LESSON 5: Refining an Ocean Model

Teacher's Guide

Objective: In this lesson, students will apply what they learned about computer modeling by modifying existing code to reflect more complex ocean processes. In this partnered activity, they will develop a deeper understanding of how computers can be used to make predictions and recreate natural systems

Materials:
- Internet-connected devices for student pairs
- Individual copies of the Lesson 5 Student Guide

Inquiry question: How do scientists refine computer-based mathematical models?

Time Required: One-two class periods

Science Standards Addressed:

6th Grade: SC.6.E.7.4, SC.6.N.1.1, SC.6.N.1.3, SC.6.N.3.4, SC.6.N.1.4
7th Grade: SC.7.N.1.1, SC.7.N.1.3, SC.7.N.3.2, SC.7.N.1.5, SC.7.L.17.3
8th Grade: SC.8.N.1.5, SC.8.N.1.6, SC.8.N.3.1, SC.8.E.5.10, SC.8.L.18.1, SC.8.L.18.3
Middle School Computer Science: SC.68.CS-PC.2.8, SC.68.CS-PC.3.1, SC.68.CS-PC.3.5, SC.68.CS-CS.1.2, SC.68.CS-CS.1.4, SC.68.CS-CS.2.2, SC.68.CS-CS.1.3, SC.68.CS-CP.3.1, SC.68.CS-CS.2.4, SC.68.CS-CS.2.11, SC.68.CS-CS.6.3

PROCEDURES

Step 1

Orientation to StarLogo Nova

Individual students or student pairs will need web-enabled devices (PCs, laptops, tablets).

Using instructions on the **StarLogo Nova Student Guide** (page 41 of this curriculum), students should register, login, and load a model. After examining the code underlying the model, student pairs will alter the model. To edit a model, have them click "Remix" at the top of the page to add it to their gallery and allow changes to be made. For this first run, the modification does not have to be realistic for the model, just a chance to practice making changes.

Each student pair should show a neighbor once they have successfully edited the *Model Floating Ducks Ver1*. Groups should show the new model workspace and explain the code.

Step 2

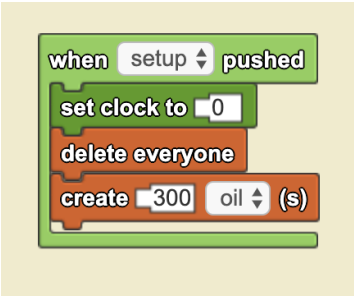
Model modification

Using the suggested items on the student guide, pairs will edit models to include other variables using pair programming. You can learn more about pair programming here: https://www.youtube.com/watch?v=vgkahOzFH2Q.

If students work on models showing different components (evaporation, microbes, sinking) these can be combined into a single model (groups can share the coding blocks from their separate models so that each group can come up with a combined model).

A series of screenshots for each of the modifications is included in the answer key. This can be used to help students get to a working model, but they should not be shown the example code. Note that this is not the only correct answer, and if students are able to create a working model with a different set of code, that may also be correct. To get students started, the base code can be used as a starting point.

Base Code



NAME _____ **Class** _____ **Period** _____

QUESTION: How do scientists refine computer-based mathematical models?

Let's use what you've learned to make a more refined oil spill model. Work with a partner for this activity. You will use the ***StarLogo Nova Student Guide*** to create a login on the website. Email addresses are not required. Your programming team will share the login.

Activity 1

1. Load the *Model Floating Ducks Ver1* model.
2. Play around with changing the code to make this model do different things. Troubleshoot as you run into problems. If you get too lost, you can always re-load the original model.

What features did you change in the model and what was the result?

Activity 2

Open the current oil spill model - Model Oil Dispersal with Current Ver2.
Run the model and describe what happens.

Activity 3

Now it's time to include some new information in this model. Choose from one of these options to refine the model. If you are successful, see if you can use two or three of these options.

- **Option 1:** There are oil-consuming microbes present in the area. These microbes must eat 5 units of oil in order to have enough energy to reproduce. To represent this in the model, there is a 20% chance of reproduction after each encounter with an oil particle.
- **Option 2:** Different types of oil evaporate at different rates. Jet fuel evaporates at a rate of .002 percent per time unit. Diesel evaporates at a rate of .001 percent per time unit. Crude oil evaporates at a rate of .0005 percent per time unit.
- **Option 3:** Oil-consuming microbes will reproduce rapidly in the presence of oil, but as oil runs out, the microbes die off. This die-off starts to happen after 100 time units and there is a .005 percent chance of dying per time unit after 100. Once they die, microbes will sink to the bottom.

Now that you and your partner have developed a computer-based mathematical model for the fate of oil, share your work. StarLogo Nova will give you the option of creating a graph from your data. Create your graph!

Activity 4

Conclusion questions:

1. Which option did you choose for your final model?

2. What was the most challenging part of programming?

3. Could you use this model to predict what would happen in the Gulf of Mexico?

4. What other features of the system could be included in this model to make it a more realistic representation of the Gulf of Mexico?