

Bridging Culture, Indigenous and Scientific Ways of Knowing. Glen Aikenhead & Herman Michell (2011). Don Mills ON: Pearson. 196 pp. ISBN: 978-0-132-10557-6

Science as a school subject is alienating for many students. Fewer students choose to specialize in science at college level, and even fewer students choose to pursue science related careers. In a world where the products of science and technology permeate our lifestyles, one wonders why the subject is not appealing to students. During the past few decades, several educators have looked at the relationship between school science and students' everyday experiences, cultures and worldviews. Results from Cobern and Loving's (2000) study on everyday thoughts about nature shows that science teachers know more about science than do their ninth grade students and Costa (1995) suggested that it is critical that teachers find ways to help students "cross the boarders" from the everyday way of knowing their world to the scientists' ways of knowing. Costa's study revealed that students are normally left to do their own accommodations as they attempt to "cross boarders" and they emerge either as "potential scientists" or "outsiders". When the culture of science is at odds with a student's worldviews, science instruction will tend to disrupt the student's worldviews by trying to force the student to abandon or marginalize his or her worldviews and reconstruct scientific ways of conceptualization; a process referred to as assimilation (Aikenhead and Jegede, 1999). Such challenges of science learning are greater for Indigenous students who come from cultures that have different worldviews from the Eurocentric worldview that is represented in school science.

Indigenous knowledge is increasingly being recognized as an important legitimate source of understanding of the physical world, and in Canada, efforts have been made to include Indigenous worldviews in the school curriculum. Despite such efforts, there are several reasons why many teachers find it hard to implement Indigenous worldviews in the science curriculum. Realizing the need to support teachers who are experiencing the challenges of including Indigenous perspective in the science curriculum, Glen Aikenhead a white male of British ancestry and Professor Emeritus at the Aboriginal Education Research Center at the University of Saskatchewan and Herman Michell a Woodland Cree Scholar and Director of Northern Teacher Education Program and Northern Professional Access College at La Ronge in Saskatchewan co-authored the book entitled '*Bridging Culture, Indigenous and Scientific Ways of Knowing*'. This book is a great resource, not only for teachers, but for student teachers, teacher educators, school administrators and those implementing professional development programs for teachers. The authors did a fantastic job providing in-depth descriptions of Eurocentric science and Indigenous knowledge, followed by a comparison of the two ways of knowing, and finally providing some suggestions and examples for teachers who want to create science classrooms where students can learn the best of both Indigenous and scientific ways of knowing nature. Drawing on personal experiences of indigenous educators and writers, the authors made an effort to ensure that the content in the book is applicable not only to different Indigenous groups in Saskatchewan but to other regions in Canada and to other places with Indigenous populations including the United States, Aotearoa New Zealand, South America and Northern Europe.

Chapter 1 lays out the goal of school science as a way of conveying how academics understand nature, and showing how only students who share the same worldviews as their science teachers thrive. On the other hand, students who prefer to understand nature through other worldviews may become alienated from the subject and teachers seldom detect this

because of the subtle nature of the students' reactions. For this reason, success in school science continues to elude Indigenous students who do not share the same worldviews as their science teachers. At the end of the chapter, the authors acknowledge the fact that Indigenous ways of knowing nature are being recognized in Canada as a result of Indigenous peoples asserting their human rights. According to the authors, there is a move by provinces to work together with First Nations, Inuit and Métis communities to determine what Indigenous knowledge will appear in the science curriculum alongside the conventional science content. This book provides valuable insights for those preparing professional development programs for teachers faced with the challenge of teaching the indigenous knowledge identified in the curriculum. It is also a valuable resource that can help student teachers and teachers in urban Indigenous schools to integrate cultural sensitivity for both Indigenous and non-Indigenous students.

In chapter 2, the authors provide several compelling reasons for placing Indigenous knowledge in the science curriculum. These reasons include ensuring equity and social justice for Aboriginal students who are under-represented in science and technology occupations, university programs as well as high school courses. The lack of indigenous people in science-related fields results in economic and social disadvantage for indigenous communities. The authors however go on to acknowledge the fact that, the Ministers of Education in Canada and other educational jurisdictions worldwide have realized; a) the need to offer an enhanced science curriculum that recognizes Indigenous knowledge as key to improving the enrollment and retention rates of Indigenous students in science-related fields; b) that better education among indigenous people will lead to increased earning power which in turn is seen as a major economic contributor to economic progress of the country; c) the need for sovereignty and cultural survival of Indigenous people through rebuilding Indigenous nations oppressed by colonization; and d) that the survival of Indigenous cultures will benefit all non-Indigenous people by encouraging stewardship of earth and promote sustainable lifestyles. The authors go on to provide examples of how inclusion of Indigenous knowledge into school science has worked in several countries including Africa, United States, Aotearoa New Zealand, Australia, and Canada.

Chapters 3 and 4 focus on explaining the epistemological underpinnings of Eurocentric science, the culture of Eurocentric science and its origins. In chapter 3, the authors did an excellent job providing the readers with a comprehensive understanding of what constitutes science, the foundations of Eurocentric science, its historical evolution, and its culture. They trace the origins of Eurocentric science to ancient Egypt and to the evolution of the Greeks' philosophical ways of understanding nature. Around the 17th Century, natural philosophy focused on gaining power over nature and it later became a social institution with the founding of the Royal Society in England and similar organizations in other countries. Around the 19th Century, the word science was chosen to replace natural philosophy. Eurocentric science is defined as what scientists do in different science disciplines and careers. The authors go on to clearly show that there is no universal science but diverse science disciplines and diverse ways of doing science. They define scientists as practitioners of the scientific culture in their discipline.

In chapter 4, the authors credit Thomas Kuhn's (1962) *The structure of scientific revolution* for shading some light on the subjective human elements in scientific ways of knowing. Scientific knowledge is a result of the culture of like-minded scientists who produce

and validate each other's work through the peer review process. The authors pointed to the problem of universalism in school science where the scientific method is viewed as the way Eurocentric science is done. They go on to identify variations in different sorts of Eurocentric science, for example qualitative/quantitative and experimental/observational. The authors also debunk the myth of the objective nature of scientific knowledge given the process of scientific knowledge creation which involves the peer review process and consensus making within a community of scientists to determine what scientific knowledge is.

Chapters 5 and 6 provide an exploration of Indigenous knowledge. Chapter 5 begins with clarification of the terms Indigenous, knowledge, nature and coming to know as a step towards bridging Eurocentric science and the diverse knowledge systems of Indigenous peoples worldwide. The authors define Indigenous people as the original people to inhabit a locality, and this includes people whose colonial settlers became dominant e.g. the First Nations of Canada, the American Indians of the United States and those where colonizers never reached a majority but left a legacy of colonization e.g. Africa and some parts of Asia. In the Indigenous languages, knowledge translates to 'ways of living' or 'ways of being' and scientific knowledge translates to 'ways of living in nature'. Hence the authors refer to Indigenous knowledge as 'Indigenous Ways of Living in Nature' (IWLN). In chapter 6 the authors provide an in-depth exploration of the fundamental attributes of IWLN that comprise the essence of a collection of Indigenous worldviews. They identified IWLN as place-based, monist, holistic, rational, mysterious, dynamic, systematically empirical, based on cyclical time, valid, rational, and spiritual. The authors view these attributes as essential for teachers who are beginning to bridge Indigenous and scientific ways of knowing nature.

In chapter 7, the authors did a fabulous job, providing a comprehensive comparison of the Eurocentric and Indigenous ways of knowing nature. Whereas Eurocentric science is anthropocentric in nature, creating a dichotomy of mankind versus nature and an ideology of dominion over nature; Indigenous knowledge translates to ways of living in nature, meaning that Indigenous people share a strong connection to the land because of their hunting, fishing, and gathering practices. Indigenous people share a worldview in which humans are interdependent with the natural world. The authors take a pluralistic position that there are multiple ways of knowing science and that Eurocentric science is one strand within a complex network of traditions worldwide. This view contrasts with a universal perspective which allows only one way of legitimately knowing nature. It is the authors' assertion that Eurocentric science and IWLN have common features and also have different but complimentary ways of dealing with nature; they are not equal but they can co-exist. This claim has support from the fact that some scientists have found tremendous value in coming to know IWLN for resolving current environmental problems.

In chapter 8, the authors provide some general advice and suggestions for teachers who want to create science classrooms where students can learn the best of both Indigenous and scientific ways of knowing nature. Since there is no universal way to combine Indigenous knowledge and Eurocentric science in school, the authors suggest the following cultural resources that can serve as a guide for combining the two: a) elder involvement; b) learning from community gatherings; ceremonies and powwows; c) inviting Indigenous role models to the classroom; and d) being critical at selecting resources to avoid culturally insensitive materials

which may lead to stereotypes. The authors also emphasize the need for teachers to be aware of and draw on the learning strengths of Indigenous students as well as create a classroom environment where the teacher becomes a lifelong student of the culture by learning from students and the community. Some instructional approaches provided by the authors include; a) drawing attention to students' prior knowledge and experiences and building on the existing knowledge; b) using time-honoured indigenous ideas of teaching which include demonstrations, practices, c) sharing circles and d) storytelling. Other instructional strategies include integrating science with other subjects e.g. Social studies, Math and Native studies; and making explicit connections between the world of Eurocentric science and the world of the learner in order to make learning more meaningful and practical for Indigenous students. In addition, the appendices to this book have tonnes of resources that the authors provide for teachers. These include: a) cross-cultural units on the Rekindling Traditions website; b) several internet resources from different countries and c) a list of recommended books about Indigenous worldviews.

This book is a vital resource for teachers, student teachers, administrators and professional development experts who are seeking ways to improve science learning for Indigenous students at all levels of schooling. The authors make compelling arguments for including Indigenous knowledge in the school curriculum and they do a fine job of providing a clear understanding of what Eurocentric knowledge is. This helps debunk the myths about the universal and objective nature of science and the authors built a clear case to show that Eurocentric science, just like the Indigenous ways of living in nature, has its own culture and it is a theory-laden human endeavour. This understanding is crucial for helping the reader realize that there is nothing wrong with including Indigenous ways of knowing nature in the Eurocentric science curriculum because both are ways of knowing nature that are practiced by people from different cultures. The book '*Bridging Culture, Indigenous and Scientific Ways of Knowing*' will appeal to teachers and administrators who are working hard to improve the education of Indigenous students as well as teacher educators who are preparing the next generation of teachers. The ideas and practical examples provided in this book are invaluable resources for including Indigenous worldviews in the science curriculum worldwide.

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