cubelets
ROBOT BLOCKS

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Steering Robots

Lesson Overview

Students design steering robots using their understanding of SENSE Cubelets and THINK Cubelets.

Steering robots take Cubelets to the next level, and prepare students for challenges that ask for robots to navigate their environment (i.e. solve a maze or explore "Mars"). There are many different ways to design Steering Robots using what students already know, and today is all about that learning process. It is important to be prepared for each group to have access to at least two Drive Cubelets for this task.

Lesson Tags

Grade Level
Grades 7+

Difficulty
Artisan

Duration
55 minutes

Prerequisite Knowledge
ACT Cubelets
SENSE Cubelets
How SENSE Cubelets control ACT Cubelets

Supplies

Cubelets (for each group)
2 Distance SENSE
1 Brightness SENSE
1 Rotate ACT
2 Drive ACT
1 Flashlight ACT
1 Battery
1 Blocker
1 Inverse
1 Passive
Have all other Cubelets available in central location for students who need them.

Other Supplies
Flashlight (one per group)
Science Notebook or blank paper to record notes and successful designs.
Youtube Video - Tracked Vehicle Turning (0:35)
Youtube Video - Personal Tracked Vehicle in snow (1:58)

Description

Outline

1. How do Tracked Vehicles Turn?
2. Students design steering robot constructions.
3. Students share and compare designs.

Objectives

Students will design multiple steering robot constructions.

Assessment

Teachers look for students using collaborative language, comparing their robot behavior to tracked vehicles, and looking for ways to improve and simplify their robot construction.

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Standards

ISTE	1.d. With guidance from an educator, students explore a variety of technologies that will help them in their learning and begin to demonstrate an understanding of how knowledge can be transferred between tools. 4.a. With guidance from an educator, students ask questions, suggest solutions, test ideas to solve problems, and share their learning. 4.d. Students demonstrate perseverance when working to complete a challenging task. 5.b. With guidance from an educator, students analyze age-appropriate data and look for similarities in order to identify patterns and find solutions.
K12CS	Program Development - People design meaningful solutions for others by defining a problem's criteria and constraints, carefully considering the diverse needs and wants of the community, and testing whether criteria and constraints were met. Control - Programmers select and combine control structures, such as loops, event handlers, and conditionals, to create more complex program behavior.
NGSS	MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Vocabulary

Tracked Vehicle	Battery
Weighted Average	Distance
Collaborate	Brightness
Cubelets	Drive
Robot	Flashlight
Sense	Rotate
Think	
Act	

Resources

Attachments

Tips & Tricks

- **Keep the lights dim or off during this lesson**

Pacing

10 minutes: How do Tracked Vehicles turn?
30 minutes: Students design steering robot constructions.
15 minutes: Students share and compare designs.

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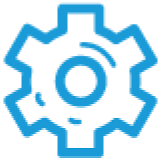
Instructional Steps



Step 1 - Pre-class setup

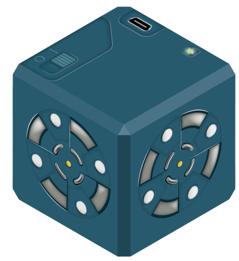
Time: 10 minutes

Cubelets Needed

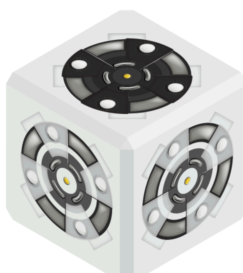
❏ Separate Cubelets into groups, each containing:

❏ **2x** Distance SENSE

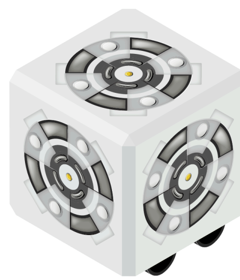
❏ 1 Brightness SENSE



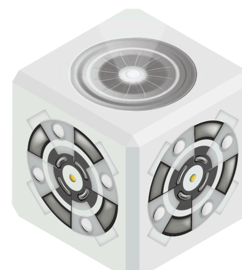
❏ 1 Battery



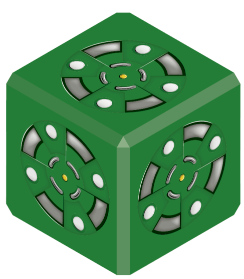
❏ 1 Rotate ACT



❏ **2x** Drive ACT

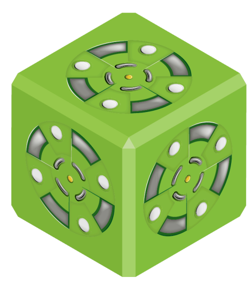


❏ 1 Flashlight ACT



❏ 1 Blocker

❏ 1 Inverse



❏ 1 Passive

Classroom Management

❏ Plan 6 student groups (groups should be no more than 4 students, and are best with 2-3).

❏ Dim or turn off lights so students can more easily tell the difference between the Distance SENSE and Brightness SENSE

❏ 1 real flashlight

How did this lesson work for you? Let us know! goo.gl/bKXj6Z
Check out **our newest resources** at *www.modrobotics.com/thehub*

Step 2 - Cultivate Wonder

Time: 5 minutes

Introduce Task

"We've spent a few days exploring Cubelets and it's time to take our engineering to the next level. Today's challenge is to design several steering robots. Before we do, though, it may be helpful to compare Cubelet steering to other vehicles we may know about. Does anyone know how a snowcat or tank steers?"

- Students share ideas.

Step 3 - Experience Before Expertise

Time: 10 minutes

How do Tracked Vehicles Turn? (10 minutes)

"Some of us do have background knowledge about how tracked vehicles turn which may help you a lot today. Let's take a couple minutes to build a little more of our common understanding as a class. First, here's a model of a tracked vehicle turning. Notice how this video marks one spot on each track with a red dot - keep an eye on those red marks throughout the turn. We'll watch the video a couple times.

- Youtube Video - Tracked Vehicle Turning (0:35)
- Discuss and re-watch video as necessary for everyone to observe the two tracks moving at different speeds.

Here's a real-world example of someone turning on a tracked snow vehicle they made. It very clearly shows the tracks moving at different speeds.

- Youtube Video - Personal Tracked Vehicle in snow (1:58)
- Discuss and re-watch video as necessary for everyone to observe the two tracks moving at different speeds.

Based on what we know so far about Cubelets and now tracked vehicles, what predictions might you make about how to design Cubelets robots that can steer?

- Students share predictions.

Notes

★ Tracked vehicles turn by moving each track at its own unique speed. This will be important when designing steering robot constructions because Cubelets move like tracked vehicles (in that the Drive Cubelet does not "turn" in order to steer. The only way to control Drive Cubelets is their speed and wheel direction).

Step 4 - Co-Construct Meaning

Time: 30 minutes

Design Steering Robots (30 minutes)

"Now you have 30 minutes to design steering robots. There are many different ways to do this. After you've made one design and drawn a model in your science notebook, please continue to look for other designs using different SENSE and THINK Cubelets. Having multiple designs will be incredibly important if you choose later to design a maze-solving robot or Mars explorer."

- Students design steering robot constructions and record successful designs in their science notebooks.

Notes

★ To design a steering robot, you need to split your robot into two halves. You can do this by putting a Blocker Cubelet in the middle or by putting two SENSE Cubelets next to each other in the middle. Some students may also keep the two halves attached, but use a combination of different SENSE Cubelets and an INVERSE Cubelet on one side.

Step 5 - Check for Understanding

Time: 10 minutes

Share designs (10 minutes)

Take a minute to rebuild your favorite steering robot you designed today. Then you'll share it with the class, explaining how it works, what problems you had to solve to land at this final design, and how you might use this robot.

- Students share designs and discuss the designs of other groups.

Differentiation - Intervention & Extension

Time: NA

Intervention

For students who struggle to build a steering robot, ask them to build two simple Drive-bot towers and then attach them together using a Blocker Cubelet.

Extension

After students have designed at least two different steering robot constructions, have them use books or tissue boxes to make a simple maze, then challenge them to design a robot that can navigate the maze on its own. (The maze should be at least 18" wide for students' first attempt.)