Instructor Guide

Teaching Notes

This exercise is a case study that, if used in full, takes students through the entire learning cycle from invitation to reflection. Pieces of the exercise can be used as appropriate for the instructor goals.

- Students are invited to learn about the importance of shellfish aquaculture in the Pacific Northwest and how changing ocean conditions are threatening the success of the industry and impacting the community groups who value shellfish as a resource.
- The Challenge Questions in the data labs should be used to invite students to explore data and make predictions. (Invitation)
- Several types of data are presented, some as time series data with the interactive widgets, and students are asked to speculate on the relationships between the wind and different water properties (Exploration in learning cycle).
- This guide provides background on important concepts, and several ideas are given for having students access their previous learning on pH, carbonate chemistry, and surface ocean circulation (Concept Invention in learning cycle).
- After coming to a conclusion of the cause of the low pH surface waters, students are challenged to apply what they have learned to a longer data set (Application in learning cycle).
- This case requires students to reflect on the interaction between wind, circulation, water properties, biology, and the societal impact of changing ocean conditions so at the conclusion students are asked to think about what they have learned about this complexity and identify concepts/topics they would like to learn more about (Reflection in learning cycle).

Learning goals and assessments:

Students will be able to:

Describe and interpret patterns in individual data sets and correlations between the different data types presented (Exploration)

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  - Write a figure legend for the first pH graph seen
  - Write a figure legend for all four of the graphs together

Explain the relationship between wind direction and pH on the Oregon coast, using data and relevant oceanographic concepts to support their conclusions. (Exploration)

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  - Identify a time range in which upwelling is occurring
  - Explain what is happening, including how and why the pH changes.

Identify oceanographic conditions that negatively impact shellfish populations, and determine when those conditions are occurring. (Application)

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  - Identify a time when conditions will negatively impact shellfish populations
  - Draft an advisory to shellfish aquaculturists describing the problem, why it is occurring, and suggesting possible solutions.

Identify the communities that rely on shellfish as a resource and explain why. (Invitation to Reflection)

Assess the value and economic contribution of shellfish farming and wild harvest in Washington. (Invitation to Reflection)

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  - Translate research findings into infographic to share on course website and social media

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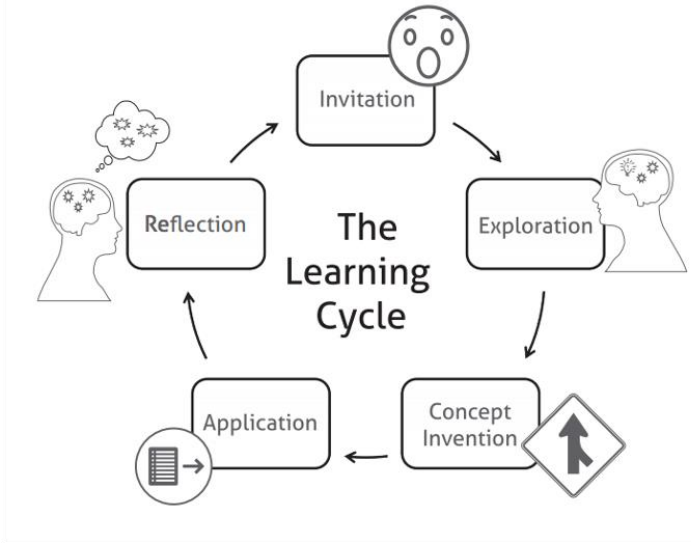

Invitation: Students are invited into the activity by sharing their personal experience with shellfish consumption or harvest.

- Activity Type: class discussion
- Time: 1 class session (30-50 mins)
- Additional Time: 15 mins of student preparation before class

Exploration: Students use interactive data widgets to explore how changing weather conditions and ocean circulation patterns affect ocean pH.

- Activity Type: online data lab
- Time: 1 class session (50 mins)

Concept Invention: Students work together to identify and explain the link between CO_2 and pH of a solution

- Activity Type: in-class activity or lab
- Time: 1 class session (50 mins)

Application: Students use interactive data widgets to predict when coastal waters would be harmful to shellfish.

- Activity Type: online data lab
- Time: 1 class session (50 mins)

Refection: Students assess the value and economic contribution of shellfish farming and wild harvest in Washington and translate research findings into fact sheets to share on course website

- Activity Type: Jigsaw
- Time: 3 class sessions (50 minutes)

Additional Time: 15 mins of student preparation before the first jigsaw & 3-4 hours of student time before second jigsaw