

An Examination Of The Nature Of Science
Presentation In High School Chemistry
Textbooks Used In The United States and
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AN EXAMINATION OF THE NATURE OF SCIENCE PRESENTATION IN HIGH SCHOOL CHEMISTRY TEXTBOOKS USED IN THE UNITED STATES AND INDIA

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Abstract

The need for a scientifically literate society is essential to advance civilization and solve many global problems such as depletion of natural resources and carbon-based fuels, cure for life threatening ailments, famine, hunger, epidemics, and several other serious global problems. Scientific literacy is not restricted to factual knowledge of science but also extends to understanding science and how the scientific enterprise works (Clough, 2000). Therefore, learning about the “nature of science” has been considered as an important goal for both science teachers and students for more than 100 years. Science textbooks play an important role in learning and delivering science content at all levels of science instruction (Lapointe, Mead, and Phillips, 1989; Stake and Easley, 1978; Weiss, 1993). This study sought to understand the extent to which science and the scientific enterprise (nature of science) have been represented in chemistry textbooks used in the United States and India. This cross-nation examination of science textbooks is important to the field of education and of science because textbooks serve as the principle teaching aids in science instruction in both countries. Nature of science can be organized by four basic themes: science as a body of knowledge, science as a way of thinking, science as a way of investigating, and science and its interactions with society and technology (Chiapetta and Koballa, 2006). Further, an additional theme has been added: science and its interactions with engineering and technology. Together these five themes lead to the main question of the dissertation study: What is the balance of the selected five aspects of the nature of science (knowledge, thinking, investigating, interaction of science with society, interaction between science, engineering, and technology with society) that are evident in chemistry textbooks used in the United States and India? To address the research question, the content analysis methodology was used in this study. To establish reliability and validity of the coding instrument, a preliminary study was conducted. The study involved analyzing random sampling of pages within five chemistry textbooks from the United States and chemistry textbooks from grades 10, 11 and 12 from India. The dissertation study involved the analysis of five samples related to topics that include acids and bases, biological chemistry, chemical reactions, hydrocarbons, and the periodic table from chemistry textbooks that are used in the United States and India. Coding procedures for analyzing the random sample involved two sets of coders. One of the coders had

previously analyzed physical science textbooks with regard to the nature of science and ethnic diversity (Brooks, 2008). The researcher was the second coder and is a community college instructor with ten years' experience of teaching chemistry at different grade levels. Both coders were trained to analyze the samples and the reliability of their coding checked before coding the chemistry textbooks. To check for inter-coder reliability, percent agreement and Cohen's kappa was calculated. Results from the study indicate that science as a body of knowledge and science as a way of investigating as the two prominent themes in chemistry textbooks used in India and the United States. The knowledge component is represented by facts, theories, and laws and emphasizes information overload and rote memorization. Textbooks used in India and the United States present to students several investigative activities that are hands-on in nature. However, textbooks from India did poorly compared to chemistry textbooks used in United States with regard to the representation as to how scientists go about their work to establish chemistry. Only those samples related to the development of the periodic table represented the thinking aspect with regard to the nature of science from chemistry textbooks used in India. Textbooks used in India did poorly in the representation of interaction of science with society and the interaction between science, engineering, and technology. Even though engineering is a favored profession by choice of many science students in India, there is very little mention of this aspect of nature of science. The textbooks did not discuss any career opportunities available to students of science in the STEM fields. Textbooks used in the United States however, did emphasize the societal aspect of the nature of science and included discussions related to many career opportunities available in the STEM fields. Most chemistry textbooks used in the United States did poorly in the representation of the engineering and technology aspect of the nature of science. Holt, Rinehart & Winston and ChemComm did present a few examples to students that support the interaction of engineering and technology with science. Textbooks are one of the primary instructional materials in science classrooms and play a dominant role in science teaching and learning. An imbalance in the representation of the five themes of nature of science suggests that students and teachers are being exposed to a poor understanding of the scientific enterprise from chemistry textbooks. Science educators, curriculum developers, and textbook publishers should make an earnest effort to provide a better balance of the five dimensions of the nature of science and to avoid portraying science as mainly a body of knowledge or as a way of investigating.

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