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Development of a 3D printing workshop to aid student comprehension of shape and isomerism

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Molecules and reaction transition states aren't 2D, yet we continually expose our students to 2D representations of these chemical concepts in textbooks, presentations and lecture notes. This can result in students experiencing difficulty in mentally "translating"these 2D representations into their correct 3D arrangements. For example, translating bond angles and representations of bonds in-perspective (i.e. the use of wedges and dashes) into the spatial distribution of atoms and bonding is often challenging for many students. Traditionally, this has resulted in a shortfall in the ability of students to draw molecules in set orientations and assign their stereochemistry. We have created a workshop activity that allows students to draw a molecule, which contains a stereogenic centre, of their choice and then have it printed during class. This computational session is complemented by a manipulation and worksheet activity to link the task to their previous studies of shape and isomerism. This intervention has led to improvements in student understanding of molecular representation and the assignment of stereochemical labels. The majority of students enjoyed the activity and wished to see more 3D-printing in their education, with the integration of steps that require students to draw the structures and prepare the printing files being found important and highly beneficial. Comparing data collected before and after the workshop highlights that this activity has led to improvements in student confidences in drawing chiral centres and increases in perceived competences in understanding, representing and assigning chirality.

Key words

Hands-On Learning/Manipulatives, Molecular Modeling, Organic Chemistry, Chirality/Optical Activity, Stereochemistry, First-Year Undergraduate/General

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