CHAPTER 16

Indigenous Knowledge Systems and Education

Up until now, the chapters in Part Three have advanced conversations among and within some of the horizons that are employed in Western cultures to make sense of human experience. Many competing traditions are omitted. Here we include one which reminds us how all traditions help us comprehend in certain ways—and miss other legitimate ways of understanding. Ray Barnhart and Angayuqaq Oscar Kawagley challenge perhaps the most entrenched and powerful Western tradition, natural science, by showing how the focus on regularities often leads to the neglect of the meaning that can be discovered in the particular.

Long and direct involvement with their environment has helped Alaska Native people acquire knowledge that is both general and specific at the same time. Repeated hunting trips on the frozen ocean, for example, helped them develop an elaborate classification of snow and ice conditions—and thirty-seven different words for ice in the Yupiaq language. More fundamental, however, is a basic respect for nature and the recognition of the need for ecological balance and sustainability—an approach that Western societies are now struggling to learn.

Ray Barnhardt is a professor of cross-cultural studies at the University of Alaska Fairbanks, where he has been involved in teaching and research related to Native education issues since 1970. He has served as the director of the Cross-Cultural Education Development Program, the Center for Cross-Cultural Studies, and the Alaska Native Knowledge Network. His research interests include indigenous education, rural education, and place-based education.

Angayuqaq Oscar Kawagley was born at Mamterilleq, now known as Bethel, Alaska, where he was raised by a grandmother who encouraged his obtaining a Western education, along with the education he received as a Yupiaq child in the camps along the rivers of Southwest Alaska. Although this created conflicting values and caused confusion for him for many years, he feels he has come full circle and is now researching ways in which his Yupiaq people's language and culture can be used in the classroom to meld the modern ways to the Yupiaq thought world. Along the way, he has completed four university degrees, including a Ph.D at the University of British Columbia. He recently retired as an associate professor of education at the University of Alaska Fairbanks.

Indigenous Knowledge Systems and Education[1]

RAY BARNHARDT AND ANGAYUQAQ OSCAR KAWAGLEY

A few years ago, a group of Alaska Native elders and educators assembled to identify ways to more effectively utilize the traditional knowledge systems and ways of knowing embedded in the Native communities, to enrich the school curriculum, and to enliven the learning experiences of the students. After listening for two days to lengthy discussions of topics such as indigenous world views, Native ways of knowing, cultural and intellectual property rights, and traditional ecological knowledge, an Inupiaq elder stood up and explained through an interpreter that he was going to describe how he and his brother were taught to hunt caribou by their father, before guns were commonplace in the upper Kobuk River area of northern Alaska.

The elder described how his father had been a highly respected hunter who always brought food home when he went out on hunting trips and shared it with others in the village. One day, at the time when he and his brother were coming of age, their father told them to prepare to go with him to check out a herd of caribou that was migrating through a valley a few miles away. They eagerly assembled their clothing and equipment and joined their father for their first caribou hunt. When they reached a ridge overlooking the nearby valley, they could see a large herd grazing and moving slowly across a grassy plain below. Their father told his sons to lie quietly up on the ridge and watch as he went down with his bow and arrows to intercept the caribou.

The boys watched in anticipation as their father proceeded to walk directly toward the caribou herd, which as he approached began to move away from him in a file behind the lead bulls. Yet he just kept walking openly toward them. This had the two brothers scratching their heads wondering why their father was chasing the caribou away. Once the father reached the area where the caribou had been grazing, he stopped and put his bow and arrows down on the ground. As the (now) elder told the story, he demonstrated how his father then got into a crouching position and slowly began to move his arms up and down, slapping them against his legs as though he was mimicking a giant bird about to take off. The two brothers watched intently as the lead bulls in the caribou heard stopped and looked back curiously at their father's movements. Slowly at first, the caribou began to circle back in a wide arc watching the figure flapping its wings out on the tundra, and then they

began running, encircling the man in a narrowing spiral until eventually they were close enough that the boys' father reached down, picked up his bow and arrows and methodically culled out the choice caribou one at a time until he had what he needed. He then motioned for his sons to come down and help prepare the meat to be taken back to the village.

As the elder finished the story of how he and his brother were taught the accrued knowledge associated with hunting caribou, he explained that in those days the relationship between the hunter and the hunted was much more intimate than it is now. With the intervention of modern forms of technology, the knowledge associated with that symbiotic relationship is slowly being eroded. But for the elder, the lessons he and his brother had learned from their father out on the tundra that day were just as vivid when he shared them with us as they had been the day he learned them, and he would have little difficulty passing a graduation qualifying exam on the subject seventy years later. The knowledge, skills, and standards of attainment required to be a successful hunter were self-evident, and what a young hunter needed to know and be able to do was both implicit and explicit in the lesson the father provided.

The insights conveyed to us by the Inupiaq elder drawing on his childhood experience also have relevance to educators today as we seek ways to make education meaningful in the twenty-first century. It is to explicating such relevance that the remainder of this article will be directed through a close examination of common features that indigenous knowledge systems share around the world.

Indigenous peoples have sustained their unique world-views and related knowledge systems for millennia, even while undergoing major social upheavals as a result of transformative forces beyond their control. Many of the core values, beliefs and practices associated with those world-views have survived and are finding relevance for today's generations just as they did for generations past. The depth of knowledge rooted in the long inhabitation of a particular place offers lessons that can benefit everyone, from educator to scientist, as we search for a more satisfying and sustainable way to live on this planet.

Actions currently being taken by indigenous people in communities throughout the world clearly demonstrate that a significant "paradigm shift" is under way in which indigenous knowledge and ways of knowing are beginning to be recognized as consisting of complex knowledge systems with an adaptive integrity of their own.[2] As this shift evolves, it is not only indigenous people who are the beneficiaries, since the issues that are being addressed are of equal significance in non-indigenous

contexts. Many of the problems that are manifested under conditions of marginalization have gravitated from the periphery to the center of industrial societies, so the new (but old) insights that are emerging from indigenous societies may be of equal benefit to the broader educational community.

The tendency in the earlier literature on indigenous education, most of which was written from a non-indigenous perspective, was to focus on how to get Native people to acquire the appurtenances of the Western/scientific view of the world.[3] Until recently there was very little literature that addressed how to get Western educators to understand Native world-views and ways of knowing as constituting knowledge systems in their own right, and even less on what it means for participants when such divergent systems coexist in the same person, organization, or community. It is imperative, therefore, that we come at these issues on a two-way street, rather than view them as a one-way challenge to get Native people to buy into the Western system. Native people may need to understand Western society, but not at the expense of what they already know and the way they have come to know it. Non-Native people also need to recognize the coexistence of multiple world-views and knowledge systems, and find ways to understand and relate to the world in its multiple dimensions and varied perspectives.

Indigenous Knowledge Systems and Cultural Well-being

In 2003 the U.S. Commission on Civil Rights issued a comprehensive report titled, *A Quiet Crisis: Federal Funding and Unmet Needs in Indian Country*, in which the following conclusion was drawn with regard to education of Native American students:

> As a group, Native American students are not afforded educational opportunities equal to other American students. They routinely face deteriorating school facilities, underpaid teachers, weak curricula, discriminatory treatment, and outdated learning tools. In addition, the cultural histories and practices of Native students are rarely incorporated in the learning environment. As a result, achievement gaps persist with Native American students scoring lower than any other racial/ethnic group in basic levels of reading, math, and history. Native American students are also less likely to graduate from high school and more likely to drop out in earlier grades.[4]

Students in indigenous societies around the world have, for the most part, demonstrated a distinct lack of enthusiasm for the experience of schooling in its conventional form—an aversion that is most often

attributable to an alien institutional culture, rather than any lack of innate intelligence, ingenuity, or problem-solving skills on the part of the students.[5] The curricula, teaching methodologies, and assessment strategies associated with mainstream schooling are based on a worldview that does not adequately recognize or appreciate indigenous notions of an interdependent universe and the importance of place in their societies.[6]

Indigenous people have had their own ways of looking at and relating to the world, the universe, and to each other.[7] Their traditional education practices were carefully constructed around observing natural processes, adapting modes of survival, obtaining sustenance from the plant and animal world, and using natural materials to make their tools and implements. All of this was made understandable through demonstration and observation accompanied by thoughtful stories in which the lessons were embedded.[8] However, indigenous views of the world and approaches to education have been brought into jeopardy with the spread of Western social structures and institutionalized forms of cultural transmission.[9]

The encroachment of Western civilization in the indigenous world changed a people that did not seek changing. Indigenous peoples' systems of education, governance, spirituality, economy, being, and behavior were very much in conformity with their philosophy of life. The Alaska Native people in general were sufficiently content with their lifestyle that they did not readily accept Eurocentric education and religions when the first envoys of the dominant society set foot in their land. It was not Western technological might that brought the Alaska Native people to compliance—rather it was the incomprehensible diseases that came with Eurocentric intrusions that decimated the people.[10] A great number of elders, mothers and fathers, shamans and children succumbed to these new diseases. Whole villages were wiped out. Missionaries began to open orphanages and schools for the newly dislocated exiles in their own land. The Federal Bureau of Education entered into contracts with religious organizations whereby money was paid to establish schools and hire the missionary teachers. The children were taught a foreign language (English) along with new knowledge and skills to become servants to the newcomers' needs and laborers for newly established businesses. The Compulsory School Attendance Law was enacted, requiring families to remain in one location for many months of the year so their children could attend school, thus ending the Native peoples' practice of moving from place to place according to the seasons and animal migration patterns. This greatly reduced the

freedom of people to be who they were, to learn traditional values and to live in harmony with their environment. It meant that the families and children no longer experienced the freedom of earlier times.

Today the schools still do not require that the Native children learn their own languages and lifeways, but they are still expected to learn a new language and the related humanities and sciences. The majority of teachers are from the outside world and have little or no knowledge of the people with whom they are working. To the original people of the land, these are an immigrant people with a different way of being, thinking, behaving, and doing. Few teachers recognize that the indigenous people are not like other European immigrant groups, such as the Irish, French, or Italians who chose to leave their homeland. By not teaching the indigenous youngsters their own language and ways of doings things, the classroom teachers are signaling that the traditional language, knowledge, and skills are of little importance. The students begin to think of themselves as being less than other people. After all, they are expected to learn through a language other than their own, to learn values that are often in conflict with their own, and to learn a "better" way of seeing and doing things. They are taught the "American Dream," which in their case is largely unattainable without leaving behind who they are.

The messages from the school, the media, and other manifestations of Eurocentric society convey an inaccurate picture of the outside world to the Native students, as well as a distorted view of their own, which leads to a great deal of confusion over who they are and where they fit in the world. This loss of identity leads to guilt and shame at being Yupiaq or Athabascan or Tlingit. The resultant feelings of hurt, grief, and pain are locked in the mind to emerge as depression and apathy, which is further reinforced by the fear of failure in school, by ridicule from non-Natives, and by the loss of their spirituality. These are a few of the contributing factors as to why Native children do not excel in school.

Recently, however, many indigenous as well as non-indigenous people have begun to recognize the limitations of a monocultural education system, and new approaches have begun to emerge that are contributing to a better understanding of the relationship between indigenous ways of knowing and those associated with Western society and formal education.[11] Our challenge now is to devise a system of education for all people that respects the diverse epistemological and pedagogical foundations provided by both indigenous and Western societies, as well as those of other cultural traditions. While the

examples used here will be drawn primarily from the Alaska Native context, they are intended to be illustrative of the issues that emerge in any indigenous context where efforts are under way to reconnect education to a sense of place and its attendant subsistence practices and cultural manifestations.

When the Earth's Crust Was Thin

Alaska Native education in its customary forms was deeply rooted in the complexities and interactions associated with one's place in an interconnected universe, as illustrated by the following traditional Yupiaq story:

In Distant Time, when the earth's crust was thin, a crane is flying around looking for a likely place to eat. The sky is blue, the sun is shining, the tundra is warming. The crane decides to check out the weather. He begins to fly in a circle. Each time he completes the circle, he gains altitude. He looks at earth from a very high altitude. He then decides to descend and look for food. He flies over a river and sights a skin boat with people in it slowly paddling down the river. He continues his flight and sees a lake. He flies to it, and finds many kinds of berries. He is very hungry.

He lands on the river bank. He contemplates going back to the tundra to eat berries, but his mind cannot forget the people coming down the river. He knows that he could be hunted. He must think of a way to warn himself when the people approach. He sits there and thinks. He finally decides that he will use his eyes as sentries. He removes his eyes and puts them on a log. He instructs the eyes by telling them, "Now when you see people coming down the river, you warn me. I will come down and get you and fly off."

After telling them so, he goes back to the tundra and starts to eat berries. Soon he hears his eyes shout, "Crane, crane, there are people coming down the river!" He hurries down, finds his eyes, and puts them back into the sockets. He looks. There is only a log drifting down the river. The branches must have resembled people. He gets upset and says to his eyes, "Now you be very careful and make sure they are people before you call for me." He goes back to the tundra and eats. Soon, he hears his eyes calling him, "Crane, crane, there is a boat with people in it coming down the river. Come quick!" He hurries down to the log and picks up his eyes and looks. There is only a chunk of tundra drifting down. Tufts of grass move up and down with movements of the clump of tundra.

"Now, look eyes you have made a second mistake. Look very carefully before you call for me. I'm going back to eat some more berries."

Soon afterward, the eyes call, "Crane, crane, people are coming down the river in a boat." This time the crane does not heed the call. He is thinking, "Well, I suppose they see something else that might resemble a boat and people. This time I won't respond." He continues to eat. Soon the eyes call, "Crane, crane, the people are almost upon us. Come quick." He does not answer.

Some time elapses, then he hears the eyes calling from a distance, "Crane, crane, the people have us, and they're taking us down the river."

The crane runs down to the riverbank and finds the log. He feels around, but there are no eyes. He sits down and thinks, "What am I going to do for eyes?" After much thought and consternation at not being able to see, he ambles back to the tundra. A thought occurs to him, "Why not try berries for eyes?" With that he finds blackberries. He plops them into his eye sockets. Lo and behold, he sees, but the world is different shades of black and grey. This can't be, so he disposes of the blackberries. He finds salmonberries, and tries them. But the world is orange with its color variations and does not look right. So he gets rid of them. He tries cranberries, but again the world is not the right color. It shows a place of red hues.

Finally, he tries blueberries. This time, the skies are blue, the tundra is green and varied in color, the clouds are white. Whew, these are to be his eyes. And that is how the crane got blue eyes.[12]

Stories and myths such as these abound from Distant Time when the earth's crust was thin, when it was easy for people and animals to communicate or transform from one to the other. So, the story of how the crane got blue eyes must be understood within the Yupiaq frames of reference. The myth is an analogical way of relating to one's environment. It reflects the human mind's interpretation of the natural world and it has to do with conveying insights as well as relationships. The Yupiaq people accepted these stories on faith because of the need to know how to make a life for themselves. If people hold to a world-view that includes a language, an epistemology, and a metaphysic all contingent on nature, their understanding is naturally derived from their everyday interaction with the world around them. The Yupiaq child listened not only with the ears but with the mind and heart, all of which were essential to recognize the patterns and events from which natural laws were derived and on which survival was dependent—the sun will rise and descend on a reliable schedule each day, the seasons will maintain their annual cycle, the spruce seeds will germinate under the right conditions, and the caribou will behave in predictable ways.

These observations are illustrated in the story by the description of the crane flying in circles and ascending. The Yupiaq know that the tundra warms under the sun. This becomes visible as one looks out across the tundra and sees heat waves rising. They know the scientific principle that hot air rises. This is the principle that the crane is using to rise high into the air to look around. The scientific laws of nature merely describe what physicists, astronomers, astrophysicists and others have observed. The Native creative mythology deals with the whole physical, intellectual, emotional and spiritual aspects of these inner and outer ecologies. The Native person realizes that he or she is a microcosm of the whole in the universe.

Native people needed to take the lives of animals to live. To exhibit honor, respect, dignity, and reciprocation with the animals whose lives were taken, the people conceived and put into practice many rituals and ceremonies to communicate with the animals as spiritual beings. These are corroborated through the mythologies which are manifestations of fundamental organizing principles that exist within the cosmos affecting all our lives. It behooves the Yupiaq person to leave something behind, such as a piece of dry fish, when getting mouse food from the tundra. The mouse food is gathered in the early fall so that the mouse and its family will have the opportunity to collect more food for the winter. The seal when caught is given a drink of water so that its spirit will not be thirsty when it travels to the animal spirit kingdom. This is done to show respect to the animal for having shared and given its life to the hunter. Medicinal plants are gathered respectfully knowing full well their power to heal, recognizing that these were given freely by nature, and therefore they should be shared freely. The Alaska Native person is aware that if one does not use these gifts of Nature regularly, mindfully and respectfully, they will begin to diminish through disuse or misuse. Earth, air, water, fire, and spirit must always be in balance. All the elements and creatures have an important niche in the ecological system.[13] In the Western system natural resources are often approached in a fragmentary way such that an expert on harbor seals does not know what the expert on herring fish is doing. This type of research lends itself to measuring and objectifying the species studied, but it is not sufficient for sustaining balance in Mother Earth.

The question now is: How do we counteract the depression, hopelessness, and despair that derive from the unfulfilled promises of the modern world, and what role can schooling and education play in this effort? To address this question, it will be necessary to take a closer look at how traditional education fits into the lives of indigenous people.

Learning from Nature

It is through direct interaction with the environment that Alaska Native people learn most naturally. What they learn is mediated by their cultural cognitive map. The map consists of those understandings that have been learned over a long period of time. As Native people interact with nature, they carefully observe to find patterns or order where there might otherwise appear to be chaos. This empirical knowledge of their environment has to be general and specific at the same time. During their hunting trips into the tundra or on the ocean in the winter, they must have precise knowledge of the snow and ice conditions, so over many years of experience and observation they have classified snow and ice with terms having very specific meanings. For example, there are at least thirty-seven terms for ice in the Yupiaq language, having to do with seasons, weather conditions, solar energy transformations, currents, and rapid changes on wind direction and velocity. To the Yupiaq people, it is a matter of survival. This knowledge is passed down from generation to generation by example, by showing, and by telling with stories to reinforce the importance of knowing about the varying conditions.

This comprises the rational side of the indigenous people. The rational mind has the ability to see and store many bits of observed information, which can then be mulled over and shared with others for more ideas of what they may mean. This may evolve into a tentative assumption of how and why something is the way it is. Being self-aware through the subconscious and intuition, they let it play in their minds until a direction or answer evolves. They observe nature's indicators and come to a tentative supposition, followed by testing with further observation of variables that may affect the conclusion. They know that nature is dynamic and they have to change with it. Thus their conduct of life changes with nature. They pass on the truths to the next generation, knowing full well that changes in interpretation will occur, but that certain of their values, such as caring, sharing, cooperation, harmony, and interconnectedness with the created whole of their environment will continue. This then validates and gives dignity to their existence.

One cannot be conscious of the world without first being aware of oneself. To know who you are, what your place in the world is, and that you are to strive to seek life is what self-awareness is all about. It is the highest level of human knowledge, to know oneself so intimately that you are not afraid to tell others of life, and to help those that need help with compassion without being dragged down by the troubles of those

being helped. Knowledge of oneself is power, and you acquire it by looking into yourself to see what strengths and weaknesses you have. You accomplish this through looking at your own reactions to everyday situations, both good and bad.

To achieve a secure sense of oneself involves meditation, visualization, intuition, and tempering of all thoughts and actions with the "heart," which is on an equal plane with knowledge of the mind. "Heart" can best be explained by giving examples: to give freely of oneself to help a person with personal problems; to bring a little bird with a broken leg home and care for it to restore its health; to come upon a moose mired in soft snow and shovel the snow away to free it; to be motivated by kindness and care—these all involve the exercise of heart. You can recognize people with heart by the respect shown them by others through kind words, inclusion in community activities, and acceptance as a stable and commonsensical member of the community.

The Yupiaq people's careful and acute observational ability taught them many years ago the presence of a Creative Force. They saw birth and death in the human and in nature. This Creative Force flowed through everything—the years, months, days, rivers, lightning and thunder, plants, animals, and earth. They studied, they connected, and nature became their metaphysic. It gave them empirical knowledge. Products of nature extended to them ideas for developing their technology. The spider web provided the idea for the net; the snowshoe hare's feet and tracks, their snowshoes; the mouse's chamber lined with grass, their houses; the moon's phases, their calendar; the Big Dipper and the North Star, their timepiece at night; wind directions, their indicators of weather; flint and slate, their cutlery. Certain plants and herbs gave them their healing powers and they discovered that certain living things were adapted to live in certain areas, while others were able to make physical adjustments through changes in coloration, forming a heavier coat for winter, hibernation, estivation, etc., all under trying conditions. They noticed change across time and conditions, and they recognized that they too would have to change with time and conditions to survive.

Their wisdom transcended the quantification of things to recognize a qualitative level at which the spiritual, natural, and human worlds were inextricably interconnected. This was accomplished through the Creative Force having endowed all earthly things with spirits, which meant that they would have to deal with all things being alive and aware. Having a Raven as creator of man and woman and everything else ensured that humans would never be superior to the other elements of

creation. Each being endowed with a spirit signified that it possessed innate survival skills. It had the will to live, propagate, and care for itself, thus the need to respect everything and to have taboos, rituals, and ceremonies to keep the three realms in balance.

Nature's indicators and voices give much knowledge for making a living, but the intuitive and spiritual knowledge gives wisdom to make a life. Therein lies the strength and tenacity with which indigenous people continue to maintain their identity, despite assaults on the philosophical, epistemological, ontological, economic, and technological fronts. Their template has certainly eroded, but the continuity of their ways to comfort and create harmony persists. As long as the indigenous peoples' spirituality is intact, they will persevere.

Indigenous Knowledge and Western Schooling Converge

As illustrated previously, while Western education tends to emphasize compartmentalized knowledge that is often de-contextualized and taught in the detached setting of a classroom or laboratory, indigenous people have traditionally acquired their knowledge through direct experience in the natural world. For them, the particulars come to be understood in relation to the whole, and the "laws" are continually tested in the context of everyday survival. Western thought also differs from indigenous thought in its notion of competency. In Western terms, competency is often assessed based on predetermined ideas of what a person should know, which are then measured indirectly through various forms of "objective" tests. Such an approach does not address whether that person is actually capable of putting that knowledge into practice. In the traditional Native sense, competency has an unequivocal relationship to survival or extinction—if you fail as a caribou hunter, your whole family may be in jeopardy. You either have it, or you don't, and it is tested in a real-world context.[14]

The American Association for the Advancement of Science has begun to recognize the potential contributions that indigenous people can make to our understanding of the world around us.[15] In addition to sponsoring a series of symposia on "Native Science" at recent annual meetings, AAAS has published a *Handbook on Traditional Knowledge and Intellectual Property* to guide traditional knowledge holders in protecting their intellectual property and maintaining biological diversity.[16] In the handbook, AAAS defines traditional knowledge as follows:

> Traditional knowledge is the information that people in a given community, based on experience and adaptation to a local culture and environment, have

developed over time, and continue to develop. This knowledge is used to sustain the community and its culture and to maintain the genetic resources necessary for the continued survival of the community.[17]

Indigenous people do a form of "science" when they are involved in the annual cycle of subsistence activities. They have studied and know a great deal about flora and fauna, and they have their own classification systems and versions of meteorology, physics, chemistry, earth science, astronomy, botany, pharmacology, psychology, and the sacred.[18] For a Native student imbued with an indigenous, experientially grounded, holistic world view, typical approaches to schooling can present an impediment to learning, to the extent that they focus on compartmentalized knowledge with little regard for how academic subjects relate to one another or to the surrounding universe.

To bring significance to learning in indigenous settings, the explanations of natural phenomena are best understood by students if they are cast first in indigenous terms to which they can relate, and then explained in Western terms. For example, when choosing an eddy along the river for placing a fishing net, it can be explained initially in the indigenous way of understanding, pointing out the currents, the movement of debris and sediment in the water, the likely path of the fish, the condition of the river bank, upstream conditions affecting water levels, the impact of passing boats, etc. Once the students understand the significance of the knowledge being presented, it can then be explained in Western terms, such as flow, velocity, resistance, turbidity, sonar readings, tide tables, etc., to illustrate how the modern explanation adds to the traditional understanding (and vice versa). All learning can start with what the student and community already know and have experienced in everyday life.[19] The indigenous student (as with most students) will then become more motivated to learn when the subject matter is based on something useful and suitable to the livelihood of the community and is presented in a way that reflects a familiar world-view.[20]

Since Western perspectives influence decisions that impact every aspect of indigenous people's lives, from education to fish and wildlife management, indigenous people themselves have begun to take an active role in re-asserting their own traditions of knowing in various research and policymaking arenas.[21] As a result, there is a growing awareness of the depth and breadth of knowledge that is extant in many indigenous societies and its potential value in addressing issues of contemporary significance, including the adaptive processes associated with

learning and knowledge construction. The following observation by Bielawski illustrates this point:

> Indigenous knowledge is not static, an unchanging artifact of a former lifeway. It has been adapting to the contemporary world since contact with "others" began, and it will continue to change. Western science in the North is also beginning to change in response to contact with indigenous knowledge. Change was first seen in the acceptance that Inuit (and other Native northerners) have knowledge, that is, "know something." Then change moved to involving Inuit in the research process as it is defined by Western science. Then community-based research began, wherein communities and native organizations identified problems and sought the means to solve them. I believe the next stage will be one in which Inuit and other indigenous peoples grapple with the nature of what scientists call research.[22]

Such an awareness of the contemporary significance of indigenous knowledge systems has entered into policy development arenas on an international level, as is evident in the following statement in the Arctic Environmental Protection Strategy:

> Resolving the various concerns that indigenous peoples have about the development of scientific based information must be addressed through both policy and programs. This begins with reformulating the principles and guidelines within which research will be carried out and involves the process of consultation and the development of appropriate techniques for identifying problems that indigenous peoples wish to see resolved. But the most important step that must be taken is to assure that indigenous environmental and ecological knowledge becomes an information system that carries its own validity and recognition. A large effort is now underway in certain areas within the circumpolar region, as well as in other parts of the world, to establish these information systems and to set standards for their use.[23]

Indigenous societies, as a matter of survival, have long sought to understand the regularities in the world around them, recognizing that nature is underlaid with many unseen patterns of order. For example, out of necessity, Alaska Native people have made detailed observations of animal behavior (including the inquisitiveness of caribou). They have learned to decipher and adapt to the constantly changing patterns of weather and seasonal cycles. The Native elders have long been able to predict weather based upon observations of subtle signs that presage what subsequent conditions are likely to be. The wind, for example, has irregularities of constantly varying velocity, humidity, temperature, and direction due to topography and other factors. There are nonlinear

dimensions to clouds, irregularities of cloud formations, anomalous cloud luminosity, and different forms of precipitation at different elevations. Behind these variables, however, there are patterns, such as prevailing winds or predictable cycles of weather phenomena that can be discerned through long observation (though global climate change is taking its toll on weather predictability). Over time, Native people have observed that the weather's dynamic is not unlike the mathematical characteristics of fractals, where patterns are reproduced within themselves and the parts of a part are part of another part which is a part of still another part, and so on.[24]

For indigenous people there is a recognition that many unseen forces are at play in the elements of the universe and that very little is naturally linear, or occurs in a two-dimensional grid or a three-dimensional cube. They are familiar with the notions of conservation of energy, irregularities in patterns, and anomalies of form and force. Through long observation they have become specialists in understanding the interconnectedness and holism of our place in the universe.[25]

The new sciences of chaos and complexity and the study of nonlinear dynamic systems have helped Western scientists to also recognize order in phenomena that were previously considered chaotic and random. These patterns reveal new sets of relationships which point to the essential balances and diversity that help nature to thrive. Indigenous people have long recognized these interdependencies and have sought to maintain harmony with all of life. Western scientists have constructed the holographic image, which lends itself to the Native concept of everything being connected. Just as the whole contains each part of the image, so too does each part contain the makeup of the whole. The relationship of each part to everything else must be understood to produce the whole image. With fractal geometry, holographic images and the sciences of chaos and complexity, the Western thought-world has begun to focus more attention on relationships, as its proponents recognize the interconnectedness in all elements of the world around us.[26] Thus there is a growing appreciation of the complementarity that exists between what were previously considered disparate and irreconcilable systems of thought.[27]

The incongruities between Western institutional structures and practices and indigenous cultural forms will not be easy to reconcile. The complexities that come into play when fundamentally different world-views converge present a formidable challenge. The specialization, standardization, compartmentalization, and systematization that are inherent features of most Western bureaucratic forms of

organization are often in direct conflict with social structures and practices in indigenous societies, which tend toward collective decision making, extended kinship structures, ascribed authority vested in elders, flexible notions of time, and traditions of informality in everyday affairs.[28] It is little wonder then that formal education structures, which often epitomize Western bureaucratic forms, have been found wanting in addressing the educational needs of traditional societies.[29]

When engaging in the kind of comparative analysis of different world-views outlined above, any generalizations should be recognized as indicative and not definitive, since indigenous knowledge systems are diverse themselves and are constantly adapting and changing in response to new conditions. The qualities identified for both indigenous and Western systems represent tendencies rather than fixed traits, and thus must be used cautiously to avoid overgeneralization.[30] At the same time, it is the diversity and dynamics of indigenous societies that enrich our efforts as we seek avenues to integrate indigenous knowledge systems in a complementary way with the system of education we call schooling.[31]

Conclusion

An underlying theme of this chapter has been the need to reconstitute the relationship between indigenous peoples and the immigrant societies in which they are embedded. By documenting the integrity of locally situated cultural knowledge and skills and critiquing the learning processes by which such knowledge is transmitted, acquired, and utilized, Alaska Native and other indigenous peoples are engaging in a form of self-determination that will not only benefit themselves, but will open opportunities to better understand learning in all its manifestations and thus inform educational practices for everyone's benefit. Traditional processes for learning to hunt caribou by observation and meaningful participation can offer insights into how we create opportunities for students learning to operate a computer. To overcome the long-standing estrangement between indigenous communities and the external institutions impacting their lives, all parties in this endeavor (community, school, higher education, state and national agencies) will need to form a true multilateral partnership in which mutual respect is accorded to the contributions that each brings to the relationship.[32] The key to overcoming the historical imbalance in that regard is the development of collaborative research endeavors specifically focusing on education and indigenous knowledge systems, with primary direction

coming from indigenous people so they are able to move from a passive role subject to someone else's agenda to an active leadership position with explicit authority in the construction and implementation of the research initiatives.[33]

In this context, the task of achieving broad-based support hinges on our ability to demonstrate that such an undertaking has relevance and meaning in the local indigenous contexts with which it is associated, as well as in the broader social, political, and educational arenas involved. By utilizing research strategies that link the study of learning to the knowledge base and ways of knowing already established in the local community and culture, indigenous communities are more likely to find value in what emerges and be able to put the new insights into practice toward achieving their own ends as a meaningful exercise in real self-determination. In turn, the knowledge gained from these efforts will have applicability in furthering our understanding of basic human processes associated with learning and the transmission of knowledge in all forms.

NOTES

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