

Goals and Standards

Implementing VEX GO STEM Labs

STEM Labs are designed to be the online teacher’s manual for VEX GO. Like a printed teacher’s manual, the teacher-facing content of the STEM Labs provides all of the resources, materials, and information needed to be able to plan, teach, and assess with VEX GO. The Lab Image Slideshows are the student-facing companion to this material. For more detailed information about how to implement a STEM Lab in your classroom, see the [Implementing VEX GO STEM Labs article](#).

Goals



Students will apply

- How to create and start a VEXcode GO project that makes the Code Base move forward, backward, and turn.
- Drivetrain blocks in the correct sequence to create a project to solve a challenge.



Students will make meaning of

- How to solve a challenge with the Code Base and VEXcode GO.



Students will be skilled at

- Using build instructions to build the Code Base 2.0 - LED Bumper Top.
- Connecting a Brain to a tablet or computer in VEXcode GO.
- Saving and naming projects in VEXcode GO.
- Adding VEXcode GO blocks to a project.
- Sequencing blocks in a project.

- Using Drivetrain blocks in a project to have the Code Base drive to a specific location.
- Changing parameters in VEXcode blocks.
- Starting a project in VEXcode GO.



Students will know

- How scientists learn about Mars with rovers, which collect samples of rock and soil for a possible return to Earth to be studied.
- How to use VEXcode GO with the Code Base to solve a challenge.

Objective(s)

Objective

1. Students will develop a VEXcode GO project that orders behaviors in a sequence to complete a challenge.
2. Students will communicate behaviors, through words and gestures, that the Code Base will need to complete in order to accomplish a task.

Activity

1. In Play Part 1, students will create and test a VEXcode GO project that has the Code Base drive to collect a sample. In Play Part 2, they will add to their project to have the robot return to the base (starting position).
2. Students will describe how the Code Base moves forward, backward, and turns in order to drive to collect a sample as they build their projects in Play Part 1. In Play Part 2, students will describe how to move the robot to return to the base as they add to their projects.

Assessment

1. Students will create a project that successfully sequences Drivetrain blocks to move the Code Base to collect a Mars soil sample in Play Part 1. In Play Part 2, students will successfully add to their projects to have the robot return to the base —or starting position. In Share, students can demonstrate their projects and discuss how they ordered the blocks in the project to complete the challenge.
2. In the Mid-Play Break, students will discuss how they ordered the blocks in their project. In the Share section, students act out the projects using gestures to show how the Code Base moved.

Connections to Standards

Showcase Standards

Computer Science Teaching Association (CSTA)

CSTA 1A-AP-10: Develop programs with sequences and simple loops, to express ideas or address a problem.

How Standard is Achieved: Students will build a VEXcode GO project to drive the Code Base to collect and return a sample in the Play section activities. Students will need to sequence the project so that the Code Base drives to the location, waits for the sample to be collected, then plays a sound before turning and driving back to the base. In the Share section, students will discuss how they built their VEXcode GO projects.

Showcase Standards

Common Core State Standards (CCSS)

CCSS.ELA-LITERACY.L.3.6: Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships.

How Standard is Achieved: Students will describe the intended movement of the Code Base using spatial language as they build their VEXcode GO projects in the Play sections of the Lab. In the Share section, students will explain how the Code Base moved, and compare that to the intended behaviors.

Summary

Materials Needed

The following is a list of all the materials that are needed to complete the VEX GO Lab. These materials include student facing materials as well as teacher facilitation materials. It is recommended that you assign two students to each VEX GO Kit.

In some Labs, links to teaching resources in a slideshow format have been included. These slides can help provide context and inspiration for your students. Teachers will be guided in how to implement the slides with suggestions throughout the lab. All slides are editable, and can be projected for students or used as a teacher resource. To edit the Google Slides, make a copy into your personal Drive and edit as needed.

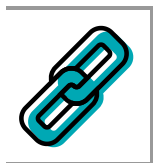
Other editable documents have been included to assist in implementing the Labs in a small group format. Print the worksheets as is or copy and edit those documents to suit the needs of your classroom. Example Data Collection sheet setups have been included for certain experiments as well as the original blank copy. While they offer suggestions for setup, these documents are all editable to best suit your classroom and the needs of your students.

Materials	Purpose	Recommendation
Pre-Built Code Base 2.0 - LED Bumper Top	For demonstration purposes.	1 for demonstration
VEX GO Kit	For students to build the Code Base 2.0 - LED Bumper Top.	1 per group
Code Base 2.0 Build Instructions (3D) or Code Base 2.0 Build Instructions (PDF)	For students to follow to build the Code Base 2.0.	1 per group
Code Base 2.0 - LED Bumper Top Build Instructions (3D) or Code Base 2.0 - LED Bumper Top Build Instructions (PDF)	To add the LED Bumper to the Code Base 2.0 Build	1 per group
Tablet or Computer	For students to use VEXcode GO.	1 per group
VEXcode GO	For students to code the Code Base.	1 per group
Lab 1 Image Slideshow Google / .pptx / .pdf	For visual aids while teaching.	1 for class to view
Robotics Roles & Routines Google / .docx / .pdf	Editable Google Doc for organizing group work and best practices for using the VEX GO Kit.	1 per group
Pencils	For students to fill out the Robotics Roles & Routines Checklist.	1 per group
Small classroom items (i.e. erasers, pom poms)	To use as samples in the challenge.	1-3 per group
Dry erase markers	To mark the sample location and the starting point on the Field.	2 markers of different colors per group
Whiteboard eraser	To erase sample locations drawn on the Tiles at the end of the Lab.	1 per group
Pin Tool	To help remove pins or pry beams apart.	1 per group
VEX GO Field Tiles and Walls	To use as a testing area for the Code Base	4 Tiles and 8 Walls per Field for testing

Materials	Purpose	Recommendation
Get Ready...Get VEX...GO! PDF Book (optional)	To read with students to introduce them to VEX GO through a story and introductory build.	1 for demonstration purposes
Get Ready...Get VEX...GO! Teacher's Guide (optional) Google / .pptx / .pdf	For additional prompts when introducing students to VEX GO with the PDF Book.	1 for teacher use

Engage

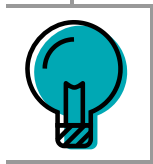
Begin the lab by engaging with the students.



Hook

Students will discuss what they know about Mars and how scientists learn more about the Red Planet.

Note: If students are new to VEX GO, use the [Get Ready...Get VEX...GO! PDF book](#) and [Teacher's Guide \(Google / .pptx / .pdf\)](#) to introduce them to learning and building with VEX GO. Add an additional 10-15 minutes to your lesson time to accommodate this additional activity.



Leading Question

We are going to pretend our Code Base robots are rovers on Mars! How do you think we could code them to pretend to collect samples as the real rovers do?



Build

Code Base 2.0 - LED Bumper Top

Play

Allow students to explore the concepts introduced.

Part 1

Students will build a project in VEXcode GO to drive the Code Base to the location of a sample and have the LED Bumper Sensor glow red for 3 seconds to indicate that it is collecting a sample. After 3 seconds, the LED Bumper will stop glowing to indicate that the sample was collected!

Mid-Play Break

Students discuss how they can add to their projects to have the Code Base bring the sample back to the base. How will they turn the Code Base around? What VEXcode GO blocks will they need?

Part 2

Students will add VEXcode GO blocks to their projects to turn the Code Base around and drive back to the base with the sample. As students test their projects, they will place a small object, like an eraser, on top of the Code Base to represent the sample when the robot pauses to collect.

Share

Allow students to discuss and display their learning.

Discussion Prompts

- How did you add to your project to have the Code Base return to the base? How did the robot have to move? What VEXcode GO blocks did you use?
- If you changed the order —or *sequence* of the blocks in your project, would the Code Base still reach the sample? Why or why not?
- What is one way you and your group solved a problem in this Lab? How were you helpful in solving the problem? Is there anything you would do differently next time?

Engage

Launch the Engage Section

ACTS is what the teacher will do and ASKS is how the teacher will facilitate.

ACTS	ASKS
<ol style="list-style-type: none"> 1. Write the word "Mars" on the board, and note students' answers as they offer information. 2. Invite students to share ideas about how scientists work. 3. Guide students to the idea of the Mars rovers. Show images from the Background Information, or other classroom resources to help. 4. Note students' responses on the board, as they pertain to what the students will be doing in the Lab (driving, collecting things, etc). 5. Guide students to thinking about the way that they control their Code Base robots, and suggest things like coding and computers if students need help to make the connection. 6. Show students Field setup where they will test their projects. Show them VEXcode GO open on a tablet or computer, and the Code Base. 	<ol style="list-style-type: none"> 1. What are some things that we know about Mars? 2. How do you think scientists figured those things out so that we could learn about them? 3. Guess what? Scientists are learning about Mars right now, from here, on Earth. How do you think they're doing that? 4. What kinds of things do you think the Mars rovers do to help scientists? 5. How do you think the rovers are able to drive around Mars to do those things? There aren't any astronauts on Mars to drive them, so how do you think that happens? 6. We are going to pretend our Code Base robots are rovers on Mars! How do you think we could code them to pretend to collect samples as the real rovers do?

Getting the Students Ready to Build

Before we can start coding our Code Bases, we need to build the Code Base 2.0!

Facilitate the Build

1

Instruct

Instruct students to join their group, and have them complete the Robotics Roles & Routines sheet. Use the Suggested Role Responsibilities slide in the Lab 1 Image Slideshow as a guide for students to complete this sheet.

2

Distribute

Distribute build instructions to each team. Journalists should gather the materials on the checklist.



Code Base 2.0 - LED Bumper Top build

3

Facilitate

Facilitate the building process.

- Builders and Journalists should begin building based on their roles and responsibilities, like those shown in the Lab 1 Image Slideshow.
- Circulate around the room to help students with building or reading instructions where needed. Ask questions about how the build is being constructed to keep all students engaged in the building process, and remind students to follow their Role Responsibilities if they need help taking turns.

4

Offer

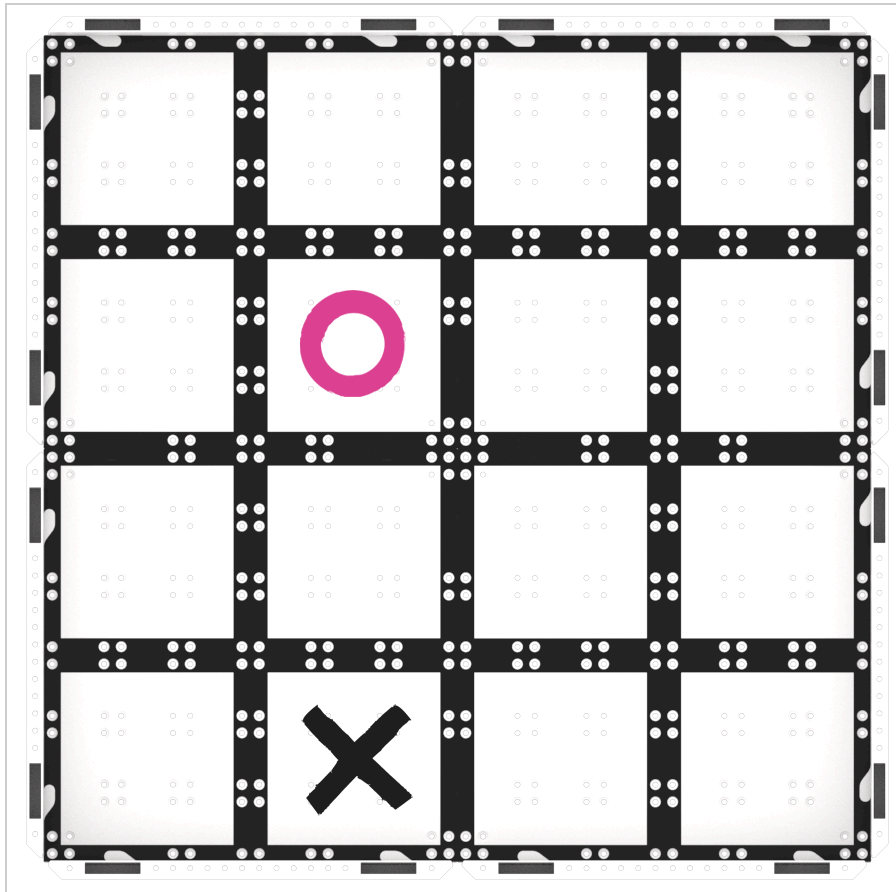
Offer suggestions and note positive team building and problem solving strategies as groups build together.

Teacher Troubleshooting

- If the wires seem to be getting in the way for students, use a rubber band to pull them together, and you can tuck the bundle into the build if needed, to keep the wires from impeding the movement of the Code Base during the Lab.
- Throughout this Unit, students will be adding “sample” items to the top of their robots. To ensure that these additions do not interfere with the movement of the Code Base, make sure the additions are lightweight and do not touch the ground when the robot is placed on a surface.

Facilitation Strategies

- **Think about how your students will access VEXcode GO.** Ensure that the computers or tablets that students will use have access to VEXcode GO. [For more information about setting up VEXcode GO, see this VEX Library article.](#)
- **Gather the materials each group needs before class.** For this Lab, each group of two students will need a GO Kit, Build instructions, a computer or tablet to access VEXcode GO, a small classroom item to act as a sample, and access to a GO Field for testing.
- **Set up your Fields ahead of time,** as shown in the image below, to serve as a testing area for the Code Base robots. Mark the start and sample locations, as shown, using a dry erase marker, or classroom items. Have these spread out around the classroom to allow students ample space to test their projects. Both Labs in this Unit will use the same Field setup, so you can leave your fields together from Lab 1 to Lab 2.



Field Setup

- **Try another project** - If students successfully reach the sample location right away, encourage them to try navigating to a different sample location. Use a dry erase marker to mark a sample location that is closer or further from the base, and have students adjust the parameters of their project to reach this new sample location.
- **Try a Turn** - For groups who finish early, and need additional challenges, have them add a [Turn for] block to the end of their project in Play Part 1, and test it to see what the Code Base will do. Ask them to experiment, and think of ways that this block could be useful in collecting samples on the Field.
- **Use the Get Ready...Get VEX...GO! PDF Book and Teacher's Guide** - If students are new to VEX GO, [read the PDF book](#) and use the prompts in the Teacher's Guide ([Google / .pptx / .pdf](#)) to facilitate an introduction to building and using VEX GO before beginning the Lab activities. Students can join their groups and gather their VEX GO Kits, and follow along with the building activity within the book as you read.
 - Use the Teacher's Guide to facilitate student engagement. To focus on VEX GO connections in a more concrete or tangible way, use the Share, Show, or Find prompts on each page to give students an opportunity to get to know their kits in more depth.
 - To focus on the habits of mind that support building and learning with VEX GO, like persistence, patience, and teamwork, use the Think prompts on each page to engage students in conversations about mindset and strategies to support successful group work and creative thinking.

- To learn more about using the PDF book and accompanying Teacher's Guide as a teaching tool any time you are using VEX GO in your classroom, see this [VEX Library article](#).

Play

Part 1 - Step by Step

1

Instruct

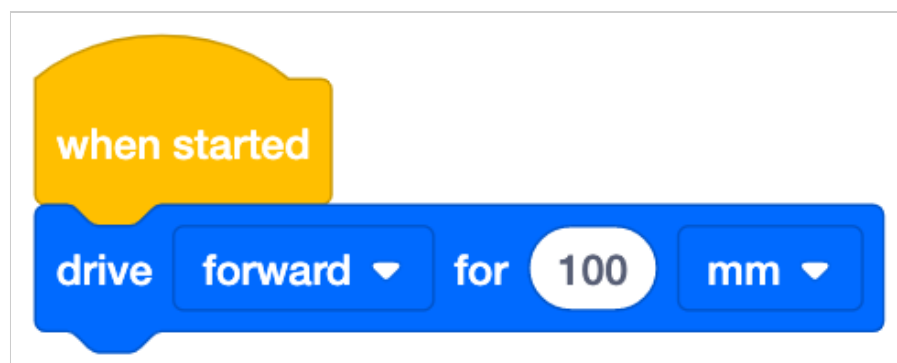
Instruct students that they are going to pretend that their Code Base robot is a Mars Rover. They will build a project in VEXcode GO to drive and collect a sample with the Code Base. This animation shows how the Code Base will move in this challenge.

2

Model

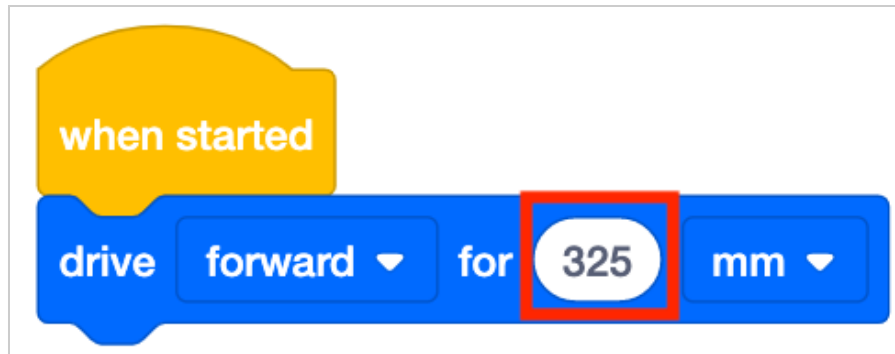
Model for students how to build a project in VEXcode GO and test their projects on the Field.

- Begin by showing students how to connect the Brain on their Code Base to their device in VEXcode GO. Because connection steps vary between devices, [see the Connecting articles of the VEXcode GO VEX Library for specific steps to connect the VEX GO Brain to your computer or tablet](#).
- They will also need to configure VEXcode GO for the Code Base. If necessary, [model the steps from the Configure a Code Base VEX Library article](#) and ensure students can see the Drivetrain blocks in the Toolbox.
- Drag a [Drive for] block into the workspace and attach it to the {When started} block.



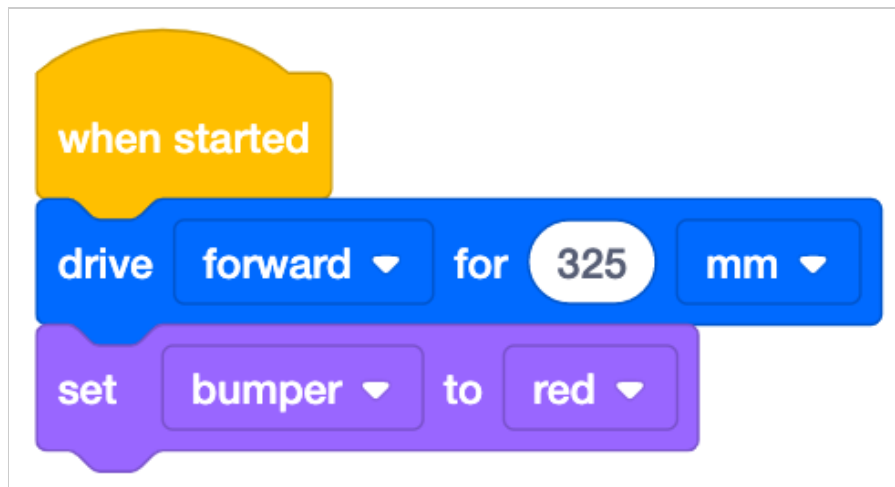
Add [Drive for] block

- Model for students how to change the parameter of the [Drive for] block so the Code Base drives forward to the sample location. Note: 325 millimeters (mm) will drive the Code Base to the sample in the recommended Field setup.



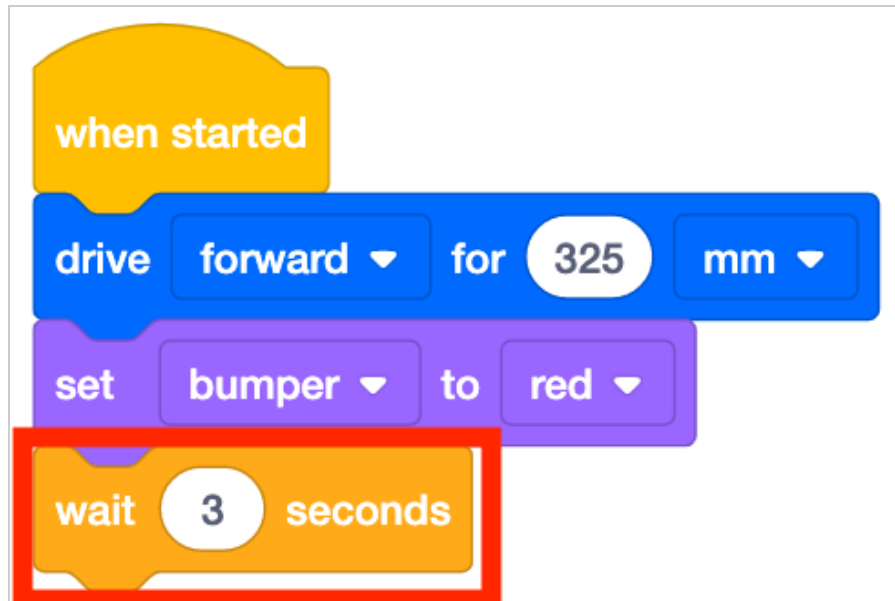
Change parameters

- Then, have students drag in a [Set bumper color] block to have the Code Base signal that it is collecting a sample. This block will have the LED Bumper glow in the selected color.



Add [Set bumper color] block

- Next, have students drag in a [Wait] block, and set it to 3 seconds. These three seconds will allow time for the Code Base to "collect the sample."



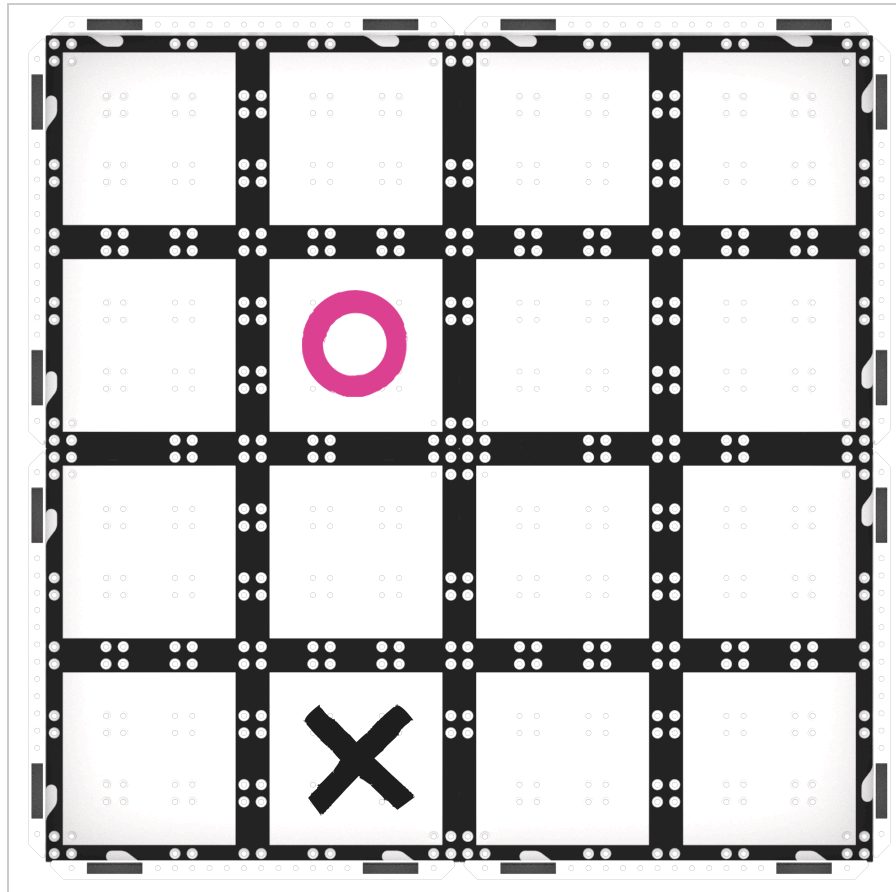
Add [Wait] block and set to 3 seconds

- Students should then add another [Set bumper color] block and set it to off. This will have the LED Bumper turn off to signal that the sample has been collected.



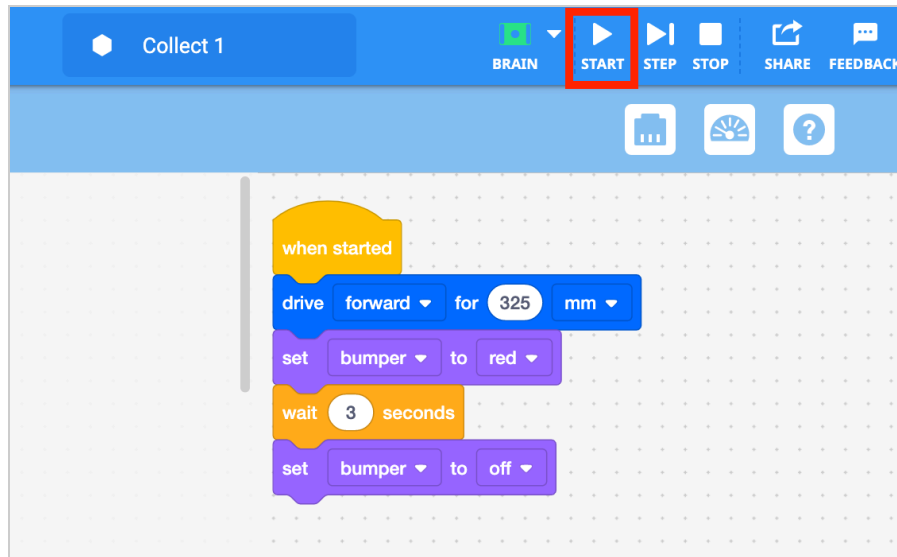
Add [Set bumper color] and set to off

- Once students have built their project, have them name their project as *Collect 1* and save it to their device. [See the Open and Save section of the VEXcode GO VEX Library for device-specific steps to save a VEXcode GO project.](#)
- Model for students where to place their Code Base robots on the Field. The robot should start on the 'X' and face the circle where the sample will be collected.



Lab 1 Field Setup

- Once the Code Base is placed on the Field, have students select Start in VEXcode GO to test their projects.



Select Start to test the *Collect 1* project

- After the Code Base drives **325 mm** to the collection location, the LED Bumper will glow red to indicate that it is collecting a sample. Students should place their “sample” item on top of the Code Base. After three seconds the LED will turn off to indicate that it is done collecting the sample.
- For groups who finish early and need additional challenges, have them add a [Turn for] block to the end of their project and test it to see what the Code Base will do. Ask them to experiment, and think of ways that this block could be useful in collecting samples on the Field.

3

Facilitate

Facilitate students working with VEXcode GO and testing their projects. While students are testing their projects, ask questions to help them think about the way their Code Bases are moving.

- Can you show me, using your hands, how your Code Base is going to move to collect the “sample”?
- How do you think your Code Base might move next if it was going to go back to the base?

4

Remind

Remind students that they can edit their projects, and retest them if their Code Base doesn't get to the "sample" location the first time. Students should check the parameter in the [Drive for] block to make sure it has the correct distance needed to reach the sample.

5

Ask

Ask students about what kinds of things they think the Mars rover is collecting on its missions. If they were scientists studying Mars, what would they want to learn about?

Mid-Play Break & Group Discussion

As soon as every group has collected the sample, come together for a brief conversation.

- Now that we've collected our sample what do you think our robot needs to do with it?
- How do you think we can code our Code Base to bring it back to the base? How will the robot need to move to deliver the sample to the base?
- What blocks do you think we might need to use in the next part of our project to do that?

Part 2 - Step by Step

1

Instruct

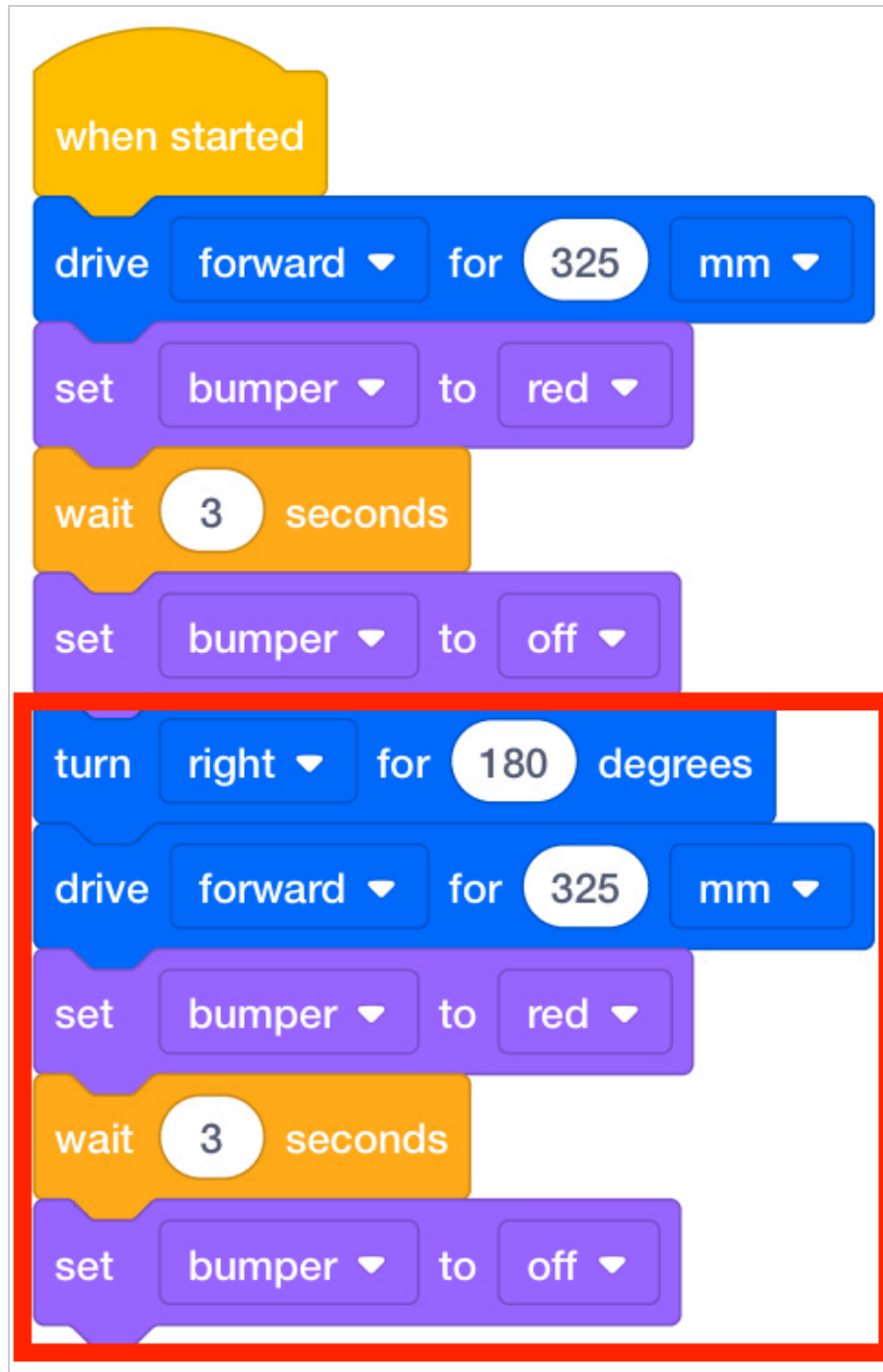
Instruct students that they will be adding onto their project so the Code Base drives the "sample" back to the base. This animation below shows the Code Base driving to collect the "sample," then return to the base to deliver the "sample."

2

Model

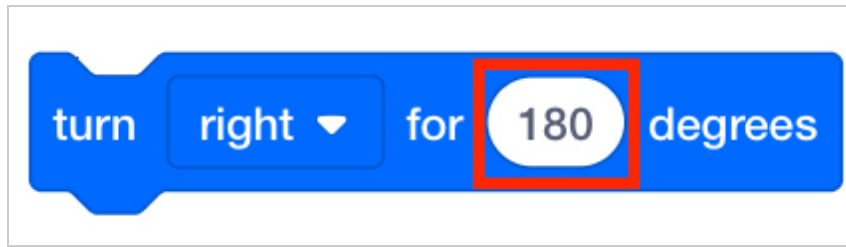
Model for students how to build onto their existing VEXcode GO project and test it on the Field.

- Your students may be able to build a project to complete the challenge on their own. However, for younger students, you may want to build the project together as a class, as you did in Play Part 1. If you are building the project together, you can follow the steps below.
- If students need to open their *Collect 1* project, model the device-specific steps, [as shown in the VEX Library articles in the Open and Save section](#).
- Have students add blocks to their VEXcode GO project to recreate the code in the image below. The red box indicates new blocks that need to be added to the project.



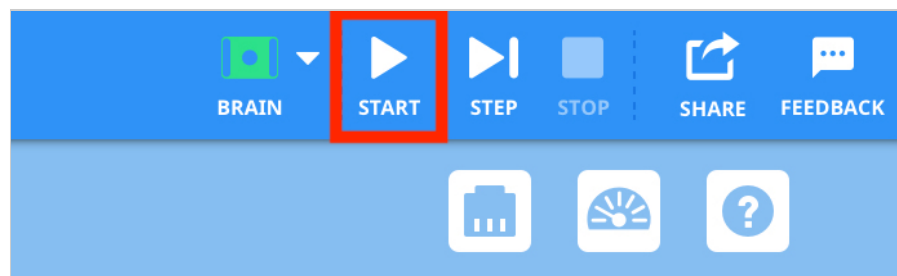
Add blocks to have the Code Base Return- *Collect Return* project

- If students have not used the [Turn for] block in a previous project, model how to drag the [Turn for] block into the project and change the parameter to 180 degrees. The turn distance is set to 180 degrees so that the Code Base turns around to face the base before driving forward to deliver the sample.



[Turn for] block set to 180 degrees

- Once students have built their project, have them name their project as *Collect Return* and save it to their device. [See the Open and Save section of the VEXcode GO VEX Library for device-specific steps to save a VEXcode GO project.](#)
- Have students place their Code Base on the Field, then select Start in VEXcode GO to test their projects.



Select Start to test the project

- After the Code Base drives to the collection location, students should place their “sample” item on top of the robot when the LED Bumper glows red. The Code Base will then turn right 180 degrees and drive back to the base. After the robot returns to the base and the LED Bumper glows red, students should remove the “sample” from the Code Base. The LED Bumper will turn off to symbolize that the sample has been delivered.
- If students finish collecting and delivering the sample and have additional time, encourage them to try navigating to a different sample location. Use a dry erase marker to mark a sample location that is one step closer or further from the base, and have students adjust the parameters of their project to reach this new sample and deliver it to the base.

3

Facilitate

Facilitate students testing their projects and taking turns on the Field. As students are testing, ask them about the sequence of blocks in their project that enables the Code Base to move to the correct place.

- Can you show me, with your hands, how the Code Base would move if the [Turn for] block was set to left instead of right?
- What would happen if the turning part of the project came before the driving part? Would your Code Base be able to reach the sample?

Review the [Using the VEX GO Sensors](#) and the [Coding with the VEX GO LED Bumper](#) articles for additional information on the LED Bumper.

4

Remind

Remind students that they should check their project and compare it to the image of the project, before testing. If one student built the project in VEXcode GO, their partner can check the code, before placing the Code Base on the Field and starting the project.

5

Ask

Ask students about how many samples they think the scientists are trying to collect to study Mars. Why would more samples be more helpful than fewer samples? Do you think our Code Bases could collect multiple samples?

Share

Show Your Learning

Discussion Prompts

Observing

- How did the Code Base have to move to collect the sample? What direction? How far? How did it have to move to return the sample to the base?
- How did you add to your project to have the Code Base return to the base? What VEXcode GO blocks did you use?
- If you changed the order—or *sequence* of the blocks in your project, would the Code Base still reach the sample? Why or why not?

Predicting

- How would you change your project if the Code Base needed to travel twice as far to reach the sample? What blocks or parameters would you add or change?

- What else could we make our Code Base do using the blocks we used today? Could they collect more samples? Where else could they travel using [Drive for] and [Turn for] blocks?

Collaborating

- What is one way you and your group solved a problem in this Lab? How were you helpful in solving the problem? Is there anything you would do differently next time?
- How did your group do following your role responsibilities? Do you have a 'favorite' job or role? Why?
- If you got a new member of your group tomorrow, how would you explain this Lab to that student?

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