Developing Culturally Responsive Science

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American Indian students are capable of excelling in science if they are given culturally appropriate instruction. Culturally appropriate instruction helps Indian students who are grounded in their tribe's traditional knowledge clarify science concepts. Unfortunately, many teachers don't recognize or value their Indian students' cultural knowledge. When teachers neglect to affirm their students' traditional teachings nurtured in the home and local community, these students can lose their desire to learn science, avoid science professions, and question their own cultural identity. Therefore, it is imperative that teachers and curriculum writers clearly address cultural issues when developing curriculum for American Indian students.

Clearly, American Indians, like everyone else, have been using science for all aspects of life. Yet, this local Native knowledge has not been included in the school science curriculum. Instead, Indian students are taught science concepts from a Western European perspective. If they are to become successful, Indian students must be allowed to utilize their own experiential knowledge to better understand science concepts being taught in school. We should recognize that the knowledge children bring to the classroom is just as important as what is being taught in the classroom.

The Need for Culturally Responsive Curriculum

In the last three decades, educators have successfully incorporated local knowledge and languages in school curricula especially in the areas of literacy and social studies. However, the science curriculum has remained largely unchanged, using a false logic that science is "culture-free" because it is absolute and universal. The fallacy here is that science in American schools is indeed funneled through Western European perspectives. The elementary school science curriculum in American classrooms is somewhat standardized in textbooks and through state and national science education standards.

Developing elementary science curriculum that includes culturally appropriate knowledge can build on this standard curriculum (Gilbert & Carrasco, 1997). This Native cultural knowledge is not necessarily "Native science," but background knowledge that relates to the science curriculum taught in school. This cultural knowledge is culled from the respective culture, and is "connected" to the existing elementary science curriculum. This knowledge consists of legends, stories, beliefs, perspectives, history, Native language and values. It also includes local "funds of knowledge" (Moll et al., 1992) in regard to hunting, agricultural and all the other survival skills that Indian people have developed over the years to sustain a living in this land of theirs, and it includes traditional ways for interpreting and employing basic scientific knowledge.

The cultural component is theoretically viewed as a motivating factor for improving achievement scores in science. It is believed that if American Indian children are grounded in their own Native "cultural knowledge," they will learn the elementary science curriculum and also have a more positive attitude toward school science and science in general. It is important to emphasize, "science is science;" and while there may be variations in ways of using and interpreting it, science is still science. The objective is not to introduce different science concepts or principles, but to support them by including Native cultural knowledge.

American Indians have different cultural perspectives on the same science concepts and universals. For example, from a Western European perspective, we are taught the names, uses and related iconic forms of the constellations, e.g., The Big Dipper/Ursa Major. American Indians have for hundreds of years known and used these same constellations, and like Western Europeans, have attached special names, and meaning to them. The phenomenon is the same, but the perspectives regarding name, uses, and meaning may differ. While most science concepts are absolute and universal, the cultural difference lies in their

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interpretation and use. How other cultures view, interpret, and apply the universal scientific phenomena, I believe is what can make science education more relevant to both American Indian and majority students.

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Insuring that the cultural science knowledge is integrated into the existing elementary science curriculum, one must obtain the local Native science cultural knowledge and transform this knowledge as science curriculum to be "connected" to or incorporated into the regular elementary school science. McCarty (1980) suggested that culturally relevant curriculum development places importance on community input. Recognizing this, Native educators, elders, medicine men and women are viewed as cultural "experts" and consulted to contribute their expertise to the development of culturally relevant curriculum. Culturally appropriate Native science knowledge may then be transformed into a curriculum that is connected to the regular school science lessons.

The cultural knowledge for the cultural science modules can be obtained from various sources that include interviewing respected Native community leaders and educators, parents and other cultural experts. These individuals present their own perspectives on each of the science topics. These include legends, stories, values, the relationship between the stars, the moon and the sun, earth and plants and animals and weather patterns. These become valuable resources of information in constructing cultural science modules/lesson; and once written, they are integrated with the regular classroom science curriculum. The instructional sequence and design criteria can be created to function as a template for science teachers using the assemblage of modules and lessons, which have been designed to integrate a cultural context for teaching scientific concepts to grades K-6th. The sequence is as follows:

Phase One

Phase One begins with the *introduction* to a lesson. A topic is chosen and/or identified, and students are engaged to inquire about and explore specific details about it. They discuss what they already know about the topic and learn the "how" of gathering information and data to learn more about it. They consider, discuss, and agree on appropriate ways of organizing data for presentations to classmates, family, and the community at large.

Phase Two

Phase Two is the introduction of the *cultural context* where traditional teachings are presented. This includes a vocabulary of specific words in the tribe's language with English translations and traditional stories and teachings. Traditional uses of certain material and elements are also communicated. The students are introduced to the cultural information and teaching, and the traditional protocols for imparting information and knowledge are observed and shared. This part of the process integrates the oral sharing of information and includes field trips. Phase two is the building block for the children's sense of knowing self, sense of place, belonging and context, a traditional knowledge data base on which textbook science can then be integrated.

Phase Three

Phase Three involves *communicating concepts*, ideas, and honing skills taught in textbook science. An objective way of viewing and learning concepts through teacher lectures is used, as well as hands-on and inquiry based activities, reading the textbook, the use of computer technology, and other electronic media to access information. The use of measuring tools, rulers, test tubes, microscopes, telescopes, and cameras for recording and monitoring information is learned. The western view and approach to learning, teaching, and absorbing information about the specific topic becomes the focus of activity. Students are exposed to thinking inductively and deductively. It is here that they begin to hone math skills and learn to develop an objective view in the learning process by identifying the specific topic for study and guidelines for gathering data. In addition, they are taught how to arrange and organize the material gathered into a format from which observations can be made and conclusions drawn.

Phase Four

Phase Four consists of "integrating" (connecting) phase two and three. It involves the blending of two approaches and interpretations of a given set of materials, ideas, facts, and information. This harmonious blending of two paths, which leads to the same place of knowing, will afford students the ability to function and perform in both realms. The subjective and objective approach to learning about natural systems and cycles are paths, where one is not exclusive of

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Indigenous Bilingual Education

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the other. Thus, it is the goal to create a curriculum of science education materials that is inclusive of and creates a place for traditional cultural belief systems and values, while at the same time amplifying and expanding existing American Indian traditional knowledge bases.

While it has been shown that integrating Native cultural knowledge into school science does make a difference in teaching and learning, I believe that this approach is applicable to all schools everywhere. For example, African American students can also improve their science achievement scores if they are also grounded in African perspectives on science. Anglo American students could also benefit from other cultural views on science. Wouldn't it be more interesting and beneficial to have, for example, Puerto Rican students in Boston learn not only about American school science perspectives, but also those of the Boricua (indigenous people of Puerto Rico), and those of other Native nations? *NN*

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References

Gilbert, W. S. & Carrasco, R. L. (1997). *Native Science Connections in Native American Classrooms*. Unpublished Manuscript. Northern Arizona University, Flagstaff, AZ.

McCarthy, T. L. (1980) Language use by Yavapai-Apache students with Recommendations for Curriculum Design. *Journal of American Indian Education*. 20(1) 1-9.

Moll, L. C. & Amanti, C., & Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice*. 31(2), 132-141.