Science Assessment System Through Course Task

Tourism Impact

Grade Level:
8
Phenomena:
Ecosystem Response to Disruption

Science & Engineering Practices:
Analyzing and interpreting Data
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence

Crosscutting Concepts:
Cause and Effect
Stability and Change

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.

Preparing to implement Through Course Tasks in the Classroom

What is a TCT?
- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?
- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:
1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
   Success criteria include:
   - What is this task designed to get evidence of?
   - What is the task asking the students to do?
   - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential "trouble spots" and plan for possible misconceptions.

During the task:
5. Collect defensible evidence of each student's competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:
7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
  - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

- Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
    - **Science and Engineering Practices**
    - *Disciplinary Core Ideas*
    - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

Tourism Impact Task Annotation

Part 1: After **analyzing and interpreting data** *about populations within an ecosystem,* **construct an explanation for** *how the disruption of a biological component of an ecosystem* <u>can change</u> *(lead to shifts in) populations.*

Part 2: After **evaluating design solutions** *for maintaining ecosystem health and minimizing impact on tourism,* **develop an argument that identifies the best solution** *for maintaining ecosystem health and tourism* <u>and explain what causes</u> **that solution to be best.**

Overall intent

There are two possible intents for this task:

       1) to assess student ability to construct an explanation

       2) to assess students' ability to engage in argumentation to evaluate competing design solutions

A teacher could use this task solely for the purpose of assessing explanation and administer only item 1. Alternately, a teacher could decide that only argumentation is to be assessed, and only evaluate student work for item 2. If the teacher intends to evaluate argumentation (item 2), students could complete item 1 in order to scaffold their understanding of the changes in the marine ecosystem and inform their argumentation. The task is designed for 8th grade students.

Phenomenon within the task

This task presents problematic changes in an aquatic ecosystem that result from increased tourism. The phenomenon is the predictable response of an ecosystem when a component is disturbed (the populations of lobster and cod are reduced due to over harvesting). Competing design solutions are proposed to restore the ecosystem, but must be evaluated in terms of their environmental, economic and social impact.

Ideas for setting up the task with students

This task should be facilitated after a learning sequence in which students have had multiple opportunities to engage in the following practices and crosscutting concepts:
- Developing and Using Models (SEP 2)
- Analyzing and Interpreting Data (SEP 4)
- Constructing Explanations (SEP 6)
- Engaging in Argument from Evidence (SEP 7)
- Stability and Change (CCC 7)

Additionally, students should have had prior learning experiences with the disciplinary core ideas as described in:

- LS2.C
- LS4.D
- ETS1.B

Depending upon the needs of the teacher/students, teachers may choose to read the initial introduction (stimulus) to students to set up the task with students.

Intent of the Task for Assessment

Scaffolds, such as graphic organizers may be useful to help students organize their thinking and provide structure to the task. However, **use of organizers is optional during facilitation.** While some students may find it useful, others may find it to be a hindrance or "double duty," so its' use should be optional based upon the needs of the individual student.

Recommended strategies for this task include:

- Introduce students to the phenomenon by reading the stimulus.
- Allow students to complete item 1 independently. There is a stop sign at the bottom of the page after item 1 to alert students to wait for instructions.
    - Option A: Stop and debrief task 1 together as a class. This will prevent any incorrect answers on item 1

from being a barrier to demonstrating learning in item 2.

- o Option B: Collect student responses and assess explanation before debriefing and completing task 2. A scoring guide for explanations is included.
- Introduce item 2.
- Allow students to work in partners or groups to develop pros and cons graphic organizers for each of the proposed solutions.
- Allow students to complete item 2 independently in order to assess their individual ability to evaluate competing design solutions and construct a written argument.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices Part 1

Analyzing and Interpreting Data

- Use graphical displays (e.g., maps, charts, graphs and/or tables) of large data sets to identify temporal and spatial relationships.
- Analyze and interpret data to provide evidence for phenomena.

Constructing Explanations

- Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.

Stability and Change

- Small changes in one part of a system might cause large changes in another part.

Success Criteria Part 1

- Student correctly interprets the presented data and uses it to support an explanation for how the overfishing has affected the ecosystem.
- Student supports the explanation with a plausible outcome for how the ecosystem stability could be affected due to overfishing.

Evidence of Learning Desired based on Progression from Appendices Part 2

Designing Solutions

- Apply scientific reasoning to show why the data or evidence is adequate for the design solution.

Engaging in Argumentation from Evidence

- Evaluate competing design solutions based on jointly agreed-upon design criteria.
- Construct, use, and/or present written argument supported by empirical evidence and scientific reasoning to support or refute an solution to a problem.

Cause and Effect
- Cause and effect relationships may be used to predict what would happen in designed systems

Success Criteria Part 2
- Student selects a proposal (claim) that is the most sustainable based on at least one of the following criteria: environmental, economic and social impact.
- Student appropriately uses relevant science concepts to thoroughly evaluate the evidence provided and support the selected claim.
- Student appropriately refutes one other proposal using appropriate evidence and reasoning using the criteria from their claim.
- Student appropriately uses relevant science concepts to thoroughly evaluate the evidence provided and support the selected rebuttal.

Possible Student Responses Part 2
*Students may choose any of the arguments, depending upon how they are able to use evidence to defend their selections. Below is one sample response in which the student selected Option C.
- Option C is the best long-term solution to the problem in Bayview. I selected Option C because it will remove many of the sea urchins, which would give the seaweed population an opportunity to recover. It also brings in both lobsters and cod, in order to give those populations an opportunity to return to their earlier numbers, as well as provide two predators that can further reduce the sea urchin population. Limiting the fishing quotas will also allow the ecosystem to recover, but won't result in as many lost jobs as removing all fishing from the area. Option C allows for the opportunity for the ecosystem to improve, but still maintains the ecosystem services that Bayview needs in order to survive.
- I did not argue for Option A because, although it would allow the ecosystem to recover over time, it causes major disruption to the ecosystem services that Bayview needs. The fishing ban would result in 200 lost jobs. While some new jobs may be created, there is no guarantee that this would happen in time to prevent those families from having to move in order to find work.
- I did not argue for Option B because, although it would keep the economy the same in the short-term, it doesn't consider the long-term effects of allowing the ecosystem to continue to change in this way. Even though people would be able to keep their fishing jobs for now, they may not have any fish left in the water in the future if the lobster and cod populations continue to decrease.

Extensions and/or other uses after the task is implemented

After constructing these arguments in written form, one natural extension would be to facilitate an opportunity for students to orally present their arguments to one another, respectfully provide and receive critiques regarding the arguments, and ask questions of one another based upon the arguments.

Through Course Task – Tourism Impact

Many families take vacations to the beach. The coastal town of Bayview is a favorite beach destination. Bayview is known for its beautiful ocean views, exciting water sports, delicious restaurants and unique shops. Bayview has become so popular that tourism has dramatically increased in recent years.

One of the best things about Bayview is the organisms that live in the ocean ecosystem along its shore. The food web model below shows the relationships between some of those organisms. People who visit Bayview love to go on dolphin watching boat tours. They love to see the sea turtle nests on the shore and attend late night parties to watch the eggs hatch. Lobster and cod are both favorite foods at Bayview restaurants, which has led to an increase in fishing for those organisms. The data table below represents information about the changes in the populations over the years.


Partial Bayview Ecosystem Food Web
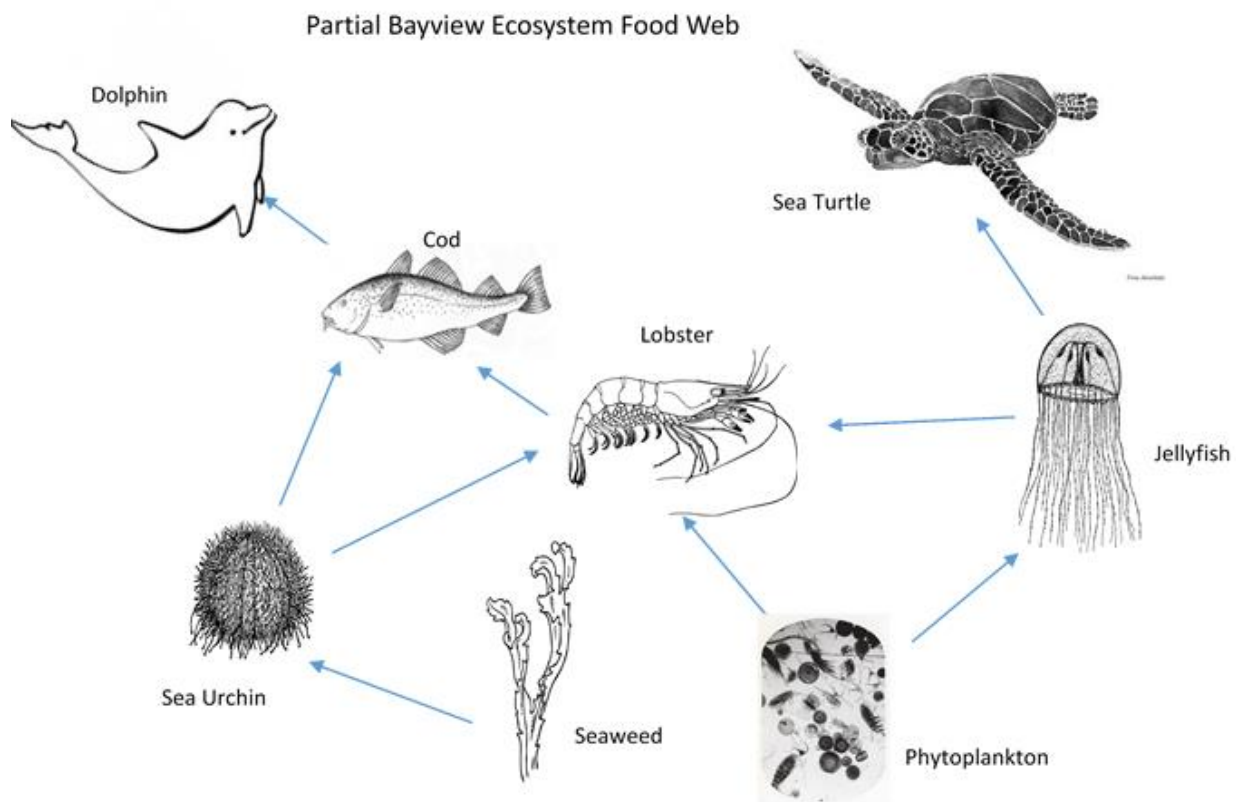
Population Changes in Bayview from 1990-2015

Year	Number of Ocean Species Near Bayview	Lobster Population*	Cod Population*	Sea Urchin Population*	Seaweed Coverage* (percentage)
1990	275	5	6	12	55
1995	273	4	5	16	45
2000	271	4	4	18	35
2005	263	3	3	20	20
2010	245	1	1	25	15
2015	230	1	0.5	30	12

*Population counts calculated per 10-square meters

1. Analyze the available information about Bayview, and **construct an explanation** about how the overfishing of lobsters and cod affected this ecosystem. Support your claim with evidence from the table. In your reasoning, describe how changes presented in the data for this ecosystem could affect its overall stability.

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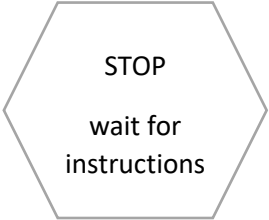
By 2016 the people of Bayview were beginning to worry about the changes in their aquatic ecosystem. They formed a committee of scientists, engineers, local fishermen and local business owners to decide what they should do. The committee hired a firm to develop possible solutions. The firm was told that the committee would take into account the impact of their proposals on the environment, the economy and tourism. The committee narrowed their choices down to the three solutions proposed below.

Option A

Working with the Environmental Protection Agency, Bayview would be designated as a protected area for a period of 20 years. Marine biologists and ecologists agree that it will take at least that long for the lobster and cod populations to return to their pre-tourism levels. No fishing would be allowed from the shoreline to a marker that would be 5 km from the shore.

Economists believe that at least 200 jobs would be lost in the Bayview area as a result of this change. But new jobs could also be created if tourism continued to increase. A continued increase in tourism could replace as many as 100 of those jobs, although it is difficult to predict if they will pay at the same rate.

Option C

Begin bringing lobsters and cod in from other parts of the country in order to immediately increase the populations and restore balance to the Bayview ecosystem. As an initial boost to the ecosystem, 450 lobsters and 850 cod would be introduced. They are not exactly the same species as the native lobsters and cod, but they are similar. The new species are larger and tend to grow at a faster rate than the original ones. A small fuel surcharge of $0.10 per gallon of gasoline will be charged in order to cover the cost of purchasing the new lobster and cod. That money will also be used to pay divers to remove as much as 35% of the sea urchins in an effort to restore the ecosystem to stability. In addition to all of this, there will be a maximum limit to the amount of fish that each fishing boat is allowed to catch each week. This is expected to cause about 50 jobs to be lost, but some of those fisherman could find work collecting urchins.

Option B

Make no changes and leave things as they are in Bayview. The economic impact of changing the fishing industry would be too great for Bayview citizens to bear. While scientists may have short-term data that suggests a decline in the lobster and cod populations, there is no evidence that those changes are a result of the fishing industry. It is possible that they could be caused by other changes, like pollution or changes in water temperature.

Since no one can know without a doubt what is causing the changes, the best course of action is to leave things as they are and protect the fishing, restaurant, and tourism industries in Bayview so that the citizens do not suffer economically.

1. After reading the proposed solutions, develop an argument for why one of them is the best long-term solution to the problem. As you develop your argument, consider the environmental, economic and/or social impacts of each option. In addition, identify a solution you did not choose and explain why you did not choose it.

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