Science In A Yupiaq Fish Camp And School: A Case Study of Ways of Knowing in a Yupiaq Eskimo Community

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Statement of the Problem

Recently, the U. S. Congress established a commission to work with Alaska State officials and Native people to "develop recommendations to the Congress and State of Alaska that would help assure that Alaska Natives have life opportunities comparable to other Americans, at the same time respecting their cultures, traditions, and special status" (Blatchford, 1990). Having relinquished key aspects of their traditional ways and spirituality in response to an array of physical, political, economic and educational pressures, Native people have experienced an existential and ontological discontinuity (Schumacher, 1977:17), with extensive social and psychological consequences.

The Western idea of a modem technological world has not been readily accepted by Alaska Native people. Many still opt to live in their own made-from-scratch houses, and they use many of their traditional technological tools in hunting and gathering, while adopting a limited number of modern devices. But, there are also many others for whom the home environment has changed so much that there is little to remind them of their Nativeness. They all retain one thing in common, however, and that is reliance on a subsistence lifestyle, which transcends their physical living conditions and technological conveniences. Although, non-Native people tend to view the subsistence way of life as being very simple, the Native practitioner sees it as highly complex. A subsistence oriented world view treats knowledge of the environment and each part's interdependence with all other parts as a matter of survival, and as such, provides a complex model for maintaining and sustaining a balance with nature.

Traditional Native subsistence technology was based on the use of natural materials for making tools. These consisted of skin, bone, stone, and wood. This was a nature-based, nature-mediated technology. The technology included metallurgy, as nature-refined copper was often used for tool making. The tool-making process was integrated into daily life and allowed sufficient free time for contemplation of natural and mythical forces. Marshall Sahlins (1972), has referred to hunting and gathering people as the "original affluent people." His research has indicated that traditionally, these people spent less than 40 hours per week foraging for food.

Unfortunately, for many Alaska Native people, this "affluence" is no longer a feature of their lifestyle.

Native people have come to realize that technological solutions as a road to 'progress" is a myth. Labor-saving tools and consumer-oriented gadgets tend to create a dependency on external resources and expertise that can lead people down a pathway of cultural dislocation and destruction (Berger, 1976). There is a need to demystify and humanize science and technology, and the place where this can begin is in the teaching of science in school.

Science teaching need not be from the textbooks alone, nor espouse the scientific method as the only way to construct knowledge. Rather, what traditionally is understood through myths, collective thinking, experiential learning, intuition and the ontological presence of mind needed to guide, temper, and get things right, should also be included. The ontological discontinuity referred to earlier need not persist. The Native ways, rituals and sense of sacredness can be understood as outward expressions of a highly developed ecological mind set. According to Cajete (1986) Native ways represent an ecological mindset of sacredness, with ecological relationships and a constant "seeking of life."

Students can be taught to become thinkers, inventors and creators, always mindful of environmental balances. Their awareness of Native and Western science perspectives for visualizing a world where harmony exists, and where there is comfort and security for everyone, could go far to instill the motivation needed to make a better world. Native students' academic aversion to mathematics and sciences is often attributable to an alien school culture, rather than a lack of innate intelligence, ingenuity or problem-solving skills. The curricula, teaching methodologies and often the teacher training are based on a world view that does not always recognize the Native notion of an interdependent universe. Souix Chief Luther Standing Bear has said:

> ... The old Lakota knew that man's heart away from nature becomes hard; he knew that lack of respect for growing living things soon led to lack of respect for humans too (Nollman, 1990:3).

It is toward the (re)integration of the human and the natural, the Native and the Western worlds in the teaching of science that this study is directed. What is needed as a first step in this process is a study of/by Native people examining their values, practices, attitudes and views in relation to their traditional and contemporary ecological perspective. It is my intent to participate in and observe life in a Yupiaq Eskimo fish camp to identify the varied ways in which people incorporate traditional and Western scientific principles in their daily life, and determine how they have been able to reconcile the seemingly antithetical values reflected in each. Can Western scientific teachings and Yupiaq scientific practices be understood and taught through a common epistemological framework? That is the central question to which the case study will be addressed.

Review of Literature

The Random House dictionary defines "science" as "a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws." If science is but a "branch" of knowledge, it implies that there are other branches as well that make up the knowledge tree. Mixed in with those other branches, with its own complementary "body of facts or truths systematically arranged and showing the operation of general laws" is the "scientific" view of the world constructed over millennia by Alaska Native people. There are many ways of making sense of the world around us, each branch with its own rules, laws and meanings that form a basis for carrying out the tasks of everyday life. Let us take a closer look at some of the characteristics of these different branches of the knowledge tree and examine what happens when they become intermingled.

Western science tends to emphasize compartmentalized knowledge (by disciplines) which is often decontextualized and taught in the detachment of a classroom or laboratory setting (Berger, 1977; Livingston, 1981; Franklin, 1990). Native people, on the other hand, have traditionally acquired their knowledge of the world around them through direct experience in the natural environment, whereby the particulars come to be understood in relation to the whole, and the "laws" are continually tested in the context of everyday survival. For a Native student imbued with a Native experiential/scientific perspective, the typical classroom approach to the teaching of Western science can present an impediment to learning, to the extent that it focuses on segmented knowledge without regard to how it relates to the surrounding universe.

Another potential interference to leaming by the Native student is the domineering, manipulative aspect of western science and technology (Franklin, 1990; Capra, 1984, 1988; Deloria, 1990; Milbrath, 1989; Page, 1989; Rifkin, 1980), which is often contradictory to the Native's view of who he is, what his place in the world is, and how he relates to it. Native people have learned to live in harmony with the earth for millennia by developing a complex integration of cultural values, traditions, spirituality, and economic base tied to the land. They have not supplanted natural plants and animals, and have acknowledged Nature's supremacy through its natural forces and processes. They have acknowledged that Nature is dynamic, and concomitantly, that people and cultures must be also.

Western thought also differs from Native thought in its notion of competency. In Western terms, competency is based on predetermined ideas of what a person should know in a certain body of knowledge, which is then measured indirectly through various forms of tests (Franklin, 1990:29). Such an approach does not address whether that person is really capable of putting the knowledge into practice. In the traditional Native sense, competency had an unequivocal relationship to survival or extinction. You either had it, or you didn't, and survival was the ultimate indicator.

Another possible problem for the young Native learner is the Western notion of scientific objectivity. The potential difficulties are pointed out in the following statement on scientific detachment by Schumacher (1977:52-3):

> … We attain objectivity, but we fail to attain knowledge of the object as a whole. Only the 'lowest,' the most superficial, aspects of the object are accessible to the instruments we employ: everything that makes the object humanly interesting, meaningful and significant escapes us.

Western science and technology are more than ways of knowing, but also consist of particular practices and methods. According to Franklin, "The scientific method works best in circumstances in which the system studied can be truly isolated from its general context" (1990:39). This process of isolation is expanded upon by Nollman (1990:74) when he indicates that, "The objective viewpoint cannot perceive the context of the whole because the objectivists, themselves, insist upon utilizing only a part of their/our whole being." Nollman goes on to say that this viewpoint places a perpetual buffer between our conscious thoughts and our "very important gut connection to nature." One of the interests of the Western corporate world has been the natural resources found in the Arctic. In their desire to exploit and extract these resources, they have overwhelmed and displaced the people indigenous to the land. From a scientific "isolationist" perspective,

the Native people are considered transmutable physical elements of the environment and objects that can be removed to a new village site, where they often become “human animals in a cultural zoo” (Hall, 1988:2 17). Already, there are several villages where affluent outsiders can fly in to view the Native in his “natural” habitat, which is demeaning to the people on display.

Another new phenomenon in the villages is pollution. Traditionally, everything that was used was recyclable and biodegradable. Now, the Native people are wallowing in garbage and sewage. Pollution is an ‘inevitable consequence of life at work,” but now, “There is only one pollution.. . people” (Lovelock, 1987:27, 122), and their desire to buy pre-packaged foods and gadgets. The educational and economic system have taught Native people to be consumers, often in the form of inappropriate products, including housing and complex technological tools and machines ill-suited to the Arctic. The cold and harsh environment makes many of these externally designed and overly sophisticated products last a relatively short period of time, though their frozen remains last forever. For instance, snow machines will operate an average of three winters then deteriorate very rapidly. This places an added burden on the owner for maintenance, oil and gas, and ultimate replacement. The villages are strewn with cannibalized and discarded machines. With all these cumulative environmental problems, Native views about the quality of life need to be re-assessed in modern times.

Native people are no exception when it comes to modern wants and needs. The numerous TV stations beamed to the villages by satellite present psuedo-realities for both young and old. They live torn between the desire to retain their traditional hunting and trapping practices, and the desire to obtain the modern advantages gained through exploitation of natural resources. However ambivalent Native people might be, “most people who are on the receiving end of offshore and Arctic oil operations. . . have greeted these enterprises with a comprehensive lack of enthusiasm, because they directly perceive the prohibitive social and environmental costs” (Lovins, 1977:4). Indeed, the syncopating lights of growth and development from the Western perspective can be mesmerizing, but Native people have come to realize that they are dealing with a perception of progress that is no longer appropriate for indigenous survival.

Traditionally, Alaska Native people developed a nature-based and nature-mediated technology to suit their needs, along with the needs of their environment and nature. As Natives have learned Western scientific and technological processes, it has been with an inclination toward ‘soft technology” (Lovins, 1977), which provides a means to temper Western technology and use it as a tool for adaptation to local culture and ecology. The

focus of this "soft technology" can be to upgrade and update traditional skills, to develop tools that can be easily repaired, to be conservational and non-polluting in the use of renewable resources for energy and raw materials, and to fine-tune the subsistence lifestyle. In searching for examples of implementing soft technology, Harrison has offered the following as representative criteria for its use (1983):

1. improving an existing traditional technique
2. modifying a modern machine
3. inventing a new machine from scratch
4. finding a useful and economical Western antique
5. applying a bit of indigenous wisdom to the solution of a new problem

In the past, Native people tended to view formal education as a hindrance to their traditional ways, but now they must look at it in a different light. They must control education, and give it direction to accomplish the goals they set for it, strengthening their own culture while simultaneously embracing Western science as a second force that can help them maintain themselves with as much self-reliance and self-sufficiency as possible. They must learn to thrive in a tough environment, and they can make it easier and less harsh, first as humans, secondly as scientists, with a carefully developed technology. Soft technology is intended to help people become the producers of those things that are needed for human support and comfort.

The Western educational and scientific paradigm developed over the past several hundred years need not be dispensed with. However, a shift needs to be made toward a more holistic education in which a teacher-student-community collaborative approach is developed to address the needs of a fast-changing society (Hall, 1988:2 16; Capra, 1989:132). To achieve this, the formal educational system needs to reassess and redirect education to a holistic mindset, in which education is viewed as multi-disciplinary, multi-directional, and multi-sensory, with the total environment serving as the laboratory (Sivaraksa, 1989:103). The critical task is to find ways to help people, and, especially teachers, to begin to recognize (and re-cognize) that the earth is indivisible and that it must be understood as a whole. To do so can help the learning process of the Native student, who enters school with all the linguistic and intellectual tools of his/her culture at his/her command, but seldom is called upon to put them to full use in the classroom setting.

I have observed and taught in rural and urban classrooms in which science was taught from textbooks, using the scientific method, and using age-tested science experiments (Cajete, 1986). My own undergraduate science education was derived from textbooks, and laboratory manuals. These teaching/learning processes do not, however, take advantage of the students' environment, or the environment's ecological processes. Nor do they prepare the students to recognize a "Creative Force" flowing in and around them at all times. This removal of the mystical force from scientific processes has rendered a society which places primary credence and faith on observational and rational faculties of man. Once this happens, we have a society in which the quality of man and life diminishes, a society which no longer honors and reveres nature, but often misuses, abuses, and disrespects nature (Schumacher, 1977). One could argue, therefore, that our science education contributes to the decay of society with a concomitant diminishment of morality.

From the review of literature, it becomes apparent that there is a significant contrast between Western scientific and Native world views. The former is formulated to study and analyze objectively learned facts to predict and assert control over the forces of nature, while the latter is oriented toward the synthesis of information gathered from interaction with the natural and spiritual worlds so as to accommodate and live in harmony with natural principles. Native reciprocity with the natural and spiritual realms implies communication which perhaps must be re-learned by the Native, as it is now being learned by Western scientists:

> The science of ecology, the study of the interactions between living things and their environments, circles back to the ancient wisdom found in the rich oral traditions of American Indian stories. Time and again the stories have said that all of the living and nonliving parts of the Earth are one and that people are apart of that wholeness. Today, ecological science agrees. (Caduto & Bruchac, 1989:5)

Research Design

I have chosen the Yupiaq Eskimo fish camp setting to explore a more holistic approach to science education. The summer fish camp season is a time of happiness, warm weather, and a place for orderly Yupiaq industry. It also presents a cornucopia of traditional and modern technologies. Although the Yupiaq people do not always have technical names for the natural processes involved, the annual fish camp routines reflect the most concentrated situation in which they use many sophisticated scientific principles in activities such as food preparation, catching and preserving of fish, reading river currents and tides, assessing weather and wind conditions, classifying plants, fishes, and animals,

utilizing solar energy, and adapting to seasonal transformations. These principles are an inherent part of daily life in fish camp. In the natural context of the camp environment, Yupiaq people feel they are in the realm of science, the world of inquiry and the process of discovery. In order for the people to live in harmony with nature, they have to learn the skills to live with nature. The secrets of nature have to be learned for mutual nurturing and sustenance, and to develop a holistic world view of the universe (Murchie, 1981).

In the fish camp, the environment becomes the laboratory and thus, all teaching/learning is drawn from an ecological perspective. The sensory data that is collected in the mind is used to formulate conclusions based on values, perspective, philosophy of life, and relations to the world. Over thousands of years, the Yupiaq culture has established a way to make the world accessible to reasoned inquiry and discovery, including ponderous questions about what is real, what is truth, and what is good and beautiful. This knowledge flows and is channeled through Native science, art and practice of the sacred. The natural phenomena in the Native world are explained in terms of characteristics easily observable, or experiences involving a high degree of intuitive thought (Cornell, 1986).

The fish camp-based educational processes outlined above reflect many of the following goals and characteristics, which have been paraphrased from a document on the environment prepared by UNESCO in 1971:

1. apply and blend Native and modern science perspectives
2. practice effective application of the scientific processes in everyday life
3. practice flexibility in levels of thinking and foster effective thinking in everyday life
4. maintain and enhance essential ecological processes and life support systems by using complex scientific technology to develop soft technology in tune with nature
5. practice Native conservation for genetic diversity
6. sustain utilization of species and ecosystems
7. exercise creative writing and creative applications of imagination and visualization to make better the natural environment and enhance natural processes of food production
8. adapt to changing conditions through a blend of Native and modern science principles

9. sustain a network of collaborative thought and effort between disciplines

In an effort to gain sufficient insight into the Yupiaq understanding and practice of "science" to be able to formulate an approach to science education that incorporates the kinds of goals and principles outlined above, I will observe and document the behaviors and related thinking that are reflected in the day-to-day subsistence activities of the summer fish camp. These observations will then be juxtaposed against the ways in which science is taught to Yupiaq children in the local school, in an effort to identify points of similarity and difference, which can then serve as the basis for proposing a more integrative approach to the teaching of science for Native people.

Methodology

As a member of the Yupiaq society, I will be working from the inside as a participant-observer. I will become an active participant with the people at the fish camp, but with constant attention to overt as well as subtle uses of, and comments about traditional and modern tools and practices. I was raised by a Grandmother and experienced seasonal trips for various hunting and trapping activities at an early age. I was taught many of the Yupiaq values of respect for others and nature. I also have an undergraduate major and have taught in the biological sciences and so have an academic understanding of Western science and the scientific method with its emphasis on objectivity. However, my elementary, high school and college education convinced me for many years that modernity was the only way to go. It was only in the last two decades that I began to realize that I was living contrary to my upbringing as a Yupiaq. I have since been searching for a synthesis between the two ways of understanding the world.

The educational process needs to go beyond the limits of sciences which are built around bodies of knowledge that are restricted to objects of the earth. This so-called "objective knowledge", which is based on factual observation of observable phenomena, is constricting to original thought. In Yupiaq thought there is a similar idea, which is translated as "seeing without feeling." In Western thought, this way of knowing has the greatest value as being objective. According to Western thought, "subjective" knowledge is less reliable because it is not verifiable through the senses. The Yupiaq word, *tangruarluku* which means "to see with the mind's eye", transcends that which we can perceive with our endosomatic sensemakers, and illustrates how a Native perspective may provide a way of bridging the so-called mythical subjective world, and the objective scientific world. It is necessary, therefore, that both modes of inquiry and sense-making be incorporated in this study, to give credence to the range of phenomena that will need to be addressed from both the Yupiaq and the Western perspective.

Interaction, observations and interviews with villagers will reveal the cultural beliefs, artifacts, and inherent knowledge used in the fish camp. The process will include probing in appropriate cultural domains to try to tease out the subtle patterns and meanings of verbal and physical activities. How do the villagers understand scientific principles? Why do they carry out certain activities the way they do? Has past science education contributed to their knowing what to do and the skills needed to succeed in certain instances? How do the villagers pass on their knowledge and skills? How has their relationship to the life-giving ecological system changed? Are there any differences between the beliefs and practices of the older and the younger generations? It is through the pursuit of information that addresses these kinds of questions in a fish camp setting that an insight into the Yupiaq scientific view of the world will be obtained.

On the other hand, to get an idea of what and how the school is attempting to teach students in the sciences will require the close examination and content analysis of curricular materials, textbooks, and science manuals, as well as observation of and interviews with teachers. Having taught science for many years, I have a preconceived notion of what to expect, however, science curricula have changed during the years since I have been in the classroom, and circumstances can vary from one school to the next. So I will have to find out what kinds of scientific knowledge are being taught, how each succeeding grade is introduced to new scientific principles, what kinds of experiments and equipment are being utilized, and most importantly, how do the teachers and students view the relationship between school-taught and Yupiaq science.

Formal interviews with teachers will be conducted to find out how they use the textbooks and manuals, whether they have students relate science to their own environment, whether they make use of science projects and science fairs, to what extent local knowledgeable people are incorporated in the lessons, etc.. All these question and others that teachers, local people, and students bring up will give valuable information as to what goes on during the teaching of science in school. Open-ended, informal discussions will also be conducted to identify areas that are not anticipated in the formal interviews. A daily journal will be maintained at all times, and tapes will be used when permissible. Through these data gathering processes, appropriate information will be assembled to gain insight into the domains of science teaching, leaming and practice in the school and community.

Analysis

This section will deal with the analysis of data gathered from the two sources, the school and the fish camp, to determine how scientific principles are understood, applied, taught and learned in each setting. There likely will be differences in the way the knowledge and skills are passed on to young people in the two settings, so an attempt will be made to determine what might be leamed about the teaching and learning of scientific knowledge and skills in each situation that can be used to put forward curriculum ideas that represent a synthesis between the two. All of this will then be written up in the form of a case study. Based upon the analysis and findings, recommendations will be made for strengthening science curricula in the schools, for Yupiaq students specifically, and for Native people more generally.

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