A PICTURE IS WORTH A THOUSAND WORDS: DEVELOPING A COMMON VISUAL LITERACY AMONGST FIRST YEAR CHEMISTRY STUDENTS

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BACKGROUND

This paper reports on the development and implementation of student-generated submicro drawing questions into a first year chemistry laboratory program.

AIMS

This study aims are to use student-generated drawings to diagnose alternative conceptions held by first year chemistry students and enhance their understanding of the main concepts covered in each laboratory class.

DESCRIPTION OF INTERVENTION

Asking students to attempt submicro drawing tasks for assessment purposes first requires the development of a common visual literacy amongst students that helps to build familiarity with such tasks and allows comparable drawings to be produced. Developing a common visual literacy for this study involved students attempting three drawing tasks and watching a short video presentation. The drawing tasks were accompanied by guidelines but still required students to express their understanding of concepts such as molecular geometry, relative sizes of atoms and ions and the interactions between the chemical entities in their diagrams. Students attempted the questions individually before being invited to attempt them again in collaborative groups.

DESIGN AND METHODS

The participants for this study were first year general chemistry students at a large university in Victoria, Australia. The study compiled preliminary data, which involved the collection of over three hundred student-generated drawings produced solely from the imaginations of the participants during week 1 of semester 1, 2013, followed by participant interviews at the end of the semester. A review of the relevant chemistry education literature and the preliminary data were used to develop the drawing tasks and video presentation that introduced students to a common visual literacy during weeks 1 and 2 of semester 1, 2014. Student-generated drawings collected during the preliminary data stage were assessed against criterion developed using a grounded approach, which enabled themes to emerge by coding and categorizing the drawings through repetitive comparison.

RESULTS

Figures 1 – 3 are examples of student-generated drawings and highlight some of the alternative conceptions that can be revealed when students' are asked to visually express their understanding of how ions interact in an aqueous solution (Figure 1) and in a solid (Figure 2). Students also revealed a number of alternative conceptions relating to water molecules and a difficulty in representing the detail required for solute-solute and solute-solvent interactions to be demonstrated (Figure 3).

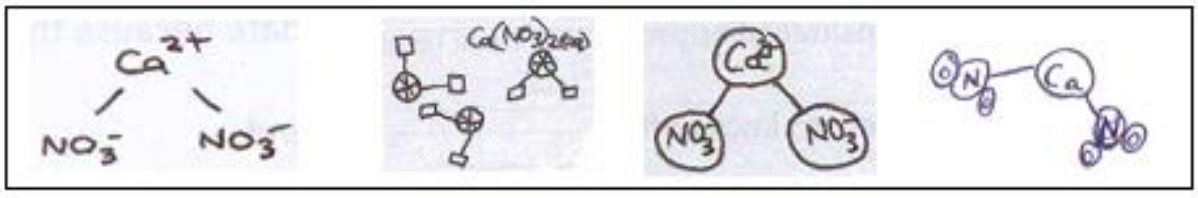

Figure 1: Drawings not meeting one or more criteria developed for aqueous calcium nitrate

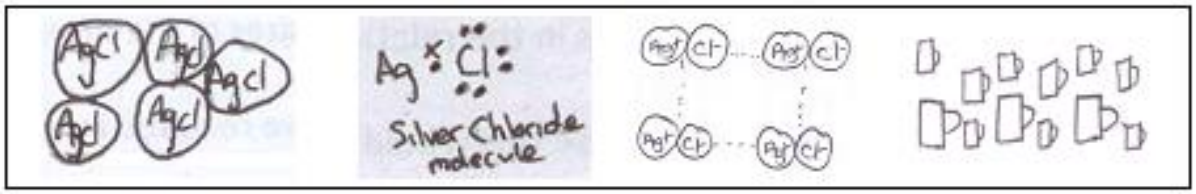

Figure 2: Drawings not meeting one or more criteria developed for solid silver chloride

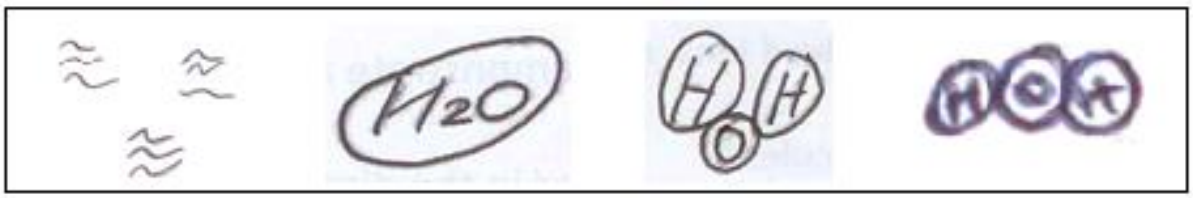

Figure 3: Drawings not meeting one or more criteria developed for liquid water

CONCLUSIONS

This study is situated within a constructivist framework which seeks to understand students' alternative conceptions and to introduce effective pedagogical approaches that help to engage students in the learning process. Questions that require students to draw submicro diagrams and use them to facilitate a shared understanding with their peers are consistent with the collaborative nature of chemistry and a student-centred approach.

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