Chapter 9
Inclusive Chemistry Education Through Culturally Relevant Modules in General Chemistry:
Developing and Implementing Culturally Relevant Modules

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ABSTRACT

Students learn better when they find connections between science and its applications to their lived experiences. Despite a call for reform in the teaching and learning of chemistry, Culturally Relevant Chemistry Education (CRCE) has remained a distant goal. This can be attributed to the lack of curricular materials to teach chemistry in a meaningful way. The study presented in this chapter has addressed this gap through modules that emphasize the relevance of scientific (chemistry-based) practices from a cultural and traditional standpoint. This chapter highlights the development and implementation of such CRCE modules in a large enrollment chemistry survey course in a Midwestern university. The impact of CRCE on student academic performance and conceptual understanding in terms of significant gains on pre and

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post assessments is presented for students participating in this exploratory mixed methods research study.

INTRODUCTION

College chemistry courses have earned the reputation of being gatekeepers of STEM (Science, Technology, Engineering and Mathematics) careers. Despite reforms to foster student retention in STEM areas, conceptual understanding and academic performance of students in general chemistry courses remains an issue (Barr et. al., 2008, Barr et; al., 2010; Ulriksen et. al., 2010). There have been significant efforts to make general chemistry courses student-centered and engaging, however deficiencies remain in the use of appropriate curricular resources and the alignment of teaching practices (Aud et al, 2010; Amaral et. al., 2013; Báez-Galib et. al., 2005; Chen, 2013). A student-centered practice aims at benefitting the learners by providing them curricular resources, classroom experiences, and using effective teaching practices to advance student knowledge and skills (Chase et. al, 2013; Foor et al., 2007).

Knowledge of general chemistry requires an integration of macroscopic, symbolic and particle level models (representations) to coherently understand and apply chemistry concepts. It is thus important for chemistry educators to focus on aspects that impact students' growth and understanding of the chemistry (Gupta & Hartwell, 2019). However, the novice instructors (or traditional teachers) remain oblivious of the impact of their curriculum resources; "think like a chemist" views and of their classroom practice and the impact of these on students. The decision making involved in teaching also includes choice of curricular resources and the ways these resources such as textbooks and technologies are used or integrated with the teaching and learning of a subject. The signals sent out by instructors are not generated in isolation - these signals reflect and convey the deficiencies that are inherent in the curricular resources that are used for teaching.

Diversity in Chemistry Teaching: Current Curriculum and Persistent Gaps

Scientific literacy encompasses a broad spectrum of science competencies that reflect of current advancements in science (Holbrook, & Rannikmäe, 1997, 1999; OECD, 2009). To be scientifically literate, the students need to a) understand characteristic's components of science as a form of human knowledge and specifically develop an understanding of the process of scientific inquiry (b) become aware of how science and technology shapes our material, intellectual, and cultural environ-

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