Adapting a theoretical framework for the analysis of students’ reasoning with representations

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Background

- Representations are valuable for communicating and integrating scientific concepts.\(^1\)
- Representations are important tools for constructing knowledge.\(^2\)
- Students experience difficulties when reasoning with commonly used representations.\(^3\)

Research Question

How can Schönborn and Anderson’s empirical model\(^4\) be applied to characterize students’ reasoning with representations of molecular structure?

Data Collection and Analysis

- Sample: 12 Organic Chemistry I students
- Protocol design:
  - Phase I investigates students’ conceptual knowledge prior to exposure to representations. 
  - Phase II investigates students’ interpretation of representations.
- Example questions:
  - What do the lines, symbols, circle represent? What information about bonding does this representation communicate?
  - How can representations help you understand the octet rule?
- Data collection: Semi-structured, think-aloud interview conducted in Fall 2020 via Zoom
- Data analysis: Deductive coding\(^5\)

References


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c, M, and C-M (dotted lines in quotes) represent factors that make constant contribution to the interpretation of representations. Reasoning (R) cannot occur without something to reason with, in this case, scientifically accepted conceptions or the features of a representation.

R-M, R-C, and C-R-M (solid lines in quotes) are factors that can be elicited from student data.

- Students use rule-based reasoning when interpreting representations.
- Students’ poor prior knowledge may lead to incorrect interpretations of representations.
- Students struggle to read and decode the deeper conceptual information encoded in representations.