Development of Online Biology Labs

This is the final report for the 20% Type B leave project approved for Susan Ramones for the Spring 2018 semester. This report is being submitted in accordance with Professional Standards committee requirements.

A. Describe the focus of the work proposed and completed during your leave:

**Purpose:**
Expand the biology department’s distance education offerings by developing rigorous and authentic laboratory activities that can be incorporated into a non-majors general education biology course.

**Objectives:**
1. Investigate possible online lab activities that are comparable to the existing BIOL 310 lab curriculum and select specific activities to develop.
2. Determine what a rigorous non-majors online biology lab module should consist of.
3. Develop Canvas modules for 12 online lab activities.

**Objective 1 - Completed**
- Evaluated 15 eScience kit labs used in my hybrid class pilot to determine which to keep and which to find better options for. Of the 15, I selected 13 to use and 2 to find alternatives for.
- Compared the lab work typically done in a semester of BIOL 310 with the estimated hours for the 13 kit labs. Determined that we should have about 12 additional labs for a total of 25 labs for a complete semester.
- Tentatively assigned specific labs to my weekly online lecture schedule to determine the order of the labs (see Table 1).
- Worked with new full-time faculty member Janet Hanstead to brainstorm about other possible sources for lab activities.

**Objective 2 - Completed**
- Read through OER biology labs taught at PIMA Community College and had email exchange with lead professor about course details including use of pictures to authenticate lab activities, use of lab discussion groups, and online lab points.
- Reviewed research based articles about online biology lab teaching.
- Talked individually to colleagues in the biology department who tried out various eScience lab activities and gave me specific feedback about the rigor and quality of specific eScience labs.

**Objective 3 - In Progress**
- Based on work on objectives #1/#2, along with information from faculty discussions, developed a template for each online lab module in Canvas (see Figure 1).
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- Developed and edited modules and associated pages and documents for 7 lab activities: Module 1 (A. General Lab Safety and B. Biodiversity Web Search), Module 2 (A. Virtual Marine Scientist), Module 4 (A. Introduction to the Microscope and B. Protista), and Module 7 (A. Enzymes and B. Cellular Respiration). Of these, 5 were based on eScience lab kits and 2 were based on my own developed activities.

This was less than I projected. I was significantly diverted by a variety of other tasks related to the online lab project (see Additional Work below). Also, the development of the first module involved creating a set of instructions that would walk a student through how to do both an eScience lab and a independently developed lab. These instructions had to be clear, not overwhelming but with adequate details; and developing these instructions was incredibly time consuming.

Additional Work

- As I have worked through this project, a number of additional, unanticipated tasks have arisen. Because they involved the process of offering these online labs and helping set up our students to succeed, I felt that time to these tasks was important to the overall purpose of the project.
  - Updated Online Labs Development Canvas site homepage to streamline access to information and labs for interested colleagues.
  - Develop language for my syllabus that describes the general expectations for the labs and lab work.
  - Edit the Student Weekly Workload section of my syllabus to show how lab fits in with the lecture components of the class.
  - Working with ARC biology lab technician for our on-campus BIOL 310 class to get an estimate of the cost per class ($4,500 serving ~32 students or ~$141 per student).
  - Worked with the eScience’s sales representative to find a more reasonably priced kit that included only the labs I am interested in using. This cut the unit price quote from $191 to $118.
  - Working with the ARC Bookstore to make sure that an inexpensive but functional webcam was available for purchase such that financial aid could cover it. Also, ensuring that the catalog language was clear that this was required but only if students didn’t have other access to a webcam at home, work or school.
  - Confirmed on-campus options at the Library and LRC for webcam enabled computers for student quizzes and exams. None available at the Natomas Center.
  - Polled BIOL 300 online students about webcam access to determine if access would be a barrier. Over 90% of students in my two online classes already owned or had easy access to computers with a webcam. Those that did not noted that they could come to the ARC campus to use a webcam.
B. What was accomplished as a result of your leave?

As a result of this leave, I am well on my way to have the lab piece of a fully online general education biology class completed. Based on the progress, I was confident enough that this will be done that I scheduled the online version to be taught in Spring 2019.

C. Explain how the work completed during your leave relates to ARC’s goals and focus areas, and to the state’s professional development guidelines.

Distance education is an important option to serve a variety of students who are unable to attend in-person classes. Distance education classes must also maintain the rigor and college-level experience that in-class students receive. The purpose of this project is to add this expanded access for students needing a general education biology course with a lab, while ensuring that the lab portion is an authentic lab experience. This supports the goals of student success, teaching and learning effectiveness, and access and growth.

**District Goal 1: Student Success**

1.2 Establish and publicize clear, efficient, and structured pathways for completion of the student’s educational goals.

Currently, the distance education program is advertising 100% online degrees and certificates. Adding a fully online lab component to BIOL 310 would add a path for students to complete both their science general education and science lab requirements entirely online that does not currently exist.

**District Goal 2: Teaching and Learning Effectiveness**

2.1 Increase faculty and staff development activities to improve teaching and learning effectiveness, with particular emphasis on basic skills, distance education, and culturally responsive instruction.

Creating these online lab modules will improve my own expertise and range of skills with the Canvas LMS. It will also allow me to work as a mentor for other department colleagues who may consider similar online or hybrid modalities in the future.

**District Goal 3: Access & Growth**

3.2 Maximize access to programs and services by continuing to develop and effectively use facilities and technologies that support the college’s enrollment trends. BIOL 310 has been identified as one of the main courses students use to satisfy both their biological science and laboratory science class requirements. If online labs could be developed that the biology faculty agreed were rigorous and authentic enough, we would be able to add this option to our students. Such online lab classes are offered by
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other institutions outside Los Rios and it is likely that our 100% distance education students are currently looking outside the district to satisfy those requirements.

D. As a result of your leave, what will you take back with you to your current assignments and/or to the college as a whole (including how you shared or plan to share the results of your project).

The main contribution to the college as a whole will be to offering this course in Spring 2019 as a fully online option for completing the GE life science lab course requirement. I have already created a Canvas shell dedicated to Online Lab Development, so this will be the main way I will share my work with my colleagues. The modules for each lab could be imported and modified as needed by those colleagues. I will also present what I created for the class, as well as, give an update on how my first semester is going to both my department and to a group of district instructors and deans interested in teaching science online.

Figure 1. Screenshot of Online Lab Module Template
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**Table 1. Tentative Online Lab Schedule**

| Module 1. Introduction and Biodiversity (Ch. 13) | A. General Lab Safety (Lab Kit)  
B. Biodiversity Web Search |
<table>
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<tr>
<td>Module 2. Science &amp; the Scientific Method (Ch. 1)</td>
<td>A. Virtual Marine Scientist</td>
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<tr>
<td>Module 3. Evolution (Ch. 10-12)</td>
<td>A. Population Genetics (Lab Kit)</td>
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| Module 4. Ecosystems & Ecology (Ch. 14-16) | A. Introduction to the Microscope (Lab Kit)  
B. Protista (Lab Kit) |
| Module 5. Biomolecules & Nutrients (Ch. 2 & 3.1) | A. Chemistry of Life (Lab Kit)  
B. Nutrition |
| Module 6. Cells & Membranes (Ch. 3.2-3.3) | A. Diffusion (Lab Kit)  
B. Osmosis (Lab Kit) |
| Module 7. Gene Expression (Ch. 9.1) | A. DNA and RNA (Lab Kit) |
| Module 8. Biotechnology (Ch. 9.2-9.4) | A. Biotechnology (gel electrophoresis, DNA digestion, transformation) |
| Module 9. Enzymes & Cellular Respiration (Ch. 4) | A. Enzymes (Lab Kit)  
B. Cellular Respiration (Lab Kit) |
| Module 10. Photosynthesis (Ch. 5) | A. Photosynthesis  
B. Campus Walk |
| Module 11. Cellular Reproduction: Mitosis & Meiosis (Ch. 6) | A. Mitosis and  
B. Meiosis (Lab Kit) |
| Module 12. Genetics (Ch. 7/8) | A. Mendelian Genetics (Lab Kit)  
B. Fertilization |
| Module 13. Respiratory & Circulatory Systems (Ch. 19) | A. Circulatory System  
B. Respiratory System |
| Module 14. Immune System (Ch. 20) | A. HIV Virtual Lab  
B. ELISA |
| Module 15. Endocrine & Skeletomuscular Systems (Ch. 21) | A. Human Senses |