QUBES MathBench Faculty Mentoring Network
Final Product: Evolved Immunity

Part 1: Context

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Institution: College of Coastal Georgia
Course: Introduction to Environmental Science Laboratory (BIOL 1120L)

Brief syllabus description:
A one-semester laboratory course for students in non-science areas of concentration. This course is an introductory, interdisciplinary course that examines current local and global environmental issues and explores possible solutions. Specific topics include human population; industrial systems; air, terrestrial and water pollution; global warming; conventional and alternative energy; agriculture and food production; and waste management. Laboratory exercises supplement BIOL 1120 Introduction to Environmental Science.

Course Learning Outcomes:
Upon completion of this course, a student will be able to do the following:

A) demonstrate core knowledge of principles of biology
B) interpret the content of assigned readings in biology
C) understand and apply the scientific method
D) demonstrate proper observational skills as well as qualitative and quantitative methods in the laboratory
E) work collaboratively with a partner or small group

General Education Outcomes:

A) Demonstrate the ability to solve problems and draw conclusions by analyzing situations and explaining them in numeric, graphical or symbolic terms
B) Demonstrate the knowledge of fundamental scientific concepts, the scientific method, and utilize laboratory procedures to observe natural phenomena.

Level (e.g., 100-level or introductory, 200-level, upper-level): This course is an introductory laboratory course for non-science major students. Note: CCGA is an open enrollment institution and many [most] students enter with less than 2 years of high school science / mathematics.

Pre-requisites: None

Mode of instruction (e.g., face-to-face, online, hybrid): Face-to-Face

Typical number of student enrolled: Laboratory courses at CCGA are capped at 24, average enrollment typically ranges from 18-24 students.

Major/non-majors: The course is designed for non-major students and fulfills a life sciences general education requirement.

Part 2: Implementation Details

1. What module did you implement?

The *Evolved Immunity* module is the focal point for this lesson.

2. What learning objectives were you addressing using the selected module? Why did you decide that MathBench was a good approach for helping students achieve these learning objectives?

Course specific learning objectives:

- A) demonstrate core knowledge of principles of biology
- B) interpret the content of assigned readings in biology
- C) understand and apply the scientific method
- D) demonstrate proper observational skills as well as qualitative and quantitative methods in the laboratory
- E) work collaboratively with a partner or small group

General education learning objectives:

- A) Demonstrate the ability to solve problems and draw conclusions by analyzing situations and explaining them in numeric, graphical or symbolic terms

Why use the Evolved Immunity *module?*

I chose this MathBench module because it included elements that addressed nearly all of my course learning objectives. This lab exercises was scheduled for one of the last class periods of the semester. As such my objective was to create a miniature capstone experience that would require quantitative skills, use multiple concepts from lab as well as lecture, and reinforce evidence based reasoning.

3. How did you integrate the module into your other class activities? Briefly describe the pedagogical techniques you used to facilitate the module and reinforce the learning objectives you identified above.

This lab was the focal point of a class period. I used the attached assignment to guide students through the exercise. Labs are by nature generally flipped or at least very active class periods. For a flipped or hybrid lecture course this class could very easily be implemented.

4. How did you incentivize students to engage fully with the module?

The module was completed in class as a computational laboratory investigation. A full laboratory exercise grade (10% of the semester) was earned by completely and thoroughly completing the lab assignment. This lesson could also be used in a lecture setting where ~1.5 or more hours are available. It could also be used across two class periods or a class period and a homework assignment. The hand out is broken into three parts that could be made into related but separate assignments. Other use suggestions care included in the reflection portion below.

5. How did you assess whether students learned the concept or skill that you were trying to teach?

Assignments were collected and reviewed. In class I was also very active in monitoring students' progress through the module. During this pilot exercise, I leaned toward accepting reasonable answers rather than perfectly correct. However, next semester grading will be more structured because this lesson had the desired high level of student engagement.

In class we ended the meeting period with a short discussion. Which also provided an informal opportunity to assess student engagement and understanding of evolved immunity.

Part 3: Reflections

1. Overall, how did your implementation go?

Module was very well received by students as a lab activity and participation was excellent. I used the module in two sections of this lab. One section was noticeably more diligent than the other section but both sections were more engaged than typically observed this semester. The lesson was used as a final laboratory lesson prior to the final exam.

2. What feedback (positive or negative), if any, did you get from your students about this experience?

Students enjoyed the activity and seemed to grasp evolved immunity as a quantitative concept. Students seemed to make progress in understanding the connection between decimals, percentages, and frequency.

3. What advice do you have for faculty who wish to implement this module in their own classes?

Use in class. Notify students to bring laptops and tablets then spend a class period working through the module. I will be replacing a lecture next semester with this activity. Active monitoring of student progress also seemed to incentivize engagement with the module.

This assignment could also be adjusted to be completed in a series of activities. Part 1 could be completed prior to class or in the first few minutes of a lecture, to then be followed by Part 2. Part 3 could be used as a follow up homework or a prompt for end of class discussion.

Next semester I also plan to create a version of this assignment to be completed and autograded for use with our learning management software (D2L). The lesson could be adapted to be an online accountability tool for homework exercises or a post lesson quiz. Part 2 seems most suited to this purpose. Additionally, Part 3 could be used as the focal point for an online discussion board.