Implementation Plan

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EDDIE Module

Module name: Wind and Ocean Ecosystems

Course/Course Format:

**Number and length of sessions per week:**

One 2.5 hr class per week (Mondays 2-4:30pm).

**Course Description (from course catalog):**

The principles of physical, chemical, biological, and geological oceanography.

**Course Context:**

Mid-level (one intro pre-req required) course required by several majors (Environmental Science, Geography). Fulfills the Quantitative Literacy across the Curriculum (QAC) general education requirement  (https://catalog.worcester.edu/undergraduate/academic-policies-procedures/lasc-wsu-pathways-discovery/quantitative-literacy-across-the-curriculum/).

**Course Goals and Topics:**

Course Goals:

1. Use the scientific method to develop and evaluate hypotheses.
2. Interpret bathymetric maps, cross sections, and graphs of marine data.
3. Explain how ocean basins form and change through time.
4. Describe how the chemical and physical properties of seawater affect marine processes and biology.
5. Describe how important marine processes (tides, waves, currents, etc.) and phenomena (El Nino, thermohaline cycle, etc.) work.
6. Describe the ocean’s role in modulating climate and weather.
7. Recognize and explain the impacts of humans on the world’s oceans and expected future conditions.

Course Topics:

1. Scientific inquiry
2. Plate tectonics
3. Marine sediments
4. Sea water
5. Atmospheric circulation
6. Shallow ocean circulation
7. Deep ocean circulation
8. Marine biological productivity
9. Waves
10. Tides
11. Coastal processes
12. Global change in the oceans

Learning objectives

**What learning objectives (content) are you planning to address in your course using the selected module materials?**

1,2,5 from above course goals

**Briefly describe the pedagogical techniques you plan to use to facilitate the module and reinforce the learning objectives you identified above.**

I taught this module over three weeks. Each week had a pre-exercise the students completed before class, a short lecture, and an exercise completed in class (and finished outside of class). The following summarizes how the original module was implemented and adapted:

Week 1:

Pre-Exercise A: Students viewed a recorded lecture on atmospheric circulation and drew a concept sketch of atmospheric circulation cells.

Exercise A: EDDIE Part A [modifications = latitude/longitude questions were shortened; excel data was pre-sorted and partially completed; Earth Null question was made more general]

Week 2:

Pre-Exercise B: Students completed EDDIE Part B [modifications = students choose and download their own buoy data from central California; instead of making a rose plot, they made two histograms (wind speeds, wind direction); all students add their individual data to a shared google sheet summary document; questions about Ekman removed]

Exercise B: Live mini lecture on ocean currents, gyres, and ekman transport. Then, students completed a follow up activity to EDDIE Part B in groups [modified summary questions from Part B; additional questions asking them to visualize/summarize group data and reflect on variability] . Next, they individually completed EDDIE Part D [modifications = students used their own sites again, the previous upwelling events they or a classmate identified in the time series data; summary questions were similar, but I deleted #31]

Week 3:

Pre-Exercise: Students reviewed reading on wind-induced vertical movement (upwelling/downwelling) in coastal regions, equatorial divergence, mid-gyre downwelling and El Nino/La Nina conditions. Next they completed a short exercise summarizing the relationship between upwelling/downwelling and productivity

Exercise: Non-EDDIE module activity on ENSO, in which the students look at historical ONI record, determine what ENSO state their chosen buoy data was from (should be all La Nina years, since I suggested specific years when they picked their data) and then look at SST anomaly data from that time period, as well as current (today) data and answer questions on the relationships among wind conditions, upwelling/downwelling, and productivity.

Are you planning on making any adaptations to the materials? If yes, please describe them here. If no, please indicate why.

Yes I made several adaptations to the materials. First, all materials were converted to google docs and used within Google Classroom. Second, I shorted and simiplified much of Part A to save time. I also did some of the excel prep for Part B (first rose diagram) ahead of time to save the students’ time so we could focus on interpretations. I also had to update the buoy list/directions-- the data used is from a buoy that is currently adrift, so navigating to the historical data looks a little different now.

Finally, for parts C and D, I had the students choose their own buoys and download the data themselves and then use that site throughout the remainder of the module. I added an additional exercise to the end of the module tying in the buoy data to ENSO.

Do you think you will need to incorporate any supplemental materials with this module? If yes, please either describe what you are planning or include any materials you have already found.

Yes , I added several mini lectures and live excel tutorials throughout the module. The lecture topics are described in summary of implementation above. In addition, I supplemented the pre-exercises with readings from an OER oceanography book (https://www.oercommons.org/courses/introduction-to-oceanography/view).

What assessments are you planning on using to measure student progress? If possible, describe, attach, or provide a link here.

Pre Exercises were graded for completion and then reviewed at the beginning of each class.

Exercises were graded for accuracy, with the option to redo and resubmit.

**Reflection Questions for after your Implementation**

Introductory Statement:

This course was an intermediate oceanography course required within the environmental science major. I used this module in my first year teaching, which also happened to be during Covid, while teaching in a hybrid format. Since my students were mostly upper level, I adapted the module to shorten the introductory parts so that we had more time to focus on the more advanced components. I also changed the second half of the module to allow students to select and download their own data instead of using a previously downloaded dataset. The students were then able to compile their respective results and more broadly compare patterns between sites.

How did it go? (What went well and why? What adjustments did you need make in real time and why?)

The implementation went fairly well, although each component took longer than I expected—I ended up splitting up the modules over three class sections. A number of students were not comfortable with sorting, formulas, and/or plotting in excel, so I shared my screen and demonstrated these techniques for the students that needed a demo. The module worked very well in a hybrid format, which allowed students to leave class when they were comfortable with the material and complete each exercise at their own pace.

Student Outcomes (What did students take away? Where did students struggle the most?)

 The students gained practice finding and downloading raw data, cleaning and organizing the data, and then plotting and analyzing data. As mentioned previously, some of the students had trouble with excel—in the future I would pre-record several excel tutorials for them to view on their own time. In addition, several students had trouble identifying an upwelling event from the temperature data—comparing their results to those of their classmates helped them correct course, so I would spend more time having them compare pre-exercise results with one another in the future.

Future Use (Would you do this activity again? What suggestions do you have? What would you change?)

 Yes, I would use this activity again. The manual sorting in excel was time intensive—I would be interested in running this activity in R, but only if the class was already based in R and the students were familiar with it. I think the students gained a lot from being able to use their own data and compare and contrast among their different results, although for an intro level course, pre-downloaded data would probably work better.