# SCDL1991 Science Showcase Pitch

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## Working Title

Effectiveness of virtual reality in strengthening students understanding of chirality in organic chemistry

## Research Question

Can the use of virtual reality aid in the teaching of complex structural concepts, specifically chirality, in organic chemistry?

## Motivation

Chemistry students often struggle with abstract concepts in chemistry, particularly those that incorporate 3-dimensional elements (Copollo 1995). Rudimentary two-dimensional models of molecules such as Lewis structures fail to convey vital information about structure and are often difficult to interpret. While basic 3-dimensional models such as molymod kits are known to be effective tools in education, they are limited by physical restrictions such as static bond length, availability of materials and the requirement of manual construction. Further, traditional teaching methods involving textbooks and lectures can be unengaging for some students and can be a catalyst for discontinuation of studies (Stockwell 2015).

Virtual reality offers a unique and engaging way to convey complex structural concepts in 3-dimensions and has been found to yield significant improvements to students fundamental understanding as well as their motivation to learn complex ideas in chemistry (Ferrel, 2019).

In previous years, virtual reality has not been found to increase student understanding of chemical reactions and it is possible that the changing molecules in virtual reality confused students. Hence this project will focus on chirality a purely structural concept. Furthermore, only a single group previously has incorporated the use of molymod kits.

## Aims

Firstly, this project aims to test the efficacy of virtual reality in teaching complex 3 dimensional topics in organic chemistry in comparison to standard teaching methods. In addition, it also aims to measure students' engagement and enthusiasm towards the lesson as a result of the medium in which it is taught.

## Approach

This experiment will be completed at the university of Sydney with the chemistry faculty as part of the SCDL1991 unit. Participating will be first year chemistry students, also attending the University of Sydney. The sample size is not yet clear but will be restricted by the time frame available to perform the lesson as well as the amount of interested students.

Participants will complete a quiz before and after the lesson, testing their knowledge in order to compare developments in their understanding. In addition, a survey will also be completed before and after the lesson to gather students' enthusiasm towards the material as well as their opinion on the mode of lesson delivery.

To test the efficacy of the virtual reality medium, three lesson plans will be constructed. One using 2-dimensional images and diagrams, another using a moly mod kit and a final lesson using a virtual reality simulation implemented in Unity.

## Implications

Sufficient evidence of the efficacy of virtual reality in teaching complex structural chemical concepts may lead to widespread implementation in curriculums. Furthermore, unique methods of education can increase students' enthusiasm towards material and consequently their motivation to continue learning.

## Considerations

This project is a continued effort from previous science showcases. Collaboration with experienced personnel such as prior students and Unity experts is essential to success. As such they must be credited for their foundational work. It is a possibility that the time frame in which the lessons are taken is too short to gather enough data for meaningful comparisons between the test groups. Further, the student participation may be a limiting factor and the target demographic of the lesson may need to be expanded from exclusively chemistry students at the University of Sydney. As chirality is a component of both chemistry 1A and 1B, preexposure to material could have a significant impact on the validity of the data.

## Hypothesis

When presented with a lesson implementing virtual reality, students will show measurable increases in enthusiasm towards the material as well as performance on a test of their knowledge than those presented with a lesson using standard 2-dimensional models or molymod kits.

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