BCS 311: Land and Environments of the Circumpolar World I

Module 1: Environmental Knowledge: Development and Quality Assessment

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Overview

This module compares and contrasts traditional and scientific knowledge as ways to understand the world. Both belief systems are designed to produce reliable information with which sound decisions can be made, and require careful observation and interpretation. Yet, the information is acquired and shared differently. Understanding the circumpolar North requires an understanding of the peoples who live in it, including ways they see and interact with the environment. This module introduces traditional knowledge as an alternative way of looking at topics and approaches explored in subsequent modules using a scientific perspective. After this module students should be able to better understand how an individual's belief system helps shape his or her understanding of the environment and apply this understanding to the remainder of the course's topics.

Learning Objectives

Upon completion of this module, you should be able to:

1. Explain how science-based and Indigenous knowledge about the northern environment is acquired, preserved and transferred to future generations.

2. Recognize key similarities and differences between Indigenous traditional and Western knowledge systems.

3. Explain how research funding, hypothesis falsification, observation and peer review contribute to the acquisition and communication of scientific knowledge.

4. Define criteria that can be used to evaluate the quality of scientific and Indigenous knowledge about the environment.

Required Readings

Huntington, H.P., T. Callaghan, S. Fox and I. Krupnik. 2004. Matching traditional and scientific observations to detect environmental change: a discussion on Arctic terrestrial ecosystems. *Ambio* 33(7): 18-23.

Noongwook, G., the Native Village of Savoonga, the Native Village of Gambell, H.P. Huntington and J.C. George. 2007. Traditional knowledge of the bowhead whale (*Balaena mysticetus*) around St. Lawrence Island, Alaska. *Arctic* 60(1):47-54.

Key Terms and Concepts

- Acquisition of Knowledge
- Belief Systems
- Scientific Knowledge
- Traditional Knowledge
- Transmission of Knowledge

Learning Material

Introduction

Most, if not all, human **belief systems** center on relationships with ourselves; with God, gods, or spirits; with other people; and with the rest of the world. Knowledge is an important aspect of these systems and relationships. Emotional attachments and responses are also important and often referred to as “transcendent,” taking us out of our normal patterns of understanding or behavior. Wisdom, the ability to apply knowledge and emotion appropriately, is essential to forming sound, lasting relationships. Knowledge, emotion and wisdom are not independent, but combine to make us what we are, make us human, allow us to create societies in which we nurture and sustain one another. In the circumpolar North, with its diversity of Indigenous and other peoples and communities, an understanding of different knowledge systems is essential if we are to understand one another, communicate effectively, and successfully live and work together.

Learning Highlight 1

We gather information for practical use and because we are curious. How we make sense of that information is our belief system.

Different belief systems have different ways of looking at the world and dividing, classifying and determining what is important. Many people distinguish between **traditional knowledge** and **scientific knowledge**. Papers have been written that attempt to explain the features of each type of knowledge (Berkes, 1999), compare and contrast key elements (Stevenson, 1996), and discuss ways of connecting the two types of knowledge (Johannes, 1981; Pierotti and Wildcat, 2000, Huntington et al. 2004a, 2004b). Neither traditional knowledge nor scientific knowledge are uniform, monolithic

systems of belief or practice. Instead, traditional and scientific knowledge are labels that attempt to encompass a wide range of belief systems for the sake of convenience or (over)simplification (Agrawal, 1995).

The goal of this module is to discuss ways of knowing and their implications for understanding the circumpolar North. Most belief systems prescribe certain actions be taken to increase the likelihood of desired outcomes. A recognition that many belief systems may be partly or completely incomprehensible to one another is an important step towards understanding biases any belief system entails and towards achieving the humility needed to approach another belief system as one who is ready to learn.

Learning Activity 1

As you read about traditional and scientific belief systems, make a list of the features of your personal belief system.

1.0 Acquiring Knowledge

We acquire knowledge to make sense of the world, understand where we fit and explore our relationships. Some of our desire to obtain knowledge is pragmatic. E.g., Where can we find food or shelter? What hazards should we avoid? We are also curious and seek information about many things that appear to have little or no practical use. We take what we learn and organize the knowledge, looking for patterns, connections and classifications. These actions produce emotions, feelings that tell us whether something is pleasurable or painful, which in turn may lead us to consider why we feel that way. We are often led to ponder moral, divine or spiritual forces that shape our being and allow us to turn knowledge and emotion into wisdom, particularly when we consider the consequences of our actions, e.g., sense of right or wrong.

There are as many ways to construct this web of knowledge, emotion and wisdom as there are people (Ingold and Kurtilla, 2000). Different groups of people share common beliefs, understandings and values and therefore can be recognized as having distinct cultures. Cultural boundaries are rarely fixed and clear. Cultures may be lumped or split. The distinction between “traditional” and “scientific” is, in this sense, a very basic division of knowledge systems into two types (Agrawal, 1995). Within either category many distinctions can be made and any attempt to define either category quickly encounters contradictions or qualifications that threaten to undermine the initial assumption of the two knowledge systems.

It is useful to consider the elements of such systems and their implications for understanding the environment in the circumpolar North. Knowledge and belief systems shape understanding of the world and guide the selection of actions to be taken. An awareness of the basis for other people’s views is required for effective communication, which is necessary for working together and undertaking collaborative action. Responding effectively and appropriately to challenges in the circumpolar North (e.g., economic, cultural and climate-change) increasingly requires mutual understanding among people with different worldviews (Pierotti and Wildcat, 2000). The more we understand the basis for our own views, the more likely we are to understand how others may see things differently.

Our senses gather information from our surroundings and these observations form the foundation of our knowledge of the world; but, they are not the only source of information upon which people rely. Emotion is important, encompassing intuition and the sense of spiritual connection implied when a hunter says he or she can “feel” the presence of an animal (Watson and Huntington, 2008). The way we use information from observation and emotion is largely dependent upon the belief system we use.

2.0 Scientific Knowledge

A basic principle of the scientific approach is to separate emotion and other “subjective” influences from what can be independently and consistently observed by different people. In this system, temperature can be measured in degrees by a thermometer, but “hot” and “cold” are subjective value judgments rather than objective measurements. The intent is to understand the world through rigorous, impersonal exploration of specific phenomena with explicit acknowledgment of potential biases, limitations and uncertainties. The important characteristic of the natural science system is the idea that data – observations and measurements – are appropriate inputs for analysis and the foundation for action.

Learning Highlight 2

Science aims for the impersonal and objective. Traditional knowledge often relies on emotion and observation.

Scientific knowledge is typically generated by formal studies or projects designed to examine a specific topic often through testing of hypotheses. A hypothesis is a statement that can be tested by observation or analysis, such as “moose browse on willows during winter,” or “climate change will lead to less sea ice in the Arctic Ocean in summers.” A good hypothesis can be proven false by observation, which requires altering the theory that helps explain relationships between parts of the environment. Scientific research is dependent upon funding, the limitations of which may not allow all interesting or important questions to be addressed. Scientific studies vary in duration and typically last a few years, apart from a handful of long-term studies (e.g., sea ice cover (National Snow and Ice Data Center) and permafrost (Circumpolar Active Layer Monitoring Network)). The duration of the study can limit the breadth and scope of inquiry though it also promotes results-driven activities to justify further funding.

Once a study is completed, the results are written and, ideally, published in a scientific journal. Such publication includes the process of peer review through which the report (and sometimes the underlying data) is reviewed by scientists with relevant expertise but who were not involved in the project. Their judgment concerning the soundness of the research determines whether the report will be published, sent back to the author(s) for revision or rejected. This formal system of evaluation is characteristic of the scientific process. It places considerable time and effort into ensuring the validity of findings before they are incorporated into the overall body of scientific knowledge.

3.0 Traditional Knowledge

Most approaches to knowledge incorporate other sources of information, especially from the emotional, intuitive and spiritual realm. Cultures from around the world, including the circumpolar North, place great importance on dreams, visions, following one's feelings, and being guided by wisdom and observation. The goal can be entirely material and pragmatic, such as providing food for one's family. The actions involved are often considered part of a wider system of belief and practice with ramifications for the present and future. In this view, a successful hunt not only produces food, but also sustains the relationships that connect the hunter with the animal thereby also providing for future hunts. Human intention and the intention of the animal or other part of the natural world are as important as, if not more than, the direct physical interaction that takes place. Failure to take emotional aspects into account leads to problems (Noongwook et al., 2007; Watson and Huntington, 2008).

The emotional and spiritual dimensions of traditional knowledge should not obscure the fact that, as with scientific knowledge, reliability is essential. Holders of traditional knowledge may often literally stake their lives on its accuracy. Traveling across dangerous terrain, such as frozen rivers or sea ice, requires the ability to recognize hazards and know how to avoid them or rescue oneself or others in case of accident. Similarly, feeding one's family and community depend on knowing where to find food and how to acquire it. Without such knowledge, starvation is highly likely.

Traditional knowledge has been tested over generations. The fact that northern peoples have survived and thrived in their environment is a testament to the depth of their knowledge. As one northern scholar put it, the more time one spends on the land with peoples of the North, the less one asks questions and simply accepts what people have to say (Nelson, 1969). This is not to say that traditional knowledge should be accepted uncritically. It is simply a comment on the respect that should be shown to those who have proven their skill and expertise time and again in the most rigorous manner.

An important aspect of any belief system is the way it classifies things it encompasses. Scientific study typically distinguishes between observer and subject. In the natural resources field humans are a category separated from the "natural" world, distinguished by our abilities to think, feel and act. Distinctions may be made elsewhere in other systems. Many northern cultures hold the raven as sacred or special, to be treated differently from other birds. The line between animate and inanimate may be drawn in different places. The root of animate is "anima" or spirit and in European culture is typically associated with animal. In other cultures, wind, water and fire may also be animate in the sense of having spirits, intentions and the ability to act on their own (Natcher et al., 2007).

Learning Activity 2

Think of situations in which what you *feel* may be as important as what you *know*. How do your feelings help guide your actions?

The way information is gathered is a key consideration. Scientific approaches seek the impersonal and universal, in which any observer should obtain the same result with the same degree of effort and basic method of study. Many belief systems regard the relationship between a person and an animal or other part of the world as a transaction between individuals, often with reference to a specific location (Pierotti and Wildcat, 2000). For example, a moose gives itself to a worthy hunter and then returns again in

moose form, while the scientific view would perceive a moose population to have a harvestable excess with a reproductive rate that yields replacements. This also applies to counting or measuring. For some cultures, the question of animal numbers is largely meaningless since the animals decide whether they are to be seen by people or whether they will give themselves to hunters. In those cultures, the sense of whether relationships between people and the world around them are healthy is likely to be more important than a numerical count of one environmental parameter or another (Fienup-Riordan, 1999).

Learning Highlight 3

Traditional knowledge is confirmed by personal experience and observation. Scientific knowledge is checked by peer review.

4.0 Transmitting and Sharing Knowledge

Knowledge is acquired by individuals and transmitted to others. Transmission of observations, information and experience may be done to teach others, initiate discussion or generate new knowledge by comparing what individuals have learned. During transmission, knowledge may be evaluated or tested to ensure relevance and accuracy before others put it to use. Cultural practices are crucial in determining how knowledge transfer is practiced.

Direct observation or experience – seeing it for oneself – is often regarded as the most reliable way of obtaining information. Many systems of transmitting knowledge rely on acquiring hands-on experience, whether by imitation of others more skilled or knowledgeable or by trying something on one's own after some form of explanation or description. In some cultures "ownership" of knowledge may rely largely on direct, personal experience. In Shaktoolik, Alaska, one elder described a certain phenomenon and another elder turned to me and said, "I'll watch for that this spring. When I see it, then I'll be able to tell you, too." He was not casting doubt on the other person's statement, but affirming the importance of personal confirmation before he could make the statement himself. Similarly, whalers in Savoonga, Alaska, when they repeat information learned from someone else indicate from whom the information came so the listener will know the provenance and be able to gauge it's applicability for him- or herself (Noongwook et al., 2007).

As knowledge accumulates, it is not possible to learn all things by direct, personal experience. Stories can be used to transmit information, values, beliefs and important cultural knowledge (Cruikshank, 1998). Stories may be especially important for unusual phenomena or experiences not everyone may have had. Where safety is concerned,

awareness of rare conditions may be vital and the opportunity to learn solely from personal experience may come too late to be useful. Descriptions of such times, particularly concerning how someone survived can be life-saving. Other experiences, particularly visions or spiritual encounters, may happen to only a few people who then tell others adding to the collective knowledge and wisdom of the group.

Learning Activity 3

Do an Internet search for scientific and traditional knowledge courses. Is there any difference in number? Why?

In the scientific realm knowledge is transferred by formal instruction, reading, lectures and other means. In most cases, presentation of research results or findings follows a reliable formula, including research objectives, methods, results, analysis and discussion. Stories are rarely used. Greater emphasis is placed on data and the process of logical progression by which one step leads inevitably to the next to support a conclusion. Unusual findings are typically discounted or regarded with skepticism. Instead, emphasis is placed on finding a reliable pattern that can be explained by factors understood by science. Spiritual and non-physical phenomena are ignored as causal explanations or even, in most cases, as topics for study.

Evaluation of knowledge typically occurs during, before and after transmission. During transmission the recipient will likely make an initial judgment of the reliability and suitability of information he or she is receiving. In any belief system, the reputation of the source is a factor in evaluation. Some scientific journals do not reveal the name(s) of author(s) during peer review in an effort to avoid the influence of reputation or bias based on prior interactions between reviewer and author. This process is designed to provide confidence in the findings of scientists one does not personally know. Comparison with personal experience and prior knowledge is a factor. Most belief systems are conservative and treat with skepticism any information that runs contrary to accepted understanding. For example, Copernicus's assertion the earth revolves around the sun was at first rejected by most people.

In Barrow, Alaska, in the late 1800s, commercial whalers from the eastern United States brought with them new ideas about proper behavior when whaling. Iñupiat whalers expected the newcomers to fail. When they did not fail, some Iñupiat thought traditional ways did not apply to the newcomers, but still applied to Iñupiat. Some Iñupiat followed the ways of the newcomers and still succeeded, undermining traditional ways (Brower, 1942). Nonetheless, many traditional beliefs associated with whaling persist today, indicating the adoption of new practices is not an all-or-nothing step, but more likely a matter of melding and synthesis.

Transmission of knowledge is a social process involving interpersonal relationships and operating in a system of behavioral expectations, cultural norms or patterns of language use (Briggs, 1986). In some cultures directly questioning the basis for an assertion may be regarded as rude, particularly if a younger person questions an older one. In other cultures, such as the scientific culture, probing questions may be a sign of respect, of taking the other person seriously by challenging an assertion in order to find holes or weaknesses that can be fixed to prevent mistakes from becoming accepted as valid knowledge. Such rules are rarely fixed but instead governed by many conditions, from how well individuals know one another, tone of voice or body language, relative social standing and so on. However, in all cases it is important to understand the social setting and system or be aware that one's own expectations and norms may differ from others.

Transmission of knowledge is not guaranteed. In the modern era, with less time spent on the land and more time spent indoors in communities, traditional knowledge is in danger of being lost. Scientific knowledge is taught in schools and considerable resources are dedicated to conducting research, making data available and publishing results. Traditional knowledge occurs informally as parents teach children by example and each generation tests by doing and adds by experience. As those experiences become less frequent, information is inevitably lost.

Learning Activity 4

How would you help promote the transmission and retention of traditional knowledge in northern communities?

Rapid environmental and technological change exacerbates this shift as older knowledge may no longer be accurate and easier means of acquiring information become available. Access to information acquired from earth-orbiting satellites (e.g., Geographic Positioning System (GPS) device or maps displayed on Google Earth) can make navigation simple and reliable supplanting generations of knowledge about the landscape. Neither technology can provide the wisdom to act appropriately on the information they provide. Knowing which direction to go is not the same as knowing whether to travel or stay, which requires evaluating weather conditions, the abilities and needs of the group, and other interrelated and subjective factors.

Learning Highlight 4

Traditional knowledge is in danger of being lost in many areas.

Technology is an imperfect replacement but can be helpful.

Conclusion

The development of knowledge occurs within the norms and expectations of a belief system. When generating and using knowledge, it is essential to keep in mind the underlying belief system or systems involved and recognize the roles of emotion and wisdom in making use of knowledge. We are guided by heart and soul as well as our brains. We need to keep human nature and human belief in mind as we develop the relationships that bind us to the world.

As we learn about the circumpolar North, it is essential to remember different ways in which one can see and understand the world. Doing so requires humility to put one's own beliefs no higher than those of others, patience to recognize that learning takes time and involves mistakes, and commitment to know that the journey is worthwhile, not just for the sake of understanding the northern environment or any other goal, but also for the relationships one builds along the way.

This module serves as an entry point for our exploration of the physical and biological environments of the circumpolar North. In the modules that follow students will examine the processes that operate within the earth's physical spheres: the atmosphere (Module 2), the lithosphere (i.e., solid earth, Modules 3 and 4), and the hydrosphere (i.e., water in its various physical states – vapour, liquid and ice; Modules 2 and 7). These processes drive the exchange and transformation of energy and matter in the atmosphere; in lakes, rivers and oceans; in the cryosphere; and in soils and rocks. The biosphere, that part of earth-atmosphere system that supports life and lies at the intersection of the three physical spheres, incorporates terrestrial and aquatic environments. The processes that influence the distribution, abundance and diversity of plants and animals inhabiting the circumpolar region are examined in Modules 5, 6 and 7. The course finishes with an exploration of the processes that drive climate change in the circumpolar region and the impacts of these changes on the flora, fauna and human populations.

Discussion Questions

1. Give examples of traditional (or experience-based) and scientific knowledge from your own life or community. When do you find traditional knowledge most useful? When do you find scientific knowledge most useful?

2. Science has a well-developed system of peer review and other procedures that ensure results are carefully checked before being accepted by the scientific community. How is this function performed in the case of traditional knowledge? How do people know when to trust what they hear from others?

3. What obstacles may arise when trying to share information from traditional to scientific knowledge or vice versa? What suggestions do you have for overcoming these obstacles? How can traditional knowledge and scientific knowledge systems better communicate?

Study Questions and Answers

1. List at least two ways traditional knowledge is acquired and two ways scientific knowledge is acquired.

   Traditional knowledge: observation, experience, learning from others (e.g., stories, songs, dances, artwork)
   Scientific knowledge: Observation, experiment, measurement, modelling

2. Why is a person's belief system important in understanding how people interpret their observations?

   Each belief system is a framework for making sense of what one observes. The same observations may be interpreted differently depending on one's worldview. Before concluding that the other person does not understand, it is important to consider how his or her belief system may help shape his or her view of a given set of observations.

3. Give examples to show why the transmission and sharing of traditional and scientific knowledge is important.

   Traditional knowledge: An individual's own experiences cannot be as broad as the experiences of an entire group of people. Learning from others can help identify unusual events or circumstances, allowing everyone to benefit from one person's rare experience. (Other answers are possible!)
   Scientific knowledge: Scientific fields are too large and diverse for any individual to become expert in them all, much less gain first-hand knowledge. Transmission of reliable findings through publication in peer-reviewed scientific journals is a way to make one's results available to a broad scientific audience.

4. Why are stories not commonly used to transmit scientific knowledge?

   Stories typically reflect the personalities and experiences of the person telling the story. Science typically aims for impersonal, objective description, separating the information from the individual presenting it.

Glossary of Terms

Belief System: one of many ways of organizing one's understanding of the world in order to create a coherent view of one's surroundings and place therein.

Scientific Knowledge: knowledge acquired by systematic, rigorous, replicable, objective procedures designed to reduce the role of personal bias.

Traditional Knowledge: knowledge acquired by experience and observation, transmitted within a community or culture, including emotional and spiritual dimensions.

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Supplementary Resources

Exchange for Local Observations and Knowledge in the Arctic (ELOKA)
www.eloka-arctic.org
This project provides support for community-based research and monitoring efforts in the North. The website provides links to various projects, emphasizing traditional knowledge and the connections between science and traditional knowledge.

Snowchange
www.snowchange.org
This program supports community-based learning and adaptation around the North, with connections to other regions of the world as well. The website provides information about Snowchange activities, including several major conferences as well as research projects and results. Traditional knowledge is a major component of Snowchange's efforts.