

## **ABORIGINALS AND SCIENCE - A CANADIAN CONTEXT**

### **Course Objectives:**

Glen Aikenhead, in his essay “Integrating Western and Aboriginal Sciences: Cross-Cultural Science Teaching” talks about the alienation process that takes place in science classrooms and how Aboriginal students in his Canadian context are particularly vulnerable to this alienation. Western science, however, is still “a major global influence in [Aboriginal] lives,” says Aikenhead, and “alienation reduces their effectiveness at 'legitimate peripheral participation' in community matters related to science and technology”. The purpose of this class, then, is to introduce students to these complexities of Aboriginal participation in the fields of science and technology, with a particular emphasis on education. At first students will be introduced to Aboriginal world-views as they pertain to science in society; they will then be introduced to initiatives which are seeking to incorporate Aboriginal world-views and cultural values into science education and research at an elementary and post-secondary level; and the final part of the course will focus on specific community cases and initiatives related to science and technology. The readings and websites are not exhaustive and students will be encouraged to find other literature related to each subject.

### **Course Requirements / Procedures:**

The course will, ideally, follow a seminar-format. Classes will also, ideally, alternate between required readings/resources and student-initiated readings/resources. For each sub-section, students will be asked to report to the class on one of the required readings and, for the weeks following those readings, report to the class on a student initiated reading/resource. Format of presentations will be discussed with the students. Formats could include a strictly oral report, a written report to hand out to the class, a series of questions related to each subject posed to the class, a prepared dialogue with another student in the class and/or other suggestions. The teacher will also make an effort to communicate with a local elder(s) / Aboriginal leader(s) in the area to see if there is an interest in joining the class for one or more of the sessions. A larger final project would be expected, format to be discussed. If the opportunity arose for projects to be presented at a local elders meeting, having students present their projects in class and at the meeting would be ideal. Depending on the geographic location of the class, students will be asked to find at least one local topic/resource/reading to present on for one of their presentations. There will, with respect to this requirement, also be time reserved in a class session near the beginning of the course to discuss relevant Aboriginal history and contemporary Aboriginal social settings as they relate to the geographic setting of the course.

## **I. Aboriginals, Science, Capitalism and Marxism: A Collision of World-Views**

*Marxism and Native Americans*. Edited by Ward Churchill Boston: South End Press, 1983(?).

Deloria, Vine Jr. *Spirit and Reason*. Golden, CO: Fulcrum Publishing, 1999.  
*Selected Essays*

“Oren Lyons – The Faithkeeper,” Interview with Bill Moyers. Public Access Television. July 3, 1991 [http://www.ratical.org/many\\_worlds/6Nations/OL070391.html](http://www.ratical.org/many_worlds/6Nations/OL070391.html)

“Lessons in Learning: The cultural divide in science education for Aboriginal learners.” Canadian Council on Learning. [http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LinL20070116\\_Ab\\_sci\\_edu.htm](http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LinL20070116_Ab_sci_edu.htm) (accessed March 4, 2009).

## **II. Aboriginals And Science Education**

### ***Elementary and Secondary, Statistics and Initiatives***

Environmental Sciences and Fisheries Roadshow.  
<http://www.roadshow.ubc.ca/staticpages/index.php?page=20070906110238204> (accessed March 4, 2009).

“Planning Guide and Framework for Development of Aboriginal Learning Resources.” British Columbia Ministry of Education, Aboriginal Education.  
<http://www.bced.gov.bc.ca/abed/planguide/welcome.htm> (accessed March 4, 2009).

First Nations Education Steering Committee. <http://www.fnesc.ca/>

### ***Elementary and Secondary, Research***

Aikenhead, Glen. “Integrating Western and Aboriginal Sciences: Cross-Cultural Science Teaching.” *Research In Science Education* 31, no. 3 (2001).

Glen Aikenhead's Webpage. <http://www.usask.ca/education/people/aikenhead/> (accessed March 4, 2009).

### ***Post-Secondary, Statistics and Initiatives***

Aboriginal Canada Portal, Education.  
<http://www.aboriginalcanada.gc.ca/acp/site.nsf/en/ao28010.html>

First Nations University of Canada, Department of Science  
<http://www.firstnationsuniversity.ca/default.aspx?page=30>

“Statistics by Subject.” Statistics Canada. [http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm?Lang=Eng&SP\\_Action=Main-Principal&SP\\_Mode=2](http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm?Lang=Eng&SP_Action=Main-Principal&SP_Mode=2) (accessed March 4, 2009).

“Aboriginal Education.” Ministry of Advanced Education and Labour Market Development. <http://www.aved.gov.bc.ca/aboriginal/> (accessed March 4, 2009).

### ***Post-Secondary, Research***

Dyck, Lillian E. “An Analysis of Western, Feminist and Aboriginal Science Using the Medicine Wheel of the Plains Indians.” *Native Studies Review* 11, no. 2 (1996).

## **III. Aboriginals, Science and the Community**

### ***Traditional Knowledge and Public Participation***

Weinstein, Martin S. “Sharing Information or Captured Heritage: Access to Community Geographic Knowledge and the State's Responsibility to Protect Aboriginal Rights in British Columbia.” Digital Library of the Commons. <http://dlc.dlib.indiana.edu/archive/00000184/> (accessed March 4, 2009).

Gilchrist, Grant, Mark Mallory and Flemming Mertel. “Can Local Ecological Knowledge Contribute to Wildlife Management: Case Studies of Migratory Birds.” *Ecology and Society* 10, no. 1 (2005). <http://www.ecologyandsociety.org/vol10/iss1/art20/> (accessed March 20, 2009)

Monastersky, Richard. The Social Pole? *Nature* 457 no. 26 (February 2009), 1077-1078.

Wertheim, Margaret. “The Way of Logic.” *New Scientist* 148 (December 2, 1995) 38-41.

### ***Sample Health Issues***

Debruyn, Adrian M H. “Ecosystemic Effects of Salmon Farming Increase Mercury Contamination in Wild Fish.” *Environmental Science and Technology* 40 (2006).

National Aboriginal Health Organization. <http://www.naho.ca/english/index.php>

### ***Science/Economic Issues – Case***

Helen Polychronakos, “Two Towns, One Choice,” *theTyee*, May 22, 2007. <http://thetyee.ca/News/2007/05/22/SalmonFarms/> and

Helen Polychronakos, “Economy vs. Ecology in Fish Farms Debate,” *theTyee*, May 24, 2007.

<http://thetyee.ca/News/2007/05/24/FishFarm2/>

Randyn Seibold, "First Nations Power Up," RenewableEnergyWorld.com, December 18, 2007.

<http://www.renewableenergyworld.com/rea/news/article/2007/12/first-nations-power-up-50888>

Gillian Riddell, "Tla-o-qui-aht plan green power project," *Westerly News*, May 29, 2008.

<http://www.bc-creeks.org/index.php/tla-o-qui-aht-plan-green-power-project/#more-159>

***Marxism and Native Americans.* Edited by Ward Churchill Boston: South End Press, 1983(?).**

A work of collected contributions, *Marxism and Native Americans* brings together essays from both Marxists and Native Americans alike. The Marxist authors were asked to share thoughts on how they believed Marxism is and could be applied to various non-Western cultural situations. The responses range from a complete dismissal of Native American concerns claiming that an insufficient material achievement in Native American society has stunted the development of thought, to an admission that Karl Marx, himself, may rightly be rejected by Native Americans but that current Marxism is open to sharing the wisdom of other cultures and, indeed, needs the wisdom of other cultures in order to fully progress.

The Native American perspectives, on the other hand, voice concerns about the European priority of “progress”; what they feel is the priority of indoctrination of the education system; the rejection of Native American authored contributions to Marxist journals; how they feel that Capitalism and Marxism both neglect to protect what is most valuable to the Native Americans – their land, territory and right to self-determination; and, embedded in all these concerns, what they feel are two opposing Euro-Centric and Native American world-views: man at odds with nature and man with nature. The Native American perspectives assert that their world-view affirms relationship with all things – land, air, people, animals, plants – and that so long as this spiritual-physical dimension is ignored, Marxism is as harmful to the Native American people as capitalism and Christianity.

**Deloria, Vine Jr. *Spirit and Reason.* Golden, CO: Fulcrum Publishing, 1999.**

### **Selected Essays**

This book of essays by Vine Deloria Jr. bring together his thoughts concerning Philosophy, Social Science, Education, the history and renewed “popularity of being” Indians, and Religion. In each essay he offers a distinctive Native American point of view, one which acknowledges the “whole” – including communities, elders, youth, women, animals and land – as more valuable than the part, whether that part be an individual person or a scientific theory. Of particular

interest is his essay and critique of Western science. His claim is that scientists impose “certain restricted patterns on the natural world, thereby limiting its potential for response....Scientists are not asking complete questions and they may not even be asking relevant questions” (12).

**“Oren Lyons – The Faithkeeper,” Interview with Bill Moyers. Public Access Television.**

**July 3, 1991** [http://www.ratical.org/many\\_worlds/6Nations/OL070391.html](http://www.ratical.org/many_worlds/6Nations/OL070391.html)

In this interview with Bill Moyers, Oren Lyons, Faithkeeper of the Turtle Clan of the Onandoga Nation, explains his role within his community, how he considers community traditions as, seemingly, disparate as lacrosse and agriculture and oral history to be spiritually real and how his community maintains hope for the continuity of their traditions in the coming future. His people, he says, think in the “time of the oak tree” or “the time of the mountain” and, thus, try to make decisions that will benefit the seventh generation to come. From this perspective, then, he says that Native American communities offer a critique of science and industry, believing that “technology has overtaken the commonsense of human beings and the understanding of time”. He also adds that, according to his people, life should not be taken too seriously, it should be enjoyed. The instruction for life, he says, is not to progress or acquire knowledge but to give thanks.

**“Lessons in Learning: The cultural divide in science education for Aboriginal learners.”**

**Canadian Council on Learning.** <http://www.ccl->

[cca.ca/CCL/Reports/LessonsInLearning/LinL20070116\\_Ab\\_sci\\_edu.htm](http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LinL20070116_Ab_sci_edu.htm) (accessed March 4, 2009).

Using a combination of census data, testing results and recent research, this article demonstrates how sharply under-represented Aboriginals are in the science and engineering fields in Canada. According to the research and statistics, the article concludes that the reason for the the under-representation is an educational one: compared to the non-Aboriginal population, Aboriginals are not only under-represented in science and engineering occupations but the percentage of Aboriginal students who study in science-related fields in post-secondary settings and those who take advanced high school science classes is also far less than the non-Aboriginal population, including other ethnic minorities. The study proposes that the reason for such disparity is cultural:

“The Aboriginal world view sees people, landscape and living resources as a spiritual whole. In contrast, the Western science approach seeks greater understanding through breaking apart the whole and analyzing it into its smallest parts. These cultural differences can create difficulties for Aboriginal students in classrooms dominated by the Western science perspective.”

The article proposes integration within science classrooms of Aboriginal content and a flexibility which allows local knowledge along with textbook knowledge to be incorporated into the classroom, without demanding that content and knowledge be inserted into previously-established Western science frameworks. Consultation with local Elders is recommended for such an project of integration. The article also describes current initiatives which are already integrating Aboriginal perspectives into their curricula and which are researching ways – along with industry partners – that would encourage Aboriginals to pursue further undergraduate and graduate education in scientific fields.

#### **Environmental Sciences and Fisheries Roadshow.**

<http://www.roadshow.ubc.ca/staticpages/index.php?page=20070906110238204> (accessed **March 4, 2009**).

An initiative of UBC Faculties of science, Aboriginal organizations, public schools, Department of Fisheries and Oceans and various levels of government, the Environmental Sciences and Fisheries Roadshow is an ongoing project which shares with Aboriginal students the educational and career opportunities available in the sciences (particularly the environmental sciences) through presentations given by graduate students. The program also seeks to establish connections between Aboriginal youth and graduate students so that the youth can begin to feel comfortable in a campus setting and community. Programs are especially targeted towards students in the Gr. 6-10 range, encouraging them and helping them understand the pre-requisites needed to gain admission to particular programs.

**“Planning Guide and Framework for Development of Aboriginal Learning Resources.”**

**British Columbia Ministry of Education, Aboriginal Education.**

<http://www.bced.gov.bc.ca/abed/planguide/welcome.htm> (accessed **March 4, 2009**).

This site includes data on Aboriginal performance in schools at all grade levels compared to non-Aboriginals, current research pertaining to behavioral considerations and learning styles, and curriculum initiatives. Of particular interest is the context-flexible Shared Learnings Guide, a guide for integrating Aboriginal content into all subject areas from K-10, including lesson plans, how to include Elder participation in the classroom, specific content for incorporation, and links to other resources. The guide, created with a public-school audience in mind, is a good example of a resource and initiative which tries to be culturally sensitive to Aboriginal learning needs in the classroom while simultaneously encouraging non-Aboriginal students to better understand the Aboriginal culture.

**First Nations Education Steering Committee.** <http://www.fnesc.ca/>

As a counterpoint to the Ministry of Education's website, the FNESC website is autonomously controlled by First Nations people. After years of negotiation, the First Nations signed an agreement with the provincial government in 2006 which gives them complete jurisdiction over the K-12 education of First Nations students, including curriculum design, content, and teacher accreditation. The agreement has stages implemented which would allow further autonomous design of post-secondary programs and early-childhood programs. The site is a point of contact for information on teaching resources, individual schools, initiatives, funding opportunities and further contact information. Of particular interest for this course is the advertised funding available for the "Science and Technology Program". Communities are encouraged to develop summer programming for youth which encourages them to learn more about science and technology, promotes careers in science and technology including employable skills like problem solving and working together, and incorporates local First Nations traditional knowledge regarding science and technology.

**Aikenhead, Glen. "Integrating Western and Aboriginal Sciences: Cross-Cultural Science Teaching." *Research In Science Education* 31, no. 3 (2001).**

This article describes the cultural assimilation that commonly takes place in science classrooms and the corresponding alienation experienced by students whose world-views do not resonate with that of the world-view of Western science commonly expressed in a classroom. Aboriginal students (in Aikenhead's Canadian context) are particularly subject to this alienation, according

to Aikenhead, and it can prove detrimental for them and their communities; for Western science is still “a major global influence in their lives. Alienation reduces their effectiveness at 'legitimate peripheral participation' in community matters related to science and technology” (2-3). Aikenhead proposes a cross-cultural approach to teaching science, one that does not seek to indoctrinate students into a particular culture or to resolve conflicts of culture, but to simply give culture, specifically Aboriginal culture, a voice. Aikenhead then illustrates what such a teaching approach could look like within specific teaching units. He pays particular attention to what words mean in each context, such as the “wolf” or “to observe”, encourages teachers to ask students to say which cultural perspective they are speaking from when they describe what they have learned, and suggests field trip initiatives and even how the design of a classroom can help students learn to look at the world from each other's perspectives.

**Glen Aikenhead's Webpage.** <http://www.usask.ca/education/people/aikenhead/> (accessed March 4, 2009).

Glen's webpage includes teacher resources for teaching cross-cultural science and technology units in a classroom as well as links to numerous published articles (his own and others) on cross-cultural (Aboriginal and other) approaches to science in the classroom.

**Aboriginal Canada Portal, Education.**

<http://www.aboriginalcanada.gc.ca/acp/site.nsf/en/ao28010.html>

A partnership between the government and Aboriginal communities, the portal contains information on natural resources and environment updates, community programs and resources, and links to education sites. There are resources, similar to those above, for elementary and secondary teachers and students. There are also links, however, to Aboriginal post-secondary institutions, training sites and employment programs by province. Of particular interest is the predominance of humanities, social sciences and human services programs over science programs. The natural resources and environment section, however, also provides links to resource management, environmental studies which emphasize a relationship to Aboriginal communities and how Traditional Knowledge regarding the environment and resources can be incorporated in studies in a manner respectful of the source of the Traditional Knowledge.

## **First Nations University of Canada, Department of Science**

<http://www.firstnationsuniversity.ca/default.aspx?page=30>

The First Nations University of Canada, Department of Science incorporates Indigenous knowledge and holistic learning and support into their research and pre-professional science programs. Their purpose, as stated on their site, is to:

“Promote scholarly research, teaching and learning activities that will directly and indirectly benefit Aboriginal communities in an age of technological advancements and globalization, and thereby, increase the representation of Aboriginal people in science and health related careers.”

Their site, apart from the university program, also describes community projects and research that the department is affiliated with. Health and science camps are sponsored for youth and one of the departments largest community-based research endeavors is National First Nations Environmental Contaminants Program. Through the program, communities and researchers apply for funding to assess the exposure level and health effects of individual communities in relation to environmental contaminants as well as funding for research to develop methods for remediation, once assessed. The program is committed to community participation at all levels – initiation, assessment, policy-making and policy-implementation, and is an example of how environmental and health related issues particular to Aboriginals are able to receive research attention when Aboriginals are part of institutional and 'expert' design of research in addition to being part of communities.

**“Statistics by Subject.” Statistics Canada.** [http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm?Lang=Eng&SP\\_Action=Main-Principal&SP\\_Mode=2](http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm?Lang=Eng&SP_Action=Main-Principal&SP_Mode=2) (accessed March 4, 2009).

Census data from the government of Canada, including information on levels of educational attainment of Aboriginals compared to non-Aboriginals as well as data on chosen fields of study of the two population groups.

**“Aboriginal Education.” Ministry of Advanced Education and Labour Market Development.** <http://www.aved.gov.bc.ca/aboriginal/> (accessed March 4, 2009)

A site of the B.C. Ministry of Advanced Education and Labour Market Development, the site contains the Charting Our Path Aboriginal Report, published in cooperation with the Ministry and Aboriginal leaders and institutions. The report includes statistics comparing Aboriginal and non-Aboriginal high-school graduation rates, transition periods and post-secondary enrollment according to institution type and subject area.

**Dyck, Lillian E. “An Analysis of Western, Feminist and Aboriginal Science Using the Medicine Wheel of the Plains Indians.” *Native Studies Review* 11, no. 2 (1996).**

This paper is a reflection and analysis by an urban-Aboriginal, feminist neuroscientist on how she, herself, does science. She uses the medicine wheel of the Plains Indians as a tool for her analysis, analyzing the Western scientist approach, the Feminist approach and the Aboriginal approach separately in relation to the four directions of the medicine wheel: North being mental/integrationist, East being spiritual/creative, South being emotional/authoritarian and West being physical/reductionist. The analysis is both a critique of the traditional “value-free” description of Western science as well as an approach which allows readers to see how Western, Feminist and Aboriginal perspectives of science can be simultaneously similar, complementary and different.

**Weinstein, Martin S. “Sharing Information or Captured Heritage: Access to Community Geographic Knowledge and the State's Responsibility to Protect Aboriginal Rights in British Columbia.” *Digital Library of the Commons*.**

<http://dlc.dlib.indiana.edu/archive/00000184/> (accessed March 4, 2009).

Through an examination of a case study involving a collaborative mapping initiative of the B.C. Government, the Ministry of Forestry and Aboriginal communities, this article explores real and potential conflict that develop when information is shared. Undertaken as a project which proposed to protect Aboriginal communities and resources by asking communities to map their own perspective of cultural and resource geography, the government then proposed that the data be held in a government database, publicly accessible. Once information becomes accessible to the wider public, however, it becomes available to unwanted parties like developers and, thus,

could undermine its initial goal of resource and property protection, according to the Aboriginal communities involved. The report demonstrates how knowledge shared for the purpose of community participation in projects and for protection of those communities can quickly develop into an information transfer which undermines that initial purpose. This example of incorporating Indigenous knowledge of territory into research is representative of the complexities of researchers must deal with when they try to involve communities in projects. Many communities may be reluctant to share relevant and important information in order for it to not be used in ways they never intended it to be used. Building a relationship of trust, offering the community something in return for the information they offer and deciding on how the information will be controlled are all important decisions that have to be made in preparation for the research.

**Gilchrist, Grant, Mark Mallory and Flemming Mertel. “Can Local Ecological Knowledge Contribute to Wildlife Management: Case Studies of Migratory Birds.” *Ecology and Society* 10, no. 1 (2005).**

<http://www.ecologyandsociety.org/vol10/iss1/art20/> (accessed March 20, 2009)

In this article, wildlife conservation researchers explore the potential benefits and potential drawbacks of combining Local Environmental Knowledge (LEK) with Institutional-Scientific knowledge. The researchers claim that is not incorporated as often as it should be into research pertaining to wildlife management and sustainable conservation efforts. Both modes of knowledge – LEK and Institutional-Scientific are necessary for a fuller understanding of environments, say the researchers. There are also limits to how each can be used. Using case-study research of migratory birds, the researchers explore these limits and benefits of knowledge sharing and propose guidelines for future research.

**Monastersky, Richard. The Social Pole? *Nature* 457 no. 26 (February 2009), 1077-1078.**

A brief summary of some initiatives of the International Polar Year which have sought to incorporate local indigenous knowledge into scientific research. The article offers examples of local northern communities and scientists who have benefited from such collaboration as well as community leaders and scientists who are skeptical of the benefits of shared knowledge. Those who advocate for the collaboration hope that the knowledge sharing will increase research

capacity within indigenous communities, will advance scientific understanding of polar environments and will help indigenous communities adapt to climate change.

**Wertheim, Margaret. “The Way of Logic.” *New Scientist* 148 (December 2, 1995) 38-41.**

This article is a brief summary of the research thrust of Helen Verran, an Australian researcher of the Yolgnu people of northern Australia. Verran has also been inducted into the Yolgnu tribe and charged with sharing their system of knowledge with the non-Aboriginal world. According to this article, Verran's research demonstrates not just the epistemological framework of the Yolgnu but how that framework is also consistently logical, as logical as any Western scientific view. To demonstrate this, Verran compares the number system with the Yolgnu kinship system, explaining how the kinship system can be used to explain relationships of the natural world just like mathematics can. The purpose Verran's research is to see “the world through different eyes, she says, [so that she] can help [non-Yolgnu] see more clearly how [their] own science was constructed.

**Debruyne, Adrian M H. “Ecosystemic Effects of Salmon Farming Increase Mercury Contamination in Wild Fish.” *Environmental Science and Technology* 40 (2006).**

An examination of the escalating mercury concentrations in demersal rockfish surrounding salmon farms in British Columbia's coastal waters. The article is of interest because the mercury contamination directly affects First Nations communities in particular who depend on a diet of wild seafood, including demersal rockfish.

**National Aboriginal Health Organization.** <http://www.naho.ca/english/index.php>

A website containing research, publications, employment links and community services for Aboriginal peoples, including the Journal of Aboriginal Health. Particular attention is to be directed to the midwifery section. The practice of Aboriginal midwifery is one where health – particularly women's health – traditional knowledge, scientific knowledge, employment opportunities and community participation all come together.

**Helen Polychronakos, “Two Towns, One Choice,” *theTyee*, May 22, 2007.**

<http://thetyee.ca/News/2007/05/22/SalmonFarms/> and

**Helen Polychronakos, “Economy vs. Ecology in Fish Farms Debate,” *theTyee*, May 24, 2007. <http://thetyee.ca/News/2007/05/24/FishFarm2/>**

A case study involving two different First Nations communities, the fish-farming conflict, unemployment and community well-being.

**Randyn Seibold, “First Nations Power Up,” *RenewableEnergyWorld.com*, December 18, 2007.**

<http://www.renewableenergyworld.com/rea/news/article/2007/12/first-nations-power-up-50888>

**Gillian Riddell, “Tla-o-qui-aht plan green power project,” *Westerly News*, May 29, 2008.**

<http://www.bc-creeks.org/index.php/tla-o-qui-aht-plan-green-power-project/#more-159>

Two case studies involving First Nations communities and local hydro-power projects.