Cleaning Up with Ozobots

Lesson Overview

Students will use an engineering design process *(see attached example)* and computational thinking to design an attachment for an Ozobot that can collect simulated pollution from roadways. The students must code their Ozobot Bits to try to collect at least 10 pieces of pollution on their route.

SC Standards Addressed

7.S.1B.1 Construct devices or design solutions using scientific knowledge to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the device or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.

*__7.EC.5A__. Conceptual Understanding: In all ecosystems, organisms and populations of organisms depend on their environmental interactions with other living things (biotic factors) and with physical (abiotic) factors (such as light, temperature, water, or soil quality). Disruptions to any component of an ecosystem can lead to shifts in its diversity and abundance of populations. *(*NOTE: This standard is not specifically addressed in this lesson but is an excellent precursor for subsequent lessons; Specifically, "Litter on abiotic and biotic factors of the environment in which it is pervasive". See Focus Question & the "Extend" portion of the lesson*)

Disciplinary Literacy Strategies

Collaborative Groups, Jigsaw (*adapted)*

Computational Thinking

Tools:
Robotics, Coding

Cornerstone(s) Addressed:

- Decomposition: Students must design a litter collector that can be attached to the Ozobot and move seamlessly when the coding program is started. They must determine the best design and materials for their Ozobots.
- Pattern Recognition: Students must find patterns in the code so that loops can be created when making the algorithm.
- Abstraction: Students will need to avoid using coding blocks that are not helpful in achieving the task. Students will need to avoid materials for their litter collectors that impede the movement of the Ozobot.
- Algorithmic Thinking: Students will create an algorithm using block coding to move robot across simulated roadway.

Lesson Plan

Time required: One 70-minute class period

Focus Question(s): Litter impacts many facets of both the biotic and abiotic parts of an ecosystem. Can robots be used to help us pick up litter?

Disciplinary Vocabulary: ecosystem, biotic, abiotic, *CS coding terms*: Screen calibration, flash loading, looping, editing, deleting, and modes

Materials needed:

- Ozobot Bits (with helmets)

- Chromebooks with access to OzoBlockly coding site
- Cardstock
- Pipe cleaners
- Construction paper
- Popsicle sticks
- Glue
- Tape
- Small plastic cups
- Hundreds of small pieces of wadded up paper to serve as litter
- Items to serve as obstacles (graduated cylinder trees, small containers for cars, etc.)
- Large pieces of bulletin board paper taped together to serve as the roadway

Engage Students will be instructed to complete a litter survey in Google Forms as they enter the classroom. While they are taking the survey (*attached*), they will be numbered 1-4 (*Collaborative Grouping*). They will be instructed to log into Google Classroom (o*r whatever platform your district uses for video*) and watch the video clip that corresponds with their number. Each video clip is from National Geographic and deals with an aspect of the problem of litter on our planet. After viewing the clips, the groups that contain a member who watched each clip will convene to discuss what impacted them about their clips. We will then briefly discuss the litter survey results as a class (*adapted Jigsaw*).

Explore Students will be shown the classroom roadway that will have hundreds of pieces of wadded up paper serving as small pieces of litter. Students must design a litter collector to tape onto the helmets of their Ozobot Bits. They will have a variety of materials with which to engineer their collectors. Students will each be given a few pieces of wadded up paper so that they can use to test the effectiveness of the different pollution collectors that they design.

Explain Students must write the codes that their Ozobots will follow to make one path across the roadway from their starting points to their collection points. They will be allowed access to the playing field to test their coding. There will be a simulated roadway set up in the classroom that has obstacles, such as cars and trees, that the Ozobots will have to be coded to move around.

Elaborate While coding their Ozobots (*see attached pictorial*), the students must communicate issues with one another about the code so that it can be altered accordingly. If the robot needs to veer in a certain direction or go around an obstacle or if it does not travel far enough to reach its destination, the team must communicate with each other and troubleshoot/try different solutions.

Evaluate *Informal assessment:* After an allotted time-period they must engineer their collectors and code their Ozobots, the students will line up their Ozobots at their designated starting points. They will initiate their codes. The Ozobots who make it to their designated collection points and have picked up at least 10 pieces of trash along the way have completed the mission successfully. *Formal assessment*: Students screenshot their Ozobot algorithm, download it into a Google doc, and identify parts of the code that were successful/not successful, what they would change, etc.

Extend Students could research how various methods of liter clean-up are currently being used and methods that have been proposed to deal with the large amount of litter around the planet. In a subsequent lesson, students could analyze the abiotic and biotic factors on specific habitats, organisms, ecosystems, etc., affected by litter.

Assessment Notes:

Use an online social media site (Seesaw or Instagram) or Google Classroom or other online site where students can easily upload and share the pictures of their designs. Flipgrid is also a place where they can record video of their robot's performance. These can be used later as part of a larger project or for reflection.

Teacher Biographical Information

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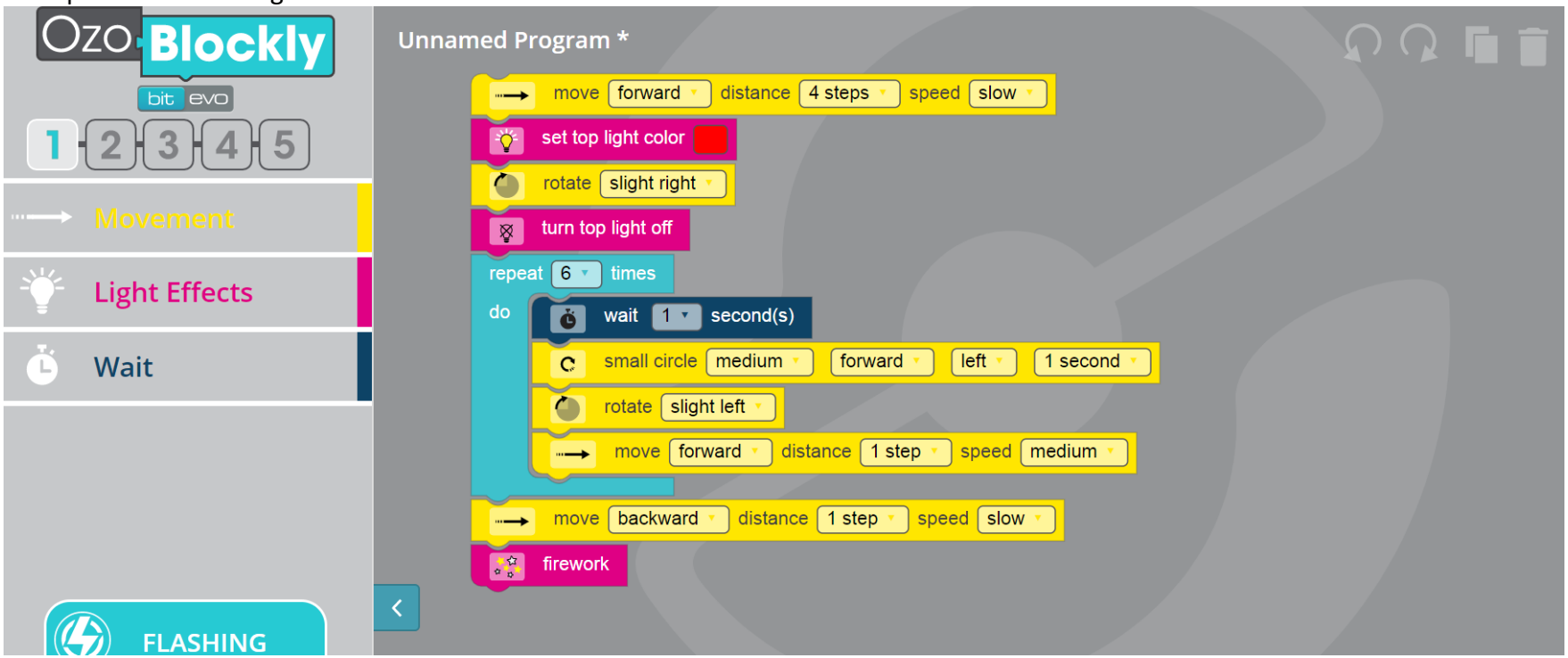
B. S. Marine Biology
M.A.T. Elementary Education
Certification: Elementary Education, Middle School Science

- 18 years teaching middle school science:
- 13 years teaching 7th grade science
- 5 years teaching 6th grade science

Online Resources:

Ozobot Coding Website:
https://ozoblockly.com/#
Trash Produced by One person in One Year from the EPA archives:
https://storage.googleapis.com/titlemax-media/trash-one-person-produces-one-year-3_80per.jpg
Ecology Videos:
https://www.youtube.com/watch?v=yaDx-WJAsaE
https://www.youtube.com/watch?v=jyLjUEOcLgg&t=7s
https://www.youtube.com/watch?v=ffzO7I4obMg
https://www.youtube.com/watch?v=B8Ihttps://www.youtube.com/watch?v=ffzO7I4obMgw0TH2czQ

Example of block coding for an ozobot:



Uploading the code to the Ozobot from a Chromebook– OR iPad.

Beta versions for other tablets and touchscreen laptops are still in the development stage.

Appendix – Handouts or Documents that can be used online for interactivity.

Litter Survey

Do you notice litter in your local area?

- ☐ Yes
- ☐ No
- ☐ I don't pay attention

If you answered yes to #1, how much litter do you notice?

- ☐ Overwhelming amount; seems to be in most places when I look around
- ☐ Large amount in certain areas
- ☐ Small amount; very scattered
- ☐ Not very much, but I see some occasionally

Do you ever see anyone picking up litter? *

- ☐ Yes
- ☐ No

Have you ever littered? *

- ☐ Yes
- ☐ No

Have you ever participated in a litter clean-up? *

- ☐ Yes
- ☐ No
- ☐ I would like to but haven't yet

Whose job should it be to pick up litter? *

- ☐ state government
- ☐ private businesses
- ☐ volunteers
- ☐ people doing community service ordered by a court

Should the amount of litter in our environment be a concern? *

- ☐ Yes
- ☐ No
- ☐ I don't know enough about the problem

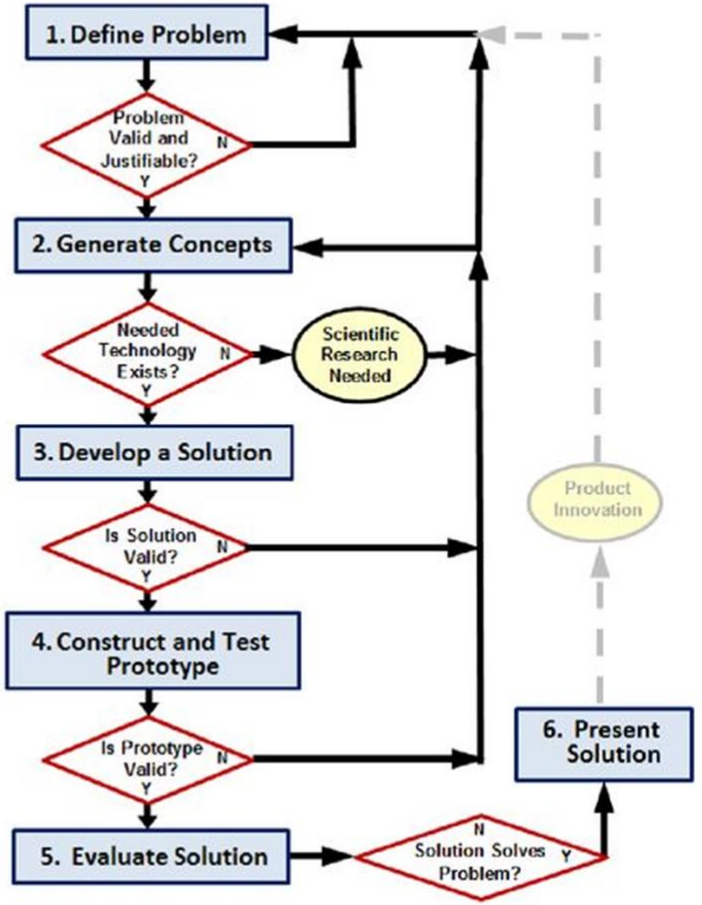
If you use an online or whiteboard-based survey you can show information instantaneous to your classes.

This is an example of an engineering design process specific for middle school students, from Project Lead the Way (PLTW).

Design Process used in IED

1. Define the Problem
2. Generate Concepts
3. Develop a Solution
4. Construct and Test a Prototype
5. Evaluate the Solution
6. Present the Solution

PROJECT LEAD THE WAY
PLTW



This design process was developed based on the University of Maryland - College Park - IRB Research Project