

Introduction: Shifting Perspectives from Universalism to Cross-Culturalism

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Introduction

Debates in science education over multiculturalism and universalism have disputed whether or not non-Western cultures have systems of knowledge about nature that could be considered science (Stanley & Brickhouse, 1994; Siegel, 1997). The following three articles have moved beyond that debate by accepting that all systems of knowledge about nature are embedded in the context of a cultural group; that all systems are, therefore, culture-laden; and that science (Western science) is the system of knowledge about nature that is predominant in Western culture. For example, some cultures give high priority to authoritative storytelling and demonstration of expertise, while others may value authoritative script and trial and error as methods of transmitting its knowledge of nature. What is contested in these articles is how to position Western science so that it can inform and be informed by the nature-knowledge systems of other cultures. Also in question is the role that non-Western nature-knowledge systems should play in the school science curriculum.

The eurocentric underpinnings of this debate

The arguments presented in the articles might best be understood against the backdrop of Eurocentrism, not because they advocate a Eurocentric perspective but, because, in some instances, they struggle against a Eurocentric notion of science. Eurocentrism refers to the idea that the people, places, and events of Western European cultures are superior and a standard against which other cultures should be judged. Conversely, non-Western cultures are inferior, and relevant only when they have a relationship to Western culture. Cobern and Loving (2001) underscore Eurocentrism in science when addressing the role of Western science in the history of European colonization: "The point is, the West judged the rest of the world by its own measure of choice, Western science and Western technology, and used education to enforce change on those societies found deficient" (p. 53), Stanley and Brickhouse (2001) also consider Eurocentric notions of science advanced by others, "exposing students from non-Western cultural backgrounds to the superiority of Western scientific methods and knowledge while exposing the epistemological deficiencies of their own culture's scientific ideas is essential to good science education" (p. 38).

The effect of Eurocentrism is pervasive in science education, as illustrated in recent standards documents. In *Science for all Americans*, for example, Rutherford and Ahlgren (1990) acknowledge that, "All human cultures have included study of nature" yet they chose to focus on "the development of science, mathematics, and technology in Western culture," without addressing how Western science "drew on ideas from earlier Egyptian, Chinese, Greek, and Arabic cultures." Similarly, the *National Science Education Standards* fails to even mention science in non-Western cultures and offers no explanation for the omission (Council, 1996). These omissions suggest to some that the non-Western contributions are not seen as important enough to merit a place in the school science curriculum (Rodriguez, 1997).

Lifting the hierarchies—a paradigm shift

The following articles shift away from the Eurocentric hierarchical view of nature-knowledge systems. Their authors acknowledge that systems developed in non-Western cultures have contributed significantly to Western science and will continue to do so. How then should the nature-knowledge systems of non-Western cultures be viewed in relation to Western science? If they are not inferior, should they be accepted in science classrooms? Should they be considered non-scientific external sources of critique for the work of Western science? Or should non-Westerners be left to determine for

themselves how these nature-knowledge systems will be used? These are questions raised in the following articles. Their answers have great potential to determine the voice that non-Western nature-knowledge systems will have in science education discourse.

Snively and Corsiglia (2001) advance a cross-cultural perspective that centers around non-Western nature-knowledge systems, referred to as traditional ecological knowledge (TEK). TEK refers to the descriptive and explanatory knowledge of nature that Aboriginal communities around the world have developed to enhance their lives. Historically, some TEK has been appropriated by Westerners for developments in numerous fields, including: medicine, architecture, engineering, and plant breeding (Snively & Corsiglia, 2001). Recently, TEK has garnered the interest of scientists and international aid agencies. Snively and Corsiglia identify Eurocentric ideologies, such as colonial materialism and domination over nature, as cultural traits inherent in Western science. Given increased interest in indigenous knowledge, cultural traits of Western science, and the growing need for environmental sensitivity, Snively and Corsiglia argue that Western science alone is too narrow for today's classrooms, and they challenge us to include TEK in the canon of school science.

Cobern and Loving (2001) begin by acknowledging the exclusivity of a universalist approach to Western science and by recognizing the myth of scientism associated with this exclusivity. In their exploration of TEK and Western science, Cobern and Loving reveal a number of new topics for further discussion. For instance, their distinction between descriptive and explanatory knowledge of nature creates the need for science educators to learn the explanatory abstractions of TEK (e.g., the conceptual model called "keepers") which in TEK can play the same role as theory/model plays in Western science. However, Cobern and Loving stand opposed to Snively and Corsiglia's idea of including TEK in the canon of Western science. To do so would be a Pyrrhic victory in that TEK would 1) lose its distinctiveness and become absorbed by the dominant discourse of science, and 2) lose status-being seen more as a token of cultural inclusiveness rather than a serious participant in scientific discourse. They advocate instead "epistemological pluralism" where TEK is brought into the classroom, not as Western science, but as a domain of knowledge with value equal to Western science that can be used to gain insights into the power and limitations of Western science.

Stanley and Brickhouse (2001) approach the debate by deconstructing many universalist notions of Western science and highlighting areas of disunity within Western science. They conclude that there is no single set of concepts that can conclusively explain the nature of Western science and argue that school science should critically examine these "grey areas." Instead of embracing Snively and Corsiglia's balance of Western science with TEK, they propose a cross-cultural, metacognitive approach for school science. TEK then becomes a powerful tool for helping students to learn precise ways in which any nature-knowledge system, including Western science, is culture-laden.

There are many more dilemmas and tensions to be discovered in the three articles. We offer a word of caution, however. The authors use the word "science" by itself, which understandably but implicitly changes meaning from context to context. To avoid potential confusion, the reader may wish to substitute "science" with one of the following phrases, as appropriate: "nature-knowledge system," "indigenous science" (e.g., TEK), "Western science," or "school science."

Shifting paradigms in school science is a stimulating journey. For educators embarking on shifting from a universalist to a cross-culturalist perspective (whatever "universalist" and "cross-culturalist" mean),

history may help ease the journey. In the history of Western science, the shift from an Aristotelian to a Newtonian perspective required both intellectual reconceptualizations and social forces. Galileo lived during a time of transition. Although he contributed to the paradigm shift, he stubbornly held on to some Aristotelian conceptions. Likewise, science educators may have similar problems shedding concepts culturally ingrained by the ideologies and conceptualizations of their Western science. We might learn from Galileo and be patient with ourselves and not expect people's perspectives to shift rapidly. Galileo alone could not cause a paradigm shift to a Newtonian perspective, but he significantly nurtured Newton's grand synthesis. In this sense, the three articles represent history in the making in science education. They engage us in the intellectual challenges brought about by a school science curriculum dedicated to a global village in crisis. The crisis may very well be the social force required for a significant paradigm shift in our field.

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