Introduction

- Course-based undergraduate research experiences (CUREs) are courses in which students experience the process of science through addressing novel research questions that have relevance to local and/or scientific communities.
- CUREs have the potential to amass valuable scientific data while also engaging students in genuine research, ultimately improving student interest and retention in science.
- We implemented a pilot CURE in two sections of an introductory biology course lab (Bio 151). Six sections remained a “traditional” lab with weekly labs corresponding to lecture materials. In this quasi-random design, students did not know before signing up for the section that they would be doing a CURE or a “traditional” lab.

Course Objectives

Students will:
- Engage the “process of science”
- Make connections between course content and their local environment and lives
- Learn hypothesis-driven research skills
- Work collaboratively
- Gain relevant quantitative skills
- Communicate science

Causal question addressed in CURE lab
- What affects CO₂ emissions and nutrient limitation in urban lakes?

Hypothesis
- We hypothesized that water source affects CO₂ emissions and nutrient limitation.

Approach
- Six lakes in Tempe, AZ were selected: 3 were maintained with groundwater and 3 with surface water.
- Students collected data on water chemistry, CO₂ emissions, and nutrient (N,P) limitation via lab incubations and nutrient diffusing substrata (NDS; Figure 3).

Student Outcomes

CURE students perform better in Bio 151 than predicted

CURE lab n= 24; “Traditional” lab n = 71; t=2.30

Table 2: Student responses to weekly survey questions at the start and end of the class.

Attitudes

Figure 1: Comparison of CI scores for students in CURE and “traditional” labs. CI score is a significant predictor of students’ final grade in Bio 151.

Attitudes

Week 4

“Working collaboratively with your peers in Bio151, a positive experience or something in between?”

CURE

Student 1

Positive Response

Negative Response

Before Experiments

20

20

After Experiments

30

10

Table 1: Open-ended responses were coded as “positive” or “negative” before and after the completion of the class experiments (n=40).

Results/Conclusions

- Students successfully collected novel data on urban lakes suggesting urban lakes maintained with groundwater tend to be phosphorus limited.
- Final course grades did not differ between CURE and “traditional” lab students. It appears as though the CURE diminished the achievement gap between these students populations (Figure 1).
- CURE students did not appear to be disadvantaged from a lack of reinforcement of lecture “content” in lab.
- Open-ended formative assessment reveals that at the end of the CURE, students perceived the CURE research question as more important than they did at the beginning of the CURE (Table 1).
- Preliminary analysis indicates that students may be able to better recognize the complexity of the scientific process and the value of collaborative work at later points in the course (Table 2).

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