The Department of Biological Sciences at Idaho State University and the Shoshone-Bannock High School are dedicated to finding ways to work together for a single focus, Native

student success in higher education. Another important ingredient for Native American success is full collaboration with Native American educators in reservation communities, in this case the Shoshone-Bannock Indian Reservation. The partnerships with Native American communities and collaboration with professors in microbiology, ecology, fisheries, and other natural resources demonstrates to Native students a clear link between academics, field work, and local environmental issues.



**Figure 5 The “Dream Team” (Rehab, Idaho)**

## **Summary**

Idaho State University, Shoshone-Bannock High school as well as several other Tribes are hosting several joint research programs dedicated not only to improving math and science education, but also to introducing our American Indian/Alaska Native American students to the university community.

In 2003, we initiated a Native American mentor program called our Native Scholars program. We ask Native American students in college now to give back some of their time to help our high school Native American students. The College Native scholars (five students) meet with students at least three times a week for a few hours after school. The Native Scholars can work on homework with the high school students, or just be a sounding board for students. Currently the five college Native American scholars work one on one with our high school scholars. This seems like an exciting and promising way for our high school students to make the transitional from the reservation to college. This will be the subject of a future study.

Our partnership seeks to formalize Native American students to the university through mentoring and providing Native American students with teams of caring contact people on and off the reservation. Critical for success is equal and full collaboration with American Indian/Alaska Native American educators, tribal elders, parents and university instructors. This crucial step has helped our students see that the transition from the reservation education system and the university is a continuum of knowledge that can be further expanded at the university level. By providing the rigors of field-based “hands-on hearts-on” learning with understanding of tribal traditional knowledge combined with workshops for university instructors to provide the understanding of Native American learning styles/philosophies, we feel we are on the road to getting our Native American students to continue their education: going to college is but one path.

Our ultimate goal is to offer as many educational opportunities to our Native American students as possible. The benefits to the university community will be more scientific and intellectually diverse students. The Tribe will benefit by having more tribal members educated,

and the student will be well on the path of the journey of education. The Tribe, university community, teachers, family and the students benefit when such collaboration takes place. Indian Summer is taught not as a single class or individual segments. All the programs that were mentioned in this paper are tied together based on relationships with students and our home, Mother Earth. Relationships of common sense that is based on knowing about the land and environment is an important component of traditional knowledge. It covers knowledge of the environment, resources and humans relationship in the great circle of life and cannot be compartmentalized. Indian Summer teaching is rooted in prayer, scientific language, Native culture, respect and compassion. The richness of local knowledge systems and scientific thought makes this way of learning and knowing greater than the sum of its parts.

Indian Summer staff members believe in a re-awakening of traditional ecological knowledge and the wisdom of the American Indian/Alaska Native about environment relationships, knowledge and wisdom that will help Tribes become effective natural resource managers and contribute to a reawakening of the educational values that American Indian/Alaska Native people have always had.

Finally, the Elder's question of teaching compassion is as most teaching and sharing with Elders entail, not a simple yes or no answer. However, the question is really a deep reflection statement to remind us all of what and why we are teaching students. Baba Dioum (speaking to the 1968 general assembly of the International Union for Conservation of Nature, <http://everything2.com/title/New%2520Delhi%252C%2520India>) , a Central African Conservationist, stated the Elders question very eloquently: "For in the end we will conserve only what we love. We will love only what we understand. And we will understand only what

we are taught.” The authors believe that not only can compassion be taught with science and mathematics, it must be. This is what the Shoshone-Bannock Elder taught the authors.

### **Personal Note (Ed Galindo)**

I would like to thank members of the Shoshone-Bannock Tribe and Idaho State University Biology Department for sharing my passion of American Indian/Alaska Native education. This is also a very personal story, I was a graduate student at Idaho State University (ISU) Biology Department. It was at ISU, that respect and compassion was exhibited in learning, teaching and research methods. As a minority graduate student, this was good to see. The circle is now complete. The author who was once a student at ISU, became a science teacher/researcher on the reservation, and now brings his Native American students to the University. It is hoped that compassion as well as STEM curriculum is taught and learned by the students and research mentors. Both are important to me.

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