

Chemistry in an Environmental Context: Research into a Context-Based Learning Approach

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Abstract

Discussions held in the chemical education community have generated a variety of reports and recommendations for the need to reform the chemistry curriculum in high schools. The recommendations, which refer to teaching chemistry in the context of real-world issues, have been suggested as a way to enhance students' motivation and their interest. We believe that real-world problems highlight the interdisciplinary nature of chemistry and the relevance of chemistry to students' lives. Moreover, an active learning environment requires students to solve more sophisticated problems, design their own experiments, and to think critically. In this study an attempt was made to incorporate these recommendations by using analytical chemistry together with environmental chemistry as a springboard for teaching chemistry.

The main goals of this study were (1) to provide meaningful learning based on the need to know ideas for learning a new chemical theory and practice, (2) to create a coherent flow of activities in which students learn the chemical concepts from their own activities, and (3) to explore the change in students' attitudes and perception towards chemistry after experiencing learning chemistry through environmental context.

In order to attain these goals, an analytical chemistry unit was developed. This unit focused on environmental chemistry issues that include five laboratory sessions (4-6 hours each) in which the concepts of analytical chemistry in the context of a specific environmental problem are learned (for details regarding the laboratory activities, see section 3.1.3). Two modules have been developed on the topics of drinking-water quality and the greenhouse effect. A variety of teaching techniques are used in order to increase student participation in the decision-making process and to increase motivation.

The research questions focus on the change in the attitudes and perceptions of the students towards chemistry and environmental issues, after learning the environmental unit. Another interest of this study was the perception and attitudes of the teachers, who participated in the teaching process of "I Have Chemistry with the Environment" unit, towards teaching in context and in particular, teaching environmental chemistry.

The research population consists of 12th grade students (N~400) and 18 teachers in 18 classes and 16 schools who opted to major in high-school chemistry. The schools from which the sample was retained could be characterized as urban high schools, which are academic in nature and consist of students from average socioeconomic backgrounds.

The research study was conducted using a combination of both quantitative and qualitative measures in order to address the research questions. By using two different types of tools, we expected to obtain a more comprehensive picture of the change the students undergo while studying the module "I Have Chemistry with the Environment" (Tobin, 1998).

The results indicate that the students underwent a significant change in their awareness of environmental issues. All the students mentioned that the unit influenced their everyday-life perceptions of environmental issues and there was an increase in their awareness of environmental issues.

Another finding was that more students found that learning the "I Have Chemistry with the Environment" unit encouraged them to learn chemistry. Most students reported that they appreciated the unit more than their regular chemistry lessons. They wrote that they especially appreciated the feeling that they could discover things themselves. In particular, they referred to a sense of purpose: "We were doing real experiments, with a purpose". Students indicated that the unit was meaningful, and that this "why and how" was missing in their regular chemistry lessons. From the results, it can be seen that students found that learning the unit was relevant to chemistry learning as well as to their personal lives. Most of them stated that they want to learn about environmental issues in order to make changes and to improve the quality of their lives.

In summary, the data indicate that teaching chemistry based on relevant context-based learning, namely, environmental chemistry is an effective means of motivating students to find chemistry as a relevant, important, and interesting subject to study.