

How Technology Can Help Students to Visualize the Molecular World without Inducing Misconceptions about Chemistry

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Chemistry is a science that operates at many levels, including the invisible molecular level. Conveying molecular-level chemistry processes to students is notoriously difficult. Recent research studies have found that many students, regardless of prior chemistry background and academic ability, have misconceptions about molecular-level structures and processes. These misconceptions interfere with learning many of the concepts characteristic of the molecular world. Chemistry instructors have found animations and visualizations to be useful means of communicating accurate images of dynamic molecular concepts to students. Often students are able to correct their misconceptions after viewing either still molecular visualizations or dynamic animations and simulations. However, scientific visualizations and animations can be too complex to be accurately perceived, especially by novices, who may not know how to interpret what they are seeing or even where to look. These visualizations have also been found to reinforce misconceptions and even to create new ones.

The latest theories and research techniques of cognitive psychology have been combined with state-of-the-art tools of educational technology to study molecular visualizations designed to support the learning of chemistry. The result is a multifaceted research-based approach to designing visualizations that are effective in communicating abstract chemistry concepts. The approach is being tested with a broad variety of concepts and at various levels of learning, from secondary school through upper division university courses.