

Abstract

The enrollment of English Language Learners (ELLs) across the U.S. colleges and universities has been increased for years. These students recently immigrated to the U.S. and whose primary language is other than English, face an additional challenge when learning chemistry in pursuit of their goals in this country. Prior studies have shown that several factors such as ELLs' attitude and English language proficiency can affect their learning. This level of language proficiency is one of the factors that leads to an achievement gap between ELLs and their peer native English speaking students. Also, prior research revealed that ELLs' primary language can contribute to their learning and impact their test performance during assessment. While focusing on the learning process, this study was aimed to explore differences in attitudes toward chemistry between two language groups, ELLs and their peer native English speaking students, and the perceptions of ELLs about the role of language in learning and performing in chemistry.

Fifty-six participants including 43 native English speaking students, 13 ELLs, and their three instructors were chosen from three general chemistry 111 classes at a community college in the Rocky Mountain region. Out of these 13 ELLs who volunteered to participate, seven were selected for interviews. In this mixed methods approach, surveys, classroom observations, semi-structured interviews, and artifacts were used to understand how ELLs' attitude toward chemistry, their primary language, and other factors influenced their learning of chemistry. Quantitative findings from the survey data collected and analyzed through SPSS software were used to examine whether or not there was a difference in chemistry attitude between ELLs and their native English speaking peers. The study indicated that there was no statistical difference on attitude toward chemistry between the two language groups. Qualitative findings from the interviews, classroom observations, and artifacts were analyzed using grounded theory and constant comparative

method to identify codes and develop emerging themes. To increase validity of data, two coders were involved in the process of data coding. Transcripts were coded independently and the intercoding agreement was calculated. The seven themes included translation into primary language, instructor or tutor's use of primary language, primary language use in assessment, chemistry attitude and self-determination, assessment choice, instruction, and importance of chemical formulas and mathematics. These qualitative results indicated ELLs' perceptions about the role of language in their learning of chemistry concepts. In general, they revealed that their primary language use during learning can facilitate their understanding of concepts and improve their performance on the unit tests during assessment. In addition, ELLs' positive attitude and self-determination as well as their preference regarding test format type and instructor's strategies can contribute to their learning process of chemistry.

These findings carry important educational implications for helping ELLs and their instructors to overcome some challenges they face in a general chemistry class. Further study would be needed by using different sites to increase the number of ELL participants and to have more linguistically diverse population of these participants.