

# Course-based Undergraduate Research Experience as a Tool to Improve Academic Success in Science Courses

Report by Edgar Rosas Alquicira

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## 10/09/2020 – Initial Meeting

Members attending:

1. Claudia Owen
2. Stephen Clarke
3. Richard Glover
4. Colin Phifer
5. Lisa Munger (UO)
6. Edgar Rosas Alquicira (Facilitator)

In this meeting, first, I explained the goals and the associated asynchronous and synchronous activities. Second, participants introduced themselves and explained their experience implementing course-based undergraduate research experiences (CUREs), and their expectations from participating in the FIG. Third, we discussed the five research dimensions that make a CURE an effective learning experience (Auchincloss *et al.* 2014), such as the use of scientific practices, discovery, broadly relevant, iteration, and collaboration. Finally, I explained the key points that participants needed to review as prep material for meeting 2.

## 10/30/2020 – Second Meeting

Members attending:

1. Claudia Owen
2. Stephen Clarke
3. Richard Glover
4. Colin Phifer
5. Stacey Kiser (Participant, and Guest speaker)
6. Lisa Munger (UO)
7. Edgar Rosas Alquicira (Facilitator)

In this meeting, first, we reviewed our understanding about the five research dimensions that make a CURE an effective learning experience. Second, we discussed how the five research dimensions can be represented in different laboratory learning experiences, such as traditional laboratory, inquiry laboratory, and CUREs. In addition, according to the levels of representation of each of these five research dimensions, we concluded that when comparing CUREs and other laboratory experiences, CUREs obtained the highest score. Moreover, Stacey Kiser shared with us her experience about implementing CUREs in majors vs non majors courses in biology, LCC Honors Program, which is focused on research, and community college resources that are associated with CUREs. Finally, I instructed participants about the guidelines and key topics that we needed to consider regarding our CUREs' presentations in upcoming meetings, such as a course objective outcomes that the CURE covers, research goal, methodology, and

instructional resources for students. Also, participants worked on self-evaluating their CUREs based on the levels of representation of each of the five research dimensions cited by Auchincloss and collaborators (2014).

### **11/13/2020 – Third Meeting**

Members attending:

1. Stephen Clarke
2. Richard Glover
3. Colin Phifer
4. Stacey Kiser
5. Lisa Munger (UO)
6. Edgar Rosas Alquicira (Facilitator)
7. Andrea Goering (Guest speaker)
8. Doug Young (Guest speaker)

In this meeting, first, I presented a CURE that can be implemented in introductory marine biology courses at LCC. The CURE's research goal is to determine the effects on growth rates of the green marine algae *Ulva sp.* under different experimental conditions. The self-evaluation of the CURE and the Q&A session helped to determine the CURE areas that can be improved, such as balancing the class time that students would need to spend on it. Second, Doug Young described how chemistry instructors have implemented a CURE in a series of three chemistry courses at LCC. Finally, Andrea Goering shared her experience implementing an inquiry lab in astronomy courses at LCC based on the collection of data from a Zooniverse project.

### **11/20/2020 – Fourth Meeting**

Members attending:

1. Stephen Clarke
2. Richard Glover
3. Colin Phifer
4. Stacey Kiser
5. Claudia Owen
6. Lisa Munger (UO)
7. Edgar Rosas Alquicira (Facilitator)
8. Pat Boleyn (Guest speaker)

In this meeting, three participants presented their CURE and their CURE's self-evaluations. First, Rick Glover presented an implemented CURE in an EES course at LCC. The CURE is based on evaluating data of the water supply from different governmental agencies and media data, so students can calculate flood probabilities from their study area. Moreover, this CURE was developed to be applied in remote courses and based on public data. At the end of the CURE, students shared their main findings as a poster format. Second, Lisa Munger presented a CURE that has been implemented in a UO BI357 Marine Biology course at UO. During this CURE, first students were guided in previous labs to build knowledge about different marine

organisms, and second, students designed a lab that was developed in one session and which let them test their research questions and hypotheses. Finally, students presented their main results in a poster symposium. Third, Colin Phifer presented a CURE that has been implemented in his BI 103E courses at LCC. This CURE is based on students' field observations on bird window collisions at LCC. For this CURE and during class time, students participated in building surveys, rotated through the buildings, data entry, data analysis, and poster design. As final products of this CURE, students presented their main findings as a conference poster. Finally, Pat Boleyn shared her experience implementing a CURE in a Forest Biology 102 course at LCC. The CURE's title is "Allelopathy in Trees Exploration". The research goals of this CURE are guided by the following questions: a) Do volatiles from crushed tree needles inhibit seed germination of lettuce seeds & subsequent seedling growth?, and b) Do pH changes influence seed germination of lettuce seeds in the presences of crushed tree needles? Regarding the students' goals, these are: a) conduct a scientific experiment, b) practice the scientific method, and c) write a technical report. More information about this CURE can be found in the following website: <https://serc.carleton.edu/curenet/collection/239757.html#author>.

### **12/04/2020 – Final Meeting**

Members attending:

1. Stephen Clarke
2. Richard Glover
3. Colin Phifer
4. Stacey Kiser
5. Claudia Owen
6. Lisa Munger (UO)
7. Edgar Rosas Alquicira (Facilitator)
8. Peter Berquist (Guest speaker, Thomas Nelson Community College)

In our last meeting, three participants presented their CURE and CURE's self-evaluations. First, Claudia Owen presented an implemented CURE in her G201 Earth Materials and Plate Tectonics at LCC. In this CURE, students produced a geological map containing cross sections and interpretation of the geological structures. Finally, students presented their results as a poster during the Science Undergraduate Research Days Symposium at LCC. Second, Steve Clarke presented an implemented CURE in his 205 Soil course at LCC. During this CURE, students explored and identified soil functions, and applied a discipline framework to link soil properties to soil functions and ecosystem services. As a final product of this CURE, students presented their main findings in a poster. Third, Stacey Kiser shared her experiences implementing CUREs in her BI 212 Principles of Biology, and BI 213Z Principles of Zoology courses at LCC. During these CUREs, students collected data from game cameras and/or analyzed data sets that were collected by former students, and finally presented their main findings in the modality of posters. Finally, Pete presented how he has implemented CUREs in his Historical Geology and Oceanography classes at Thomas Nelson Community College.