COSINE (Coding System for Investigating Sub-problems and Network): A New Method to Analyze Students’ Problem Solving Performances

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Abstract: Success with problem solving depends on several variables, including students’ conceptual understanding, strategies, and skills. Determining the influence of each variable is an important task in revealing the sources of the challenges with problem solving. A coding system was developed and used to evaluate solutions of seventeen university students working several stoichiometry problems in a think-aloud protocol. The stoichiometry problems were evaluated as a series of sub-problems (e.g., writing chemical equations, mole concept, empirical formulas, mass percent, or limiting reactant), and the coding scheme was used to categorize each sub-problem solution as successful, neutral, or unsuccessful, with more detailed codes comprising the neutral and unsuccessful categories, for a total of eight codes. The application of the new code system was shown to reveal difficulties that might have otherwise been missed by an analysis that focused on end results only.

In addition to presenting the background of the coding system, details on how to implement the coding system will be shared and implications of findings for teaching will be discussed.

Ozcan Gulacar has 6 years of high school and 11 years of college teaching experience. He received his Ph.D. in science education from Western Michigan University and his B.A. in chemical education from Uludag University, Turkey. His research interests revolve around the factors affecting students’ problem solving performances. Investigated variables include but are not limited to knowledge base, cognitive abilities, inquiry-based methods, and educational technology.