## OZOBLOCKLY BASIC TRAINING LESSON 2:

# SHAPE TRACER LEVEL 2

PREPARED FOR OZOBOT
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### Essential Question

How can we teach Ozobot Bit to move using programming?

### Objective

Learn to use loops while programming Ozobot Bit to trace different shapes. Ozobot must match its LED light to the line color.

### Prerequisites

It is recommended that students have completed OzoBlockly Basic Training Lesson 1 - Shape Tracer Level 1.

### Information

The OzoBlockly games (http://games.ozoblockly.com) will teach the OzoBlockly language and general programming concepts. Both students who have had experience with Blockly and those who have not will enjoy all levels of the tutorials. The practice will prepare students to create their own programs, load the program onto Ozobot and run the program.

The simulated version of the Ozobot Bit that is available in the OzoBlockly games is very good at following commands exactly. The real Ozobot Bit is very good at following commands too. However, the real Ozobot Bit may not turn as precisely as the simulated Ozobot Bit. This is related to the wheels. It is important for students to understand that the real Ozobot Bit will approximate the movements, especially the turns. Students' program for the robot may need to compensate for this. Can they build something into their program to help the Ozobot Bit reach the goal?

### Grouping

Groups of two or three students

## Materials

- Tablet or computer with the Ozobot Games website, http://games.ozoblockly.com and the OzoBlockly editor http://ozoblockly.com/
- Ozobot Bit, 1 per group of 2-3 students
- Optional: printout of the "Activity Shapes Worksheet", one per group

## Age/Grade Level

Grade 2 and up. Older students may move more independently through the levels of the tutorials. The tutorials are appropriate for all levels to learn the Ozoblockly programming language.

## OzoBlockly Programming Topics

Free Movement, Loops, Light Effects

## OzoBlockly Mode

Use mode 2 or higher

## Lesson Duration

45 – 55 minutes

## Vocabulary

- *Ozobot Bit* - Little robot that can follow drawn lines or can be programmed using visual codes or through the OzoBlocky programming language
- *OzoBlocky* - A visual editor which allows to create programs by plugging blocks together. The blocks can be used to control Ozobot's behavior like movement, LED lights, etc.
- *Rotate Right or Left* – Approximate 90° turn
- *Rotate Slightly Right or Left* – Approximate 45° turn
- *Steps* – a unit of movement forward
- *Loop* – a repeat command in the Ozoblockly programming language. Multiple command blocks can be put 'inside' a loop. Those commands will be repeated X amount of times.
- *Nesting* – Putting one repeat block (loop block) inside another repeat block (loop block)
- *Line Following* – Ozobot's capability of sensing and following lines on paper or digital screens

## Overview

1. Students play the tutorial games 1-10 to introduce them to OzoBlockly and programming concepts.

   Concepts:

   - Movement forward and turns
   - Loops
   - Light Effects

2. Students will write their own tutorial level in the Ozoblockly Editor.

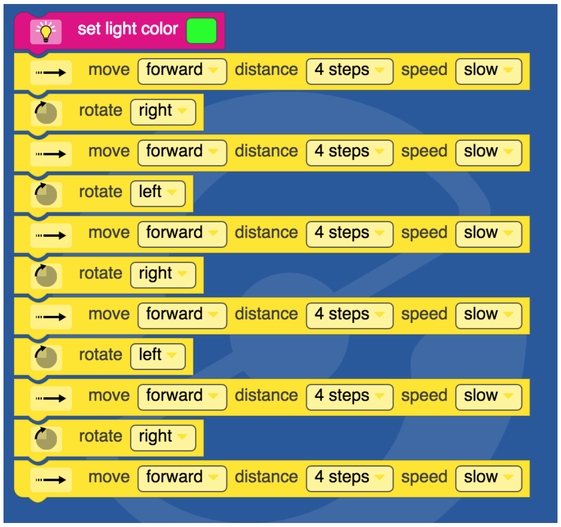
   *Note: Levels 4, 7, and 10 are Ozobot Bit only levels. Students must use the Ozobot Bit to test and run the completed program. The simulation feature is disabled.*

## ACTIVITY

### 1. Guided Class Activity

**Level 1**

Ask the students for ideas about how they could get their Ozobot Bit to trace the stair step shape. Write some ideas on the white board. Let students explore and find solutions to the puzzle. Many students will program the Ozobot Bit like this:



```
set light color 🟩
move forward distance 4 steps speed slow
rotate right
move forward distance 4 steps speed slow
rotate left
move forward distance 4 steps speed slow
rotate right
move forward distance 4 steps speed slow
rotate left
move forward distance 4 steps speed slow
rotate right
move forward distance 4 steps speed slow
```

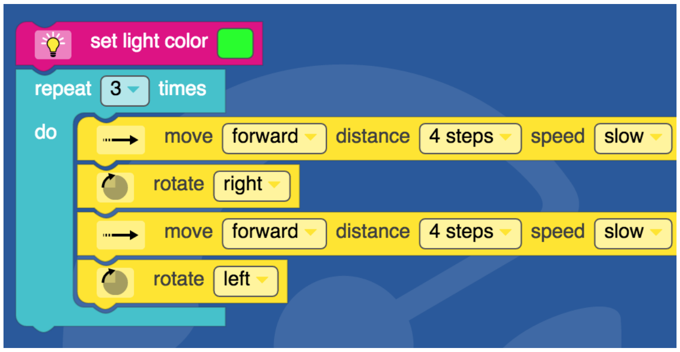
***Question***
*"Do you see any patterns in the order and types of blocks?"*

***Answer***
*"The blocks start to repeat; the same blocks are used over and over."*

Demonstrate this program and ask the students if they see any combination of blocks that repeat.

Explain that this is the purpose of the "Loop" block. Any combination of blocks that repeat can be placed inside a loop block. All you have to do it tell the loop how many times to repeat the commands.

The correct way to program this level looks like this:



```
set light color 🟩
repeat 3 times
do
    move forward distance 4 steps speed slow
    rotate right
    move forward distance 4 steps speed slow
    rotate left
```

***Question***

*"Why is using a loop a better way to program?"*

***Answers***

*"Because you use fewer blocks (lines of code) and do less work"*

*"Because it is easier to change the program if you have to modify it"*

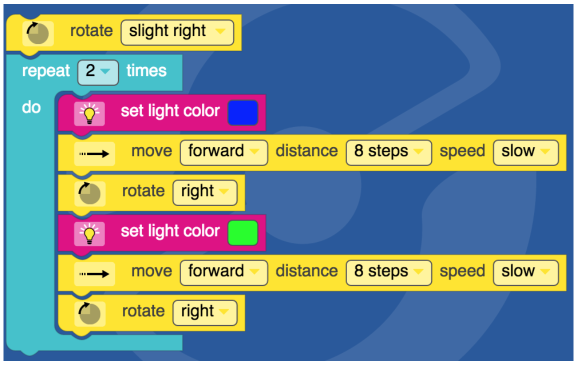
*"Because you are less likely to make a mistake if you don't have a long list of blocks"*

## Level 2

This level involves the same skills as level 1. Students solve level 2.

## Level 3

Begin this level by letting the students try and figure out the puzzle in groups or individually. After some time experimenting, ask the class what solutions they found. Many will have found solutions like this:



```
rotate slight right
repeat 2 times
do
    set light color 🟦
    move forward distance 8 steps speed slow
    rotate right
    set light color 🟩
    move forward distance 8 steps speed slow
    rotate right
```

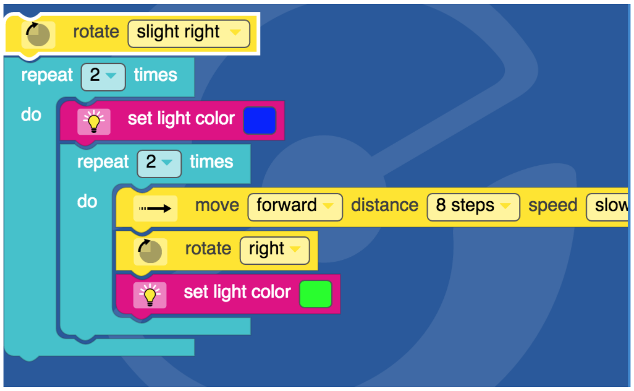
This is a perfectly valid solution and you can have students move on to the next level if you like. At this point though, you do have the option to introduce the concept of nested loops. There is actually a solution that is more efficient than the one above!

***Optional: Understanding Nested Loops*** - *What are nested loops? Nested loops are constructed by putting one repeat block (Loop) inside another in order to use the fewest number of blocks to complete the task.*

When you create nested loops, the process of running the code begins in the outer loop. When the run hits the inner loop, all of those commands are taken to completion before the run once again starts on the outer loop. The total amount of times the whole run will loop is the product of the numbers in both inner and outer loops.

1. Let students take another look at the program above that uses only one loop. They will probably have realized that the commands almost repeat, but there is a slight difference in the commands that prevent them from using fewer blocks. The difference is the change in color.
2. Create this program to demonstrate to the class.

This video from code.org will briefly explain nested loops https://www.youtube.com/watch?v=2C0p-dRhlZhk



```
rotate slight right
repeat 2 times
do  set light color 🟦
    repeat 2 times
    do  move forward distance 8 steps speed slow
        rotate right
        set light color 🟩
```

3. Allow the students to watch yours play so they can see how the program runs through the blocks. Play the solution several times and ask volunteers to explain what is happening.
4. Have the students program their Ozobot bit simulator with a nested loop.

This concludes the optional part of the lesson covering nested loops.

**All students:** after students have discussed and learned about movement and loops, **allow students to complete the 10 levels.** Note that an Ozobot Bit will be necessary to run the program on levels 4, 7, an 10 as the simulator is disabled. This gives the students practice calibrating and loading the program onto Ozobot Bit.

## 2. Independent Activity: Create Level 11

### Objective

Students will write their own tutorial level 11.

### Procedure

Now that the students have had a little practice with OzoBlockly, it is their turn to write a tutorial.

1. Optional - If students need practice writing their own code, they can use the "**Activity Shapes Worksheet**".
2. Have the students sketch a path on paper to be the basis of Level 11. The path should be slightly more difficult than levels 1-10.
   Rules:
   - The path should change colors at least four times.
   - The loop block should be used at least once. A nested loop would be even more interesting!
   - The turns must be 45°, 90°, 180° or a combination
3. Go to http://ozoblockly.com/ on a computer or tablet.
4. Choose "Beginner" (2) or "Intermediate" (3) modes.
5. Have students write the program.
6. Students test program with Ozobot Bit.
   ***Notes:*** *Student should not put the Ozobot Bit on the lines that they drew. Ozobot Bit should be able to complete the task without line following. The path the students drew is merely an abstract sketch.*

Name ______________________

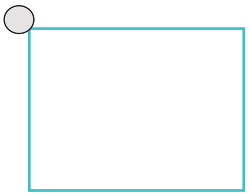
Date ______________________

## ACTIVITY SHAPES WORKSHEET

Draw a geometric shape in each box. Write the commands that you would need to create the shapes. You won't know the number of "steps" to take so estimate.

**Example**

**Start**



Forward 5 steps

Rotate Right 90°

Repeat 4 times

**Start**

**Start**

**Start**

**Some commands:**

Repeat ____ times

Forward _____ steps

Rotate Left/Right (90°)

Rotate Slightly Left/Right (45°)

Rotate U-turn Left/Right (180°)

Extra Fun:

Change Color to ________