UCMERCED UNIVERSITY OF CALIFORNIA School of Natural Sciences

CHEMISTRY SEMINAR 291

Why Should We Dig Deeper?: Insights Gained from an In-depth Analysis of Chemistry Students' Solutions

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ABSTRACT

Chemistry students struggle with interpreting given information in problems and face difficulties in separating relevant information from distractors, which cause failure in generating successful solutions. Chemistry educators have extensively studied the nature of problem solving and aimed to pinpoint the students' challenges. However, very few of these studies focus on the individual steps and mostly examine students' success with the final answer. In this study, a group of general chemistry students' cognitive abilities and domain-specific skills were compared by analyzing their performances on 25 stoichiometry questions. To better understand the reasons behind their failures and achievements, students were grouped as higher- or lower-achieving based on the results of a diagnostic test, and similarities and differences in their performances, strategies, and mistakes were investigated. The study revealed that the major difference between higher- and lower-achieving students lies in their cognitive skills, especially in domain-specific (mole concept) skills and in their abilities to deal with the complex nature of problems. Results suggest that when possible, a thoroughly differentiated set of tasks be applied in the undergraduate chemistry classroom: tasks with limited complexity and structured help or scaffolding are needed for lower-achieving students, whereas complex and abstract tasks are needed to challenge the higher-achieving ones.

BIO:

Ozcan Gulacar has a Master's degree in Physical Chemistry and a Ph.D. in Science Education. For the last 18 years, he has worked at different educational settings including international high schools and doctorate and Master's granting institutions. He has designed and taught several graduate and undergraduate chemistry and science education courses for a wide range of audience. His main research interests revolve around the understanding of problem-solving procedure and finding ways to increase high school and college students' achievement in solving problems. He enjoys taking a journey in the mind of a problem solver using qualitative and quantitative methods to understand how that person uses his knowledge to tackle a wide range of problems and tasks. So, he focuses on revealing and highlighting the interaction between problem-solving performance and nature of knowledge system. Knowing that students' knowledge system is not only the factor affecting their problem-solving performance, he also investigates the influence of teaching methods, educational technology, cognitive variables, motivation, attitude, and self-efficacy on students' success with learning and application of knowledge in problem solving. Besides teaching and running research projects, he has also developed and organized workshops about the implementation of social constructivist methods and effective use of technological tools in science classrooms for high school teachers and college professors.