

Lessons From the Ocean
Stan Feighny
7/17//2021

Cover Sheet - Exploring Underwater Food Webs

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General Notes:

This lesson plan is submitted to meet **Pedagogy Option 3: Ocean Lesson Plan**. It is designed to be used in my STEAM Lab for grades 4 - 8. An essential part of the STEAM Lab approach is subject integration. Our lab uses the [Sphero robotics system](#) to support engineering and technology investigations. The Sphero.edu [World - Ocean Food Webs](#) is the original resource for this lesson. The final lesson has six learning blocks and three rubrics for assessments.

Using this submitted pdf should work well for grading. However, if you have any difficulty or would like to get additional data or documents, please use the following links to bring up the products. These files have “anyone who has a link” permissions and should open directly.

Sphero - [Exploring Underwater Food Webs](#)

If it does not open, please send me an email, and I will fix the permissions.

Thank you for this opportunity,

Stan Feighny

Lesson Title: Author: Stan Feighny

Targeted Grade Level:

Grade 5 - 6

Background

This lesson plan is customized for a STEAM lab using the [Sphero Bolt](#) robotic system. A key design objective for lessons in the lab is to integrate technology as a learning tool for art, science, engineering, and math (STEAM) lessons. In a standard 5-6 grade technology class, students follow robotic lessons constructed with only the technical learning objective in mind. For example, the robot navigates a maze and performs additional tasks such as moving a token or flashing an integrated light. In this lesson, students program the robot to achieve similar tasks, while exploring the flow of energy and the movement of matter in a food web.

Resources

The Sphero.edu [World - Ocean Food Webs](#) is the primary resource for this lesson. This lesson plan uses the Sphero lesson plan layout that emphasizes skill-building. The Endeavor program uses the 5E lesson plan, which has a stronger emphasis on conceptual understanding.

STEAM Integration:

Subject Area	Learning Task
Science	Understanding food webs and the flow of energy
Technology	Use an Integrated Development Environment (IDE) to develop a program using a software engineering methodology.
Engineering	Prototype the food web on an 8 1/2 x 11 landscape sheet, then make the tracking food web on the 48 x 36 (W X L) sheet. Prototype simple sequence program on the Sphero to navigate one or two nodes in the web. This product is your prototype. Do not go on until this works. Then, modify the program to signaling color changes and voice announcements at nodes in the food web.
Art	Draw a representation of consumers/producers in the food web.
Math	Measure angles from the robot heading to navigate through the maze.

Schedule:

Most teachers use six 45-minute class sessions.

Each lesson has a return to this section.

Block	Lesson Phase	Topic
1.	Exploration	Meet Sphero
2.	Exploration	Food webs
3.	Skills Building	Draw a Food Web that matches an underwater forest.
4.	Skills Building	Create an algorithm to move through the web
5.	Challenge	Add sound and color to each node in the food web
6.	Evaluation	Use a rubric to evaluate progress

Standards:

Links under the Standards heading are to NGSS and CTSA standards.

Standards	Description
Ecosystems: Interactions, Energy, and Dynamics NGSS 5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
Algorithms and Programming (CTA K-12 1B-AP-10)	Develop programs with sequences and simple loops, to express ideas or address a problem.
Computer Systems (CTSA K12 1B-CS-02)	Model how computer hardware and software work together as a system to accomplish tasks.

Measurable Student Learning Objectives:

Links under the Standards heading are to NGSS and CTSA standards.

Standards	Observable features of the student performance	Work Product Rubric
Ecosystems: Interactions, Energy, and Dynamics NGSS 5-LS2-1	Students work in pairs to create a 48" by 48" food web.	Food web rubric
Algorithms and Programming (CSTA K-12 1B-AP-10)	Students work in pairs to develop and improve a program using the Sphero development environment. (Block Coding Lessons and Tutorial A to Z)	Food web navigation rubric
Computer Systems (CTSA k-12 1b-CS-01)	Students complete Sphero Parts Explosion diagram for Sphero internals	21st Century Skills Rubric

[Back to Standards](#)

Use rubrics for both formative and summative assessments.

Revise rubrics during the project with the discovery of new requirements. Revision is a fact of the working world - things change. Students are coached on accepting change every day, as this is an important life skill. Using rubrics for the formative assessment allows the teacher to award daily progress points and keep the class focused on producing a quality product.

[Student 21st Century Skills Rubric](#)

[Food Web Rubric](#)

[Sphero Navigation Rubric](#)

Materials

1 Sphero Bolt for every two students
Chromebook with Sphero.edu loaded and running
Classroom butcher paper (48 X 36)
8 ½ x 11 computer paper
Markers
Meter sticks
Protractors

Exploration - Meet Sphero

What the teacher does:

Note: Teacher directions and questions to the class are in *italics*.

This lesson assumes students can connect the robot to the Chromebook and work with the [Sphero robotic system](#).

Welcomes students to class, introduces food webs, and outlines the Sphero Robot's use to practice following food chains in a food web.

Before we work on food webs, let's look at what is inside the Sphero Bolt.

Hand out blank [Sphero parts explosion](#) for the students to label the parts.

In a future lesson, we will explore the use of each labeled item.

But, for now, just have the students locate the parts.

Open your Sphero App and find the 3D Models.



3D Models

Select the Sphero Bolt tab



[Watch the video Inner Workings of Your Bolt](#) and label your drawing. You have 15 minutes.

When most of the class is done, go over the drawing with the students. Have students correct the paper in red.

Explain that the quality of corrections counts.

What the student does:

Opens the Sphero app on the Chromebook and finds the 3d model.

Studies the model and labels the handout.

Makes corrections as the teacher goes over the 3d model.

Turns in the handout to the teacher.

Standards Addressed

Computer Systems ([CTSA k-12 1b-CS-01](#))

Formative/Summative Assessments

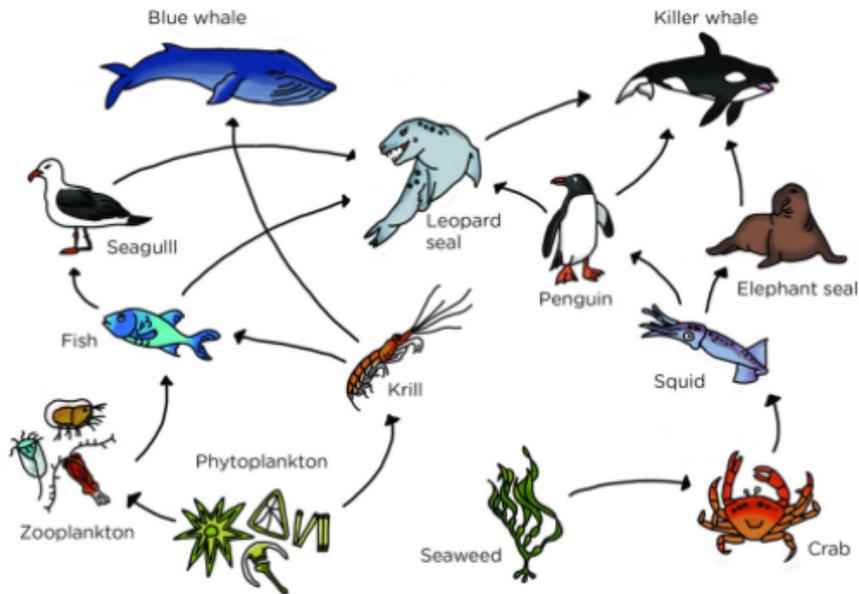
The parts explosion is a formative assessment and will not be graded. However, completing the work and quantity of formative assessments are included in the [21st Century Skills assessment](#) for the grading period.

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Exploration - Food Webs

What the teacher does:

Reviews food webs using the [Blue Whale example](#).



Have students work in pairs to come up with two food chains in the food web

Discuss which way the arrows go and why.

What do the arrows show? Transfer of energy.

Discuss the difference between a food web and a food chain.

What would happen if the Killer Whale were on the bottom?

Do you think a killer whale can get energy from the seaweed or zooplankton directly?

What the student does:

Participates in the class discussion.

Standards Addressed

Ecosystems: Interactions, Energy, and Dynamics

[NGSS 5-LS2-1](#)

Formative/Summative Assessments

Not in this block

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Skill Building - Design a Food Web**What the teacher does:**

Shows video [Underwater Forest](#) for the class

Stops at points to emphasize the learning.

Question the class:

How high does the kelp grow?

What is the longest chain in this food web?

Where does the flow of energy start?

Hands out a blank 8 ½ X 11 sheet and explains this is for the prototype food web.

Hands out the [Food Web Rubric](#) and uses it to explain the following points.

Review portrait and landscape paper orientation.

Show the students a blank 48 x 36 (W X L).

Explain how this will be the final food web.

The 8 ½ X 11 sheet is for the prototype.

Do not draw the images on the prototype. The prototype is just for practicing layout and measuring angles.

Have the students work in pairs, but each student creates their own food web on an 8 ½ X 11 landscape sheet.

The first time through is to make a list of the nodes in the food web.

Students can watch and pause it as many times as they need to get the food web on paper.

Do a walk-through as an assessment (see below) to make sure students have the starting layout.

Work with students on proportions and design layout.

Make all arrows straight as the Sphero robot will be making a straight line between each node.

When students complete the prototype, give them a 48 x 36 (W X L) sheet to do a full-size food web.

The pairs will only create one (48 x 36) food web.

What the student does:

Creates his/their own food web on (8 ½ X 11).

Works with a partner to make a food web on (48 X 36).

Standards Addressed

Ecosystems: Interactions, Energy, and Dynamics

[NGSS 5-LS2-1](#)

Formative/Summative Assessments

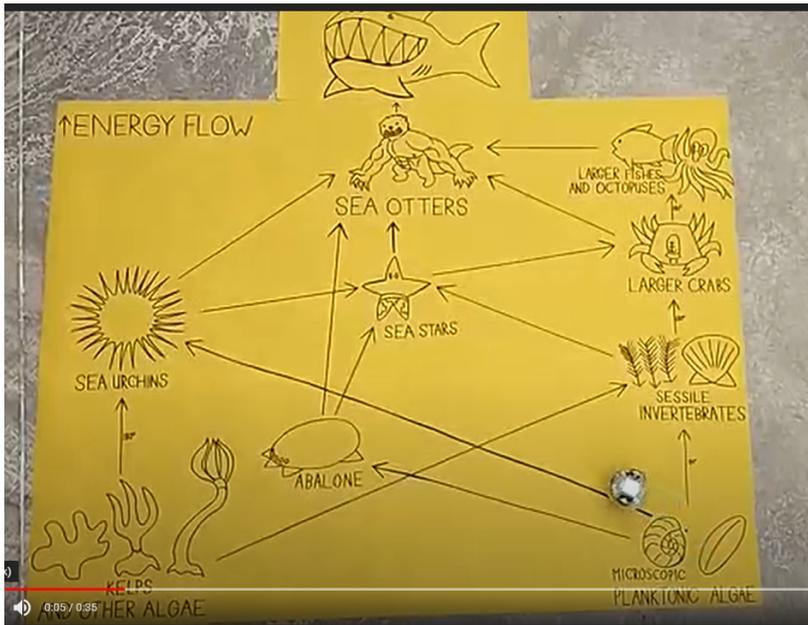
Walkthrough and do a check on the student individual food webs.

Grade as a Needs Work, Workable - with touch-ups, Ready to Go.

Keep grade for [21st Century Skills assessment](#) for the grading period.

[Food Web Rubric](#)

This [link](#) is to an example full-size web.



Artwork created by 8th grader Nash Feighny - Grandson.

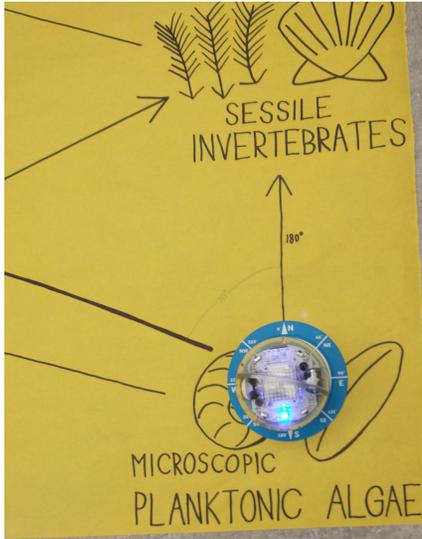
Note: ***Explain that the basic food web should include the shark and that the drawings are too large on this example.***

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Skill Building Create an Algorithm

What the teacher does:

Review heading and direction to help complete navigating the food web.



If you are not confident they have these skills have the students practice the following:

[Out and Back](#) to review heading.

[Coding Polygons](#) to develop angle skills.

When the students are confident of these skills, have them choose a path through the food web they created and program the Sphero to navigate to the top and then simulate [detritus](#) drifting to the bottom.

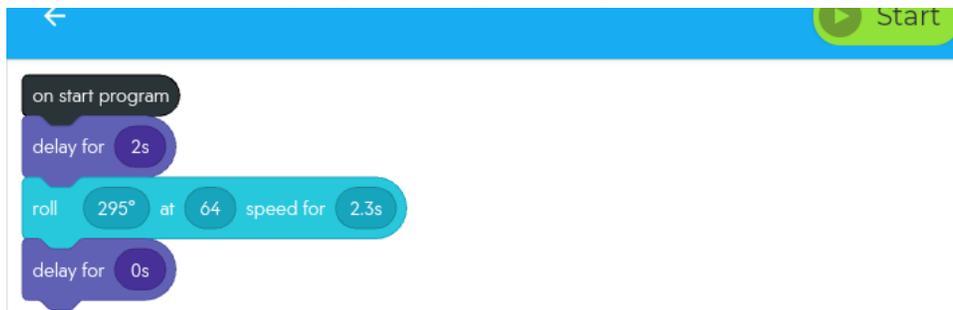
Hands out and reviews the rubric.

List the food chains and assigns students different chains.

What the student does:

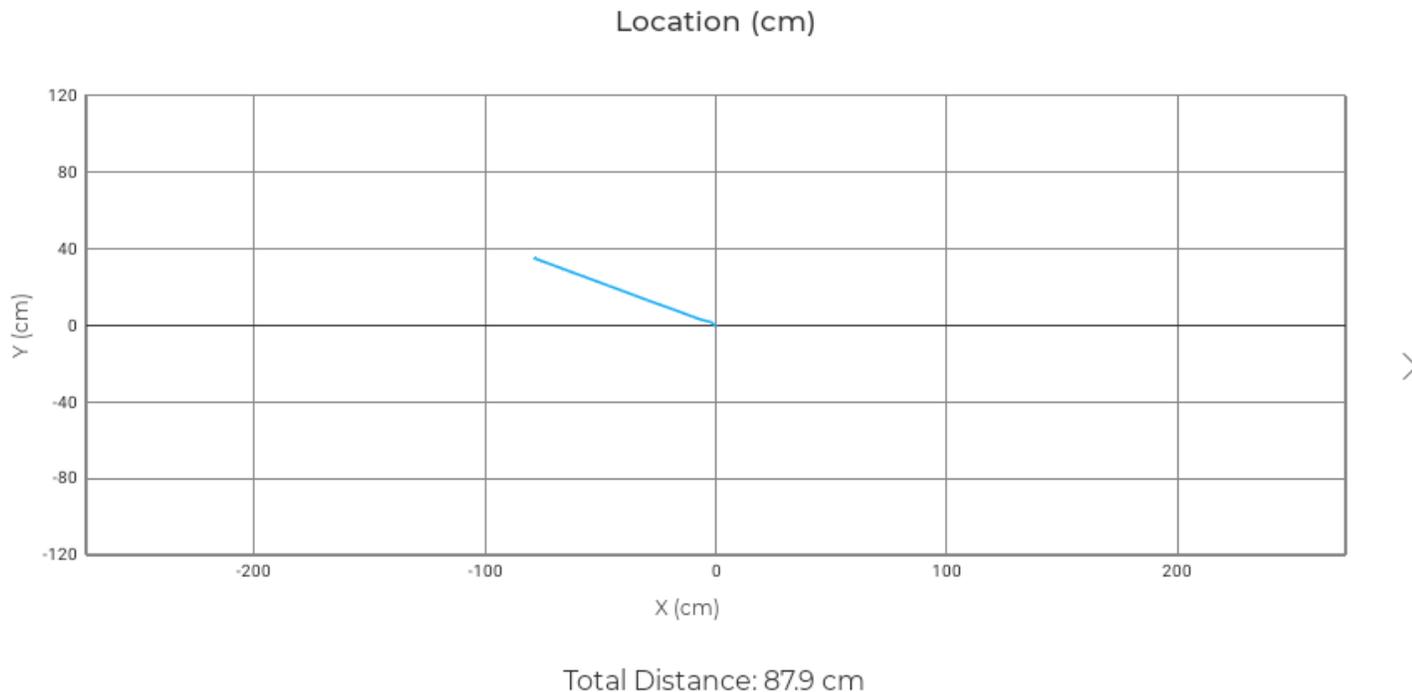
Studies the food chain and finds the angle from the current location to the next for each node.

It starts with a small program that just navigates from the first to the second node in the food web.



```
on start program
  delay for 2s
  roll 295° at 64 speed for 2.3s
  delay for 0s
```

Sphero.edu will display the location graph for the trip when the movement is completed.



Measure the distance on the food web and discuss how the heading, speed, and time all work together to produce the distance graph. When this section of code works, add the third node. This approach is piece-wise development that helps the student understand the Sphero's behavior. Often writing a line of code does not produce the expected results.

Standards Addressed

Algorithms and Programming

[\(CSTA K-12 1B-AP-10\)](#)

Formative/Summative Assessments

Complete a walk-through on the second using the [21st Century Skills assessment](#).

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Challenge Add sound and color to each node in the food web**What the teacher does:**

Some students will finish early. The challenge gives them a project to work on while the rest of the class catches up. Upon completing the Challenge, have the students help the students who have not completed the assignment.

Before students start on the Challenge, have them make a copy and name the copy:

Student Initials _ Food Web V2 F2021. Example: SF_Food Web V2 F2021.

Use the standard outlined in the food Web Program Rubric.

Students complete the challenge in V2. Using version is a software engineering rule - always have something running.

What the student does:

Researches the sound and color blocks.

Makes a V2 Version of the program and adds sound and color.

Standards Addressed

Algorithms and Programming

[\(CSTA K-12 1B-AP-10\)](#)

Formative/Summative Assessments

Use the Programming Rubric in the Evaluation section below.

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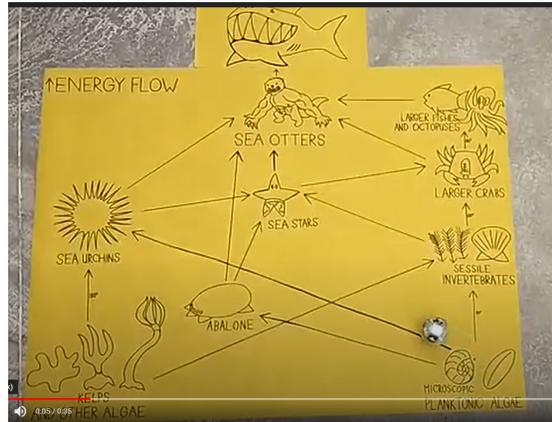
Evaluation

What the teacher does:

Reviews the [Sphero Navigation Rubric](#) and has the students grade their own work.

Goes over scoring and helps the students identify improvements.

Click on Image for Video



What the student does:

Uses Food Web [Sphero Program Rubric](#) to assess work.

Meets with the teacher to discuss improvements.

Standards Addressed

N/A

Formative/Summative Assessments

Program Rubric

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