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Causal Parsimony in Learning Science

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Abstract: The ability to understand scientific phenomena entails the creation of appropriate models of relations among variables, frequently in causal form. In the chemical world multiple factors interact to produce outcomes, e.g., chemical reactions occur only when multiple reactants react to create new product(s). Do students simply add new information to their mental models, or do they follow some sort of causal parsimony replacing old ideas with new ones? We captured students causal models of chemical phenomena and examined whether these models changed after instruction designed to foster in-depth causal understanding of chemistry concepts. The results from concept mapping activities suggest that students used causal parsimony, replacing some of their naïve conceptions with what they learned while creating paint. However, students continued to use atomic explanations sparingly, indicating that students were willing to adopt shallow-level causal explanations, but were reluctant to do the same for deeper-level chemical processes.