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Multi-directional Robot Bowling
Teacher Guide

Overview

Students will create a bowling course for their Sphero that includes three different targets at the points of a triangle.

The course will be created using standard classroom materials from a scale drawing, with attention to detailed angles and measurements. Each point of the triangle will hold a different number of cups set up as pins and Sphero will be placed at its center.

Students will develop a strategy to knock down as many pins as possible and create a program that knocks over as many of the cups as possible by adjusting speed, delay and heading. They will then test and improve their program for accuracy and consistency.

Estimated Time: 1.5 - 2 hours

Student Organization:

Objectives

- Create a scale representation of a geometric figure.
- Develop a strategy to accomplish a specific goal.
- Create a program for a robot to accomplish a goal.
- Complete an iterative testing process and document results accurately.
- Test and evaluate solutions to determine the most effective option.

Materials Needed

- Plastic cups
- Electrical or masking tape
- Protractors
- Rulers or measuring tape
- Sample Program
- Student Worksheet

FAQs:

Q: How can the game be simplified or made more challenging for students?

Begin the game by having students "bowl" in a straight line from point A to point B with a goal of knocking over just three pins. Add additional lines and targets to increase complexity. The game can also be set up in a large flat box or area with barriers to create "bumpers" for Sphero.

How the cups are oriented also affects the level of difficulty.

This cup is easier to knock over.

This cup is more challenging to knock over.

Teachers can also decide if pins should be counted as "knocked over" with basic contact, or if it is actually necessary to tip the cup over. This can extend to a more detailed discussion of force.

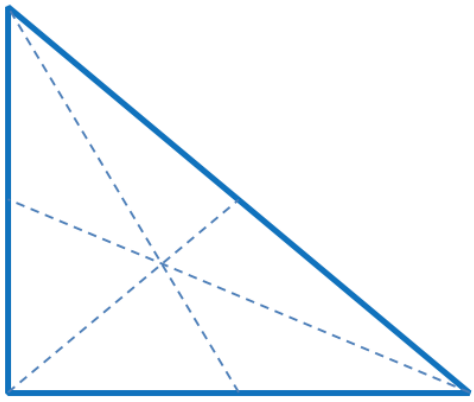
To add challenge, have students complete their own bowling courses from scale drawings of quadrilaterals or other polygons, or use cups of different colors, where each color has a different value to promote more sophisticated strategizing.

Q: How can students find the center of the triangle for Sphero placement?

Have students measure from each corner to the middle of its opposite line and mark the line with a ruler.

Complete this for each corner and place Sphero at the intersection of the lines.

These angles and shapes within the game course can also be measured and discussed as time allows.



Q: How can the course be created if masking or electrical tape isn't available or if the course has to be moved between blocks of instructional time?

Large poster paper, mural paper, or craft paper and markers can be used to create a course to scale. This can then be rolled up and transported as needed. Make sure that the paper is not folded between games as strong creases may create ridges that affect the trajectory of Sphero as it rolls.

A course can also be set up in a large box (as described above) for easy relocation.

Q: What are some sample strategies to complete the game?

Sample strategies may include:

- Knock down the pins systematically, moving from one corner to another around the outside of the triangle.
- Move in a random, zig-zag pattern and hope for the best.
- Move out to each point and then reverse directions, back to the middle of the triangle repeatedly.
- Add barriers to the game surface to act as bumpers for Sphero. (There is nothing in the game rules that prohibits the construction of additional game elements.)

Alternatively, students may be given the option to begin the game with Sphero placed on one of the outside lines instead of at its center.

NOTE: Remember that Sphero's heading is relative to the user. Each time Sphero iturned on, the tail light needs to be "aimed" to set the direction that will be used for a heading of 0 degrees.

Extensions:

- Encourage students to create more challenging courses for themselves or classmates by creating different polygons, or numbering the pins at each location so that they need to be knocked down in a particular sequence.

- Experiment with different shapes of courses. For example, create courses that follow a straight, wavy, zig-zag, or curved line. Which lines are the easiest or most difficult to navigate with the Sphero?

- Add obstacles such as ramps with the pins on a platform at the top, or archways with the pins on the other side, to add complexity or greater precision requirements to the program.