

Developing conceptual understanding of chemical equilibrium through the use of computer-based visualization software

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This paper details the development of teaching strategies arising from the use of visualization software based on three-fold representation macroscopic, molecular and symbolic, to develop a conceptual understanding of chemical equilibrium. Chemistry visualization software (SMV: CHEM –Synchronized Multiple Visualizations of Chemistry – particularly ‘chemical equilibrium’, and VisChem - Visualizing the Molecular World) was used as sources of visual materials to illustrate the molecular, macroscopic and symbolic levels of chemistry in a more integrated way.

Prior research revealed that many chemistry students have difficulties in seeing the connections among observable macroscopic changes, unobservable sub-microscopic changes (that is at the molecular level), and symbolic representations. The first level; the macro is concrete, tangible and accessible to the students. The other two are not; they are remote, abstract and complicated. The sub-microscopic representation often poses problems for students because they cannot directly see or touch atoms and molecules in the classroom environment. Hence, visualization of chemical reactions at three levels synchronously, using videos, verbal explanations (sound) and animated molecular models to see the changes at macro and molecular levels are effective in conceptual understanding of abstract chemistry concepts.

Pre-test and post-test was used to measure the effectiveness of the software. The extent of conceptual understanding developed by the software was identified through interviews. Strategies that teachers develop to improve students’ conceptual knowledge were identified through a workshop with a panel of Graduate Diploma Teachers, experienced teachers and lecturers of the University of Wollongong. Outcomes of this study are a set of appropriate software features that enhance student conceptual understanding and a set of strategies that teachers can employ to develop conceptual understanding of chemical equilibrium in a computer-based learning environment.

Key words: Chemical education; Computer-based teaching; Visualization software; Pedagogical issues