

UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

Virtual Chemistry Laboratory Equipment

Title

Ryan Simon, Tolga Karsili

Name of Submitter
(Faculty or Staff Only)

Department of Chemistry

Organization

Title: Organic Chemistry Laboratory Equipment Proposal Date: 1/14/2020
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Department/College/Org: Chemistry

ABSTRACT (250 words or less):

The purpose of this proposal is to purchase equipment in order to build a virtual reality(VR) chemical laboratory. The initial purchase of equipment will allow the faculty and students the ability to explore the current state of the art virtual learning environments. The goal is to allow to students to explore the chemistry on the molecular level as well as the macro level in a visual media. Students will use the equipment under the direction of the faculty to create open educational resources (OER) in the field of chemistry with the final goal being to allow visualization of lecture topics and laboratory materials in an open, virtual world.

A. Purpose of Grant and Impact to Student Body as a Whole

The purpose of this proposal is to acquire an Alienware Aurora R9 VR ready, custom made desktop. This specially built desktop will run the VR equipment as well as allow the students to explore new chemistry VR software. The Oculus Rift S, as well as the Oculus Quest, will be the two different VR devices that will be purchased for the students to use. These two pieces of equipment will allow the students to use two different state of the art VR devices.

Each semester, roughly 1400 students take freshman and sophomore level chemistry courses at UL. Each of these students, as well as those from other STEM majors, will benefit from an open access VR lab. This lab will be open to all students, not just chemistry majors.

The VR lab will be set-up in such a way as to allow the user to fully control and communicate with the platform. The VR framework will allow users to manipulate chemical reactions - providing students with a first-hand molecular-level understanding of chemical reactivity. Some visualization techniques have been successful in implementing interactive molecular animations. One notable example is interactive molecular dynamics (iMD) which uses modern-day molecular mechanics methods in a VR framework to provide the user with the virtual opportunity of holding a molecular structure and inserting or colliding it with another. For example, picking-up a methane molecule and leading it through a carbon nanotube.

A similar method of 'grab-and-drag' will be implemented here, in which users will control a given chemical event. For example, a typical chemical reaction comprises of the rupture and formation of chemical bonds. Students will be able to manipulate the molecular structures in the VR environment, so as to promote chemical reactivity. This will give the students a first-hand visual account of the important electronic and geometric effects that encourage/discourage chemical reactions.

The most innovative part of this project is that no other Chemistry department in the US is currently offering such an experience for their students. The project promises to aid in the development of student learning by gaining a first-order visual account of how chemistry **actually** occurs at the molecular level. The project is therefore highly innovative and potentially transformative.

If the funds are approved, the equipment will reside in room 120B of Montgomery Hall. This is the Chemistry Student Lounge as well as mentoring room. It is currently equipped with computers, a projector, and whiteboards. The addition of VR equipment will allow the students to enhance their learning experiences.

B. Projected Lifetime of Enhancement

The projected lifetime of the instruments requested is over five years.

C. Person(s) Responsible for:

Implementation: Ryan Simon and Tolga Karsili

Installation: Ryan Simon and Tolga Karsili

Maintenance: Routine maintenance covered by the Department of Chemistry

Operation: Faculty of the Department of Chemistry and Students

Training: Faculty of the Department of Chemistry

Budget Proposal

1.	Equipment	\$ 4316.00
	Alienware Aurora R9 VR custom built Desktop – \$3365.00 Oculus Quest VR Machine - \$399.00 Oculus Rift S - \$399.00	
2.	Software	\$ 0
	Software provided by department	
3.	Supplies	\$ 0
	No supplies needed	
4.	Maintenance	\$ 0
	Routine maintenance will be covered by the Department of Chemistry	
5.	Personnel	\$ 0
	No additional personnel required.	
6.	Other	\$ 0
	None	
TOTAL:		\$ 4316.00

Other Relevant Information

None

Previous STEP projects

Ryan Simon has previously authored the following funded STEP proposals:

- Organic Chemistry Laboratory Equipment Grant, R. Simon and A. Gallo, \$3666.50, awarded in May 2016.
- Demonstration Equipment Grant, R. Simon, \$501.64, awarded in January 2017.
- Maker Lab for Montgomery Hall, R. Simon and Y. Wang, \$3649.79, awarded in May 2017.
- Whiteboards for Montgomery Hall, R. Simon, \$6371.96, awarded January 2018.
- Chemical Reactions with Light: UV Lamps for Photochemical Experiments in Organic Chemistry Labs, T. Junk and R. Simon, \$2100.00, awarded January 2018.
- Electric Thermometers Grant Proposal, R. Simon and A. Gallo, \$1850.00, awarded May 2018.

Tolga Karsili has no previous experience with STEP proposals.