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 plan and start a VEXcode GO project that makes the Code Base robot move forward and turn to drive in a square.

Students will make meaning of

- How to solve a challenge with the Code Base robot and VEXcode GO that mimics real world challenges for robots in the workplace.
- How robots can do jobs that are dirty, dull, or dangerous; such as unsanitary work cleaning sewers, dull work in warehouses, or dangerous work fighting fires.

Students will be skilled at

- Creating and starting a VEXcode GO project that instructs the Code Base robot to turn right and left.
- Identifying how each wheel must move in order for Code Base to turn.
- Sequencing Drivetrain commands together so the Code Base robot moves in a square.

Students will know

- How to sequence Drivetrain commands in a VEXcode GO project so the Code Base robot moves as intended.
- How to plan and start a project with the Code Base robot and VEXcode GO that mimics real world challenges for robots in the workplace.

Objective(s)

Objective

1. Students will know how to connect a device with VEX GO to the Code Base robot.
2. Students will create and start a project that has the Code Base robot turn right and left.
3. Students will identify how each wheel must move in order for Code Base to turn.
4. Students will sequence Drivetrain commands together so the Code Base robot moves in a square.

Activity

1. In Play Part 1 and 2, students will connect their device with VEX GO to their Code Base robot.
2. In Play Part 1, students will practice using the [Turn for] block in VEXcode GO to make the Code Base robot turn.
3. In the Mid Play Break, students will discuss how the wheels need to individually turn in order for the Code Base robot to complete a turn.
4. In Play Part 2, students will use VEXcode GO to make the Code Base robot move in a square.

Assessment

1. Students will connect a device with VEXcode GO to their Code Base robot so that they can create and start projects in Play Part 1 and 2.
2. Students successfully use VEXcode GO to make the Code Base robot complete a variety of turns by completing the Warehouse Challenge in Play Part 2.
3. Students and Teacher will discuss how individual wheels move and observe the movement of those wheels in Play Part 1 and the Mid-Play Break.
4. Students will sequence commands together to move the Code Base robot in a square during the Warehouse Challenge in Play Part 2.

Connections to Standards

Showcase Standards

Common Core State Standards (CCSS)

CCSS.MATH.CONTENT.K.G.A.1: Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.

How Standard is Achieved: In Play Part 1 and the Mid-Play Break, students will be asked to describe, using either gestures or words, how the wheels on the Code Base robot have to move in order for it to make a right or left turn.

Showcase Standards

Computer Science Teachers Association (CSTA)

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

How Standard is Achieved: In Play Part 2, students will create a project where Drivetrain commands are sequenced together so that the Code Base travels in a square during the Warehouse Challenge. They will discuss their commands and the sequence of their commands during the Share section.

Showcase Standards

Computer Science Teachers Association (CSTA)

CSTA 1B-AP-11: Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.

How Standard is Achieved: During Play Part 2, students will break down the steps of creating a square with their teacher. They will then use those steps to create a VEXcode GO project for a Code Base robot to travel in a square.

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
VEX GO Kit	For students who need to build their Code Base 2.0.	1 per group
Code Base 2.0 Build Instructions (3D) or Code Base 2.0 Build Instructions (PDF)	For students to build the Code Base 2.0 if they have not already.	1 per group
Pre-Built Code Base 2.0	From previous Labs. For students to start projects.	1 per group
VEXcode GO	For students to create and start projects on the Code Base.	1 per group
VEX GO Tile	For the Warehouse challenge in Play Part 2.	1 per group
Robotics Roles & Routines Google Doc / .docx / .pdf	Editable Google Doc for organizing group work and best practices for using the VEX GO Kit. For students to build the Code Base if they have not already.	1 per group
Tablet or Computer	For the students to use VEXcode GO.	1 per group
Lab 3 Image Slideshow Google Doc / .pptx / .pdf	For teachers and students to reference throughout the Lab.	1 for teacher facilitation
Pencils	For students to fill out the Robotics Roles & Routines Worksheet.	1 per group
Measuring Tool	For students to measure distances that the Code Base robot will travel.	One Warehouse square for every four student groups.
Pin Tool	To help remove pins or pry beams apart.	1 per group
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 Google Doc / .pptx / .pdf	For additional prompts when introducing students to VEX GO with the PDF Book.	1 for teacher use

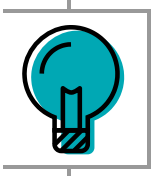
Engage

Begin the lab by engaging with the students.

Hook

Have you ever spun around in a tire swing? What about spinning around on an amusement park ride? In Math, turns are measured in degrees. You may have heard of degrees in temperature, but degrees have a special meaning in Math. Degrees in Math are units of measurement used to measure turns and angles. VEXcode GO also measures turns in Degrees. A whole turn is 360 degrees. Why is that? This is because there are 360 degrees in a circle. Since one whole turn is a full circle, it's 360 degrees.

Note: If students are new to VEX GO, use the Get Ready...Get VEX...GO! PDF book and Teacher's Guide (Google Doc/.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

How can we make our Code Base turn? How can we control how much it turns by applying our understanding of degrees?

Build

Code Base 2.0

Play

Allow students to explore the concepts introduced.

Part 1

Students will be create two projects in VEXcode GO: “Left Turn” and “Right Turn.” Students will then save and start the projects. Before they start each project, they’ll predict where the Code Base will end up.

Mid-Play Break

Did the Code Base end up where you thought it was going to? How close? How do the wheels need to move in order for the Code Base to turn?

Part 2

Students will use their knowledge of the commands learned from Play Part 1 to create a new project for their Code Base, as they participate in the Warehouse Challenge. Students will use commands in VEXcode GO to have the Code Base move in a square around a VEX GO Tile, to mimic a task performed by a warehouse fulfillment robot.

Share

Allow students to discuss and display their learning.

Discussion Prompts

- Could you rearrange the sequence of the VEXcode GO commands and get the same result? Why or Why not?
- Do you think that Code Base turns exactly 90 degrees? Why or why not?
- How does each wheel turn in order for the Code Base to turn right? Left?

Engage

Launch the Engage Section

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

ACTS	ASKS
1. Introduce the concept of turning to introduce the Lab. 2. Ask students how they know how much they have turned. 3. Introduce the Math concepts of measuring turns in degrees. 4. Let students know that this will be important when working with the VEX GO robots. 5. Explain why there are 360 degrees in a whole turn. The teacher can turn all the way around in a circle to demonstrate this point as well. 6. Ask students to use what they know about a whole turn to calculate how many degrees are in a ½ turn. The teacher can model this turn as well. They moved halfway around the circle. 7. Can they calculate how many degrees are in a ¼ turn? 8. Establish that they will be focusing on 90 degree, ¼ turns today, but will need to apply their understanding of degrees of turns in Labs later on.	1. Have you ever spun around in a tire swing? What about spinning around on an amusement park ride? 2. How do you know how much you have turned? 3. In Math, turns are measured in degrees. Degrees in math are units of measurement used to measure turns and angles. 4. VEXcode GO also measures turns in degrees. We will need to know this when programming our Code Base robots. 5. The whole turn is 360 degrees. Why is that? This is because there are 360 degrees in a circle. Since one whole turn is a full circle, it's 360 degrees. 6. Does anyone know how many degrees make a 1/2 turn? (180) 7. How about a ¼ turn? Yes 90 degrees. 8. How can we make our Code Base turn? How can we control how much it turns by applying our understanding of degrees?

Getting the Students Ready to Build

Let’s code our Code Base robot to turn!

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 Image Slideshow as a guide for students to complete this sheet.

They should check to make sure all materials are in good working order. This could be established as a “Start Up” routine: check the Code Base build, make sure the Battery and the device are charged, and launch VEXcode GO.

2

Distribute

Distribute pre-built Code Base 2.0 or build instructions to each group. Journalists should gather the materials for the build if needed.

Code Base 2.0

3

Facilitate

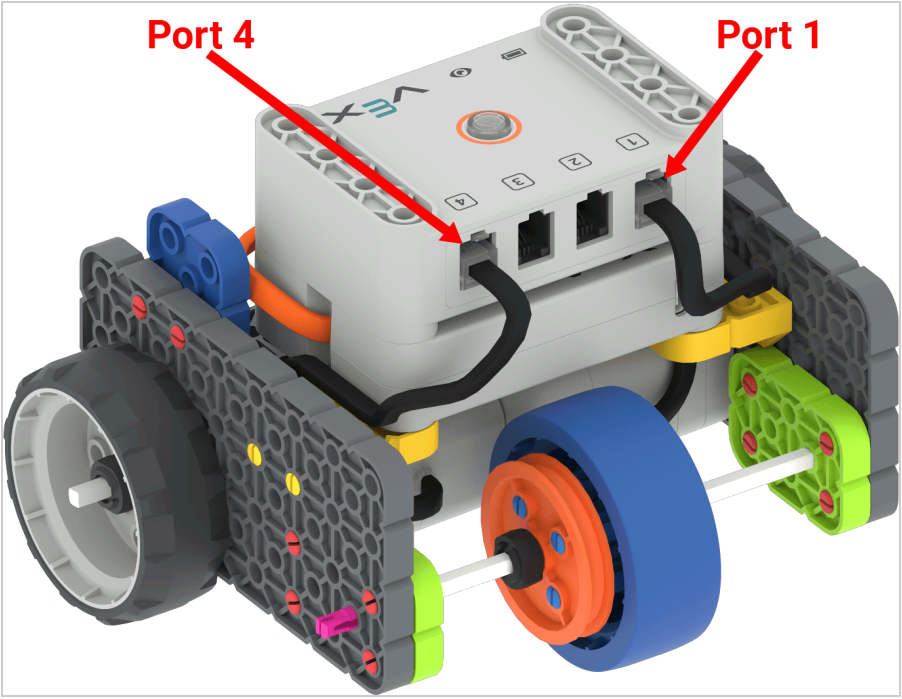
Facilitate the “Start Up” routine.

- Is the Battery charged?
- Is the Code Base built properly and not missing any pieces?
- Are all cables connected to the correct ports on the Brain?
- Is the device charged?
- Launch VEXcode GO on a device.

4

Offer

Offer support to groups that need assistance in launching VEXcode GO. Remind students to check to make sure that the cables are inserted into the correct ports.



Insert Cables Correctly

Teacher Troubleshooting

- Ensure devices and GO Batteries are charged before beginning the Lab.

Facilitation Strategies

- Establish a consistent “start up” practice as routine before working with VEX GO. If it is consistently implemented, students will take ownership of this routine and it will foster good practices for independent robotics activities.
- 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 Doc/.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

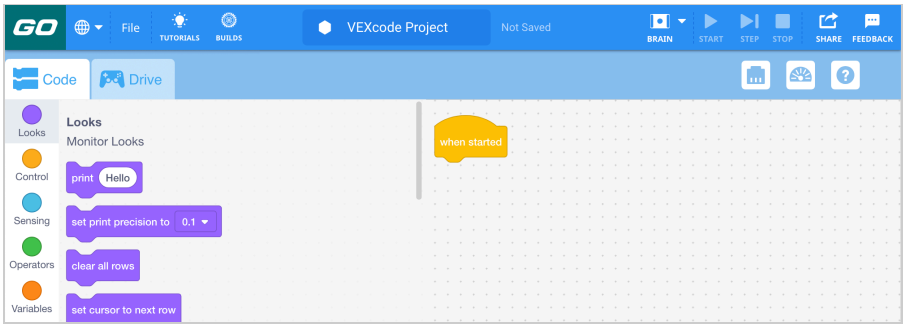
Part 1 - Step by Step

1

Instruct

Instruct students that they will explore how to make their Code Base turn left and right using degrees.

The goal by the end of this section is to have created and started two projects: *Left Turn* and *Right Turn*. To begin, each group should have a device, VEXcode GO software, and a built Code Base.



2

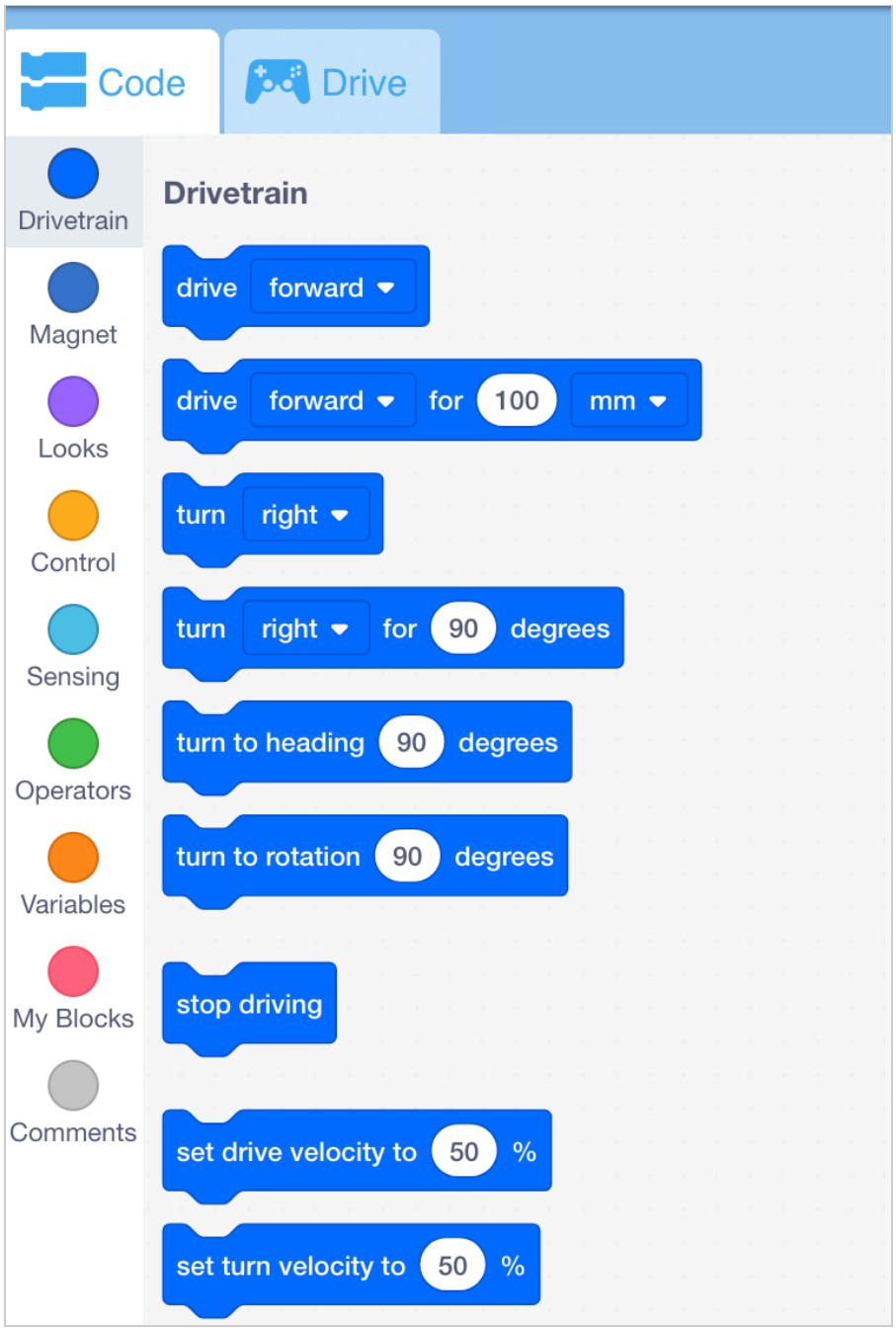
Model

Model for students the steps to open and save their project.

- Model the steps of the Open and Save a Project VEX Library article and have students follow along to open and save their project.
- Instruct students to name their project *Right Turn*.
- Have the students then connect the Brain of their Code Base to their device.

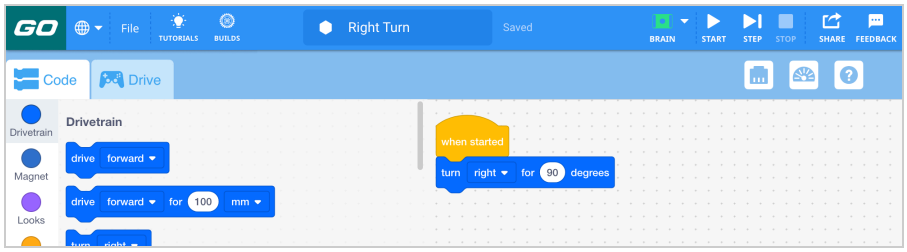
Note: When you first connect your Code Base to your device, the Gyro built into the Brain may calibrate, causing the Code Base to move on its own for a moment. **This is an expected behavior, do not touch the Code Base while it's calibrating.**

- Once students have named their project and connected the Brain to their device, model the steps to configure the Code Base. Ensure students can see the Drivetrain blocks in the Toolbox after configuring the robot.



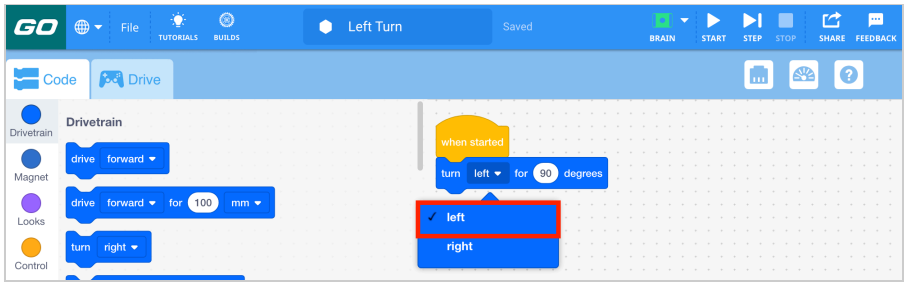
Drivetrain Category of Blocks

- Model for students how to drag in the [Turn for] block and attach it to the {When started} block to get the robot to turn right.



Right Turn Project

- Before students start their project, ask them where they think the Code Base will end up at the end of the project.
- Instruct students to start their project and observe the movement of the Code Base.
- After students have successfully turned their Code Base right 90 degrees, have students use “Save as” or "Save to Your Device" (depending on the version of VEXcode GO students are using) in the File Menu to save their project with a new name and name the new project *Left Turn*.
- After the project is saved, model how to change the parameter of the [Turn for] block from ‘right’ to ‘left.’



Left Turn Project

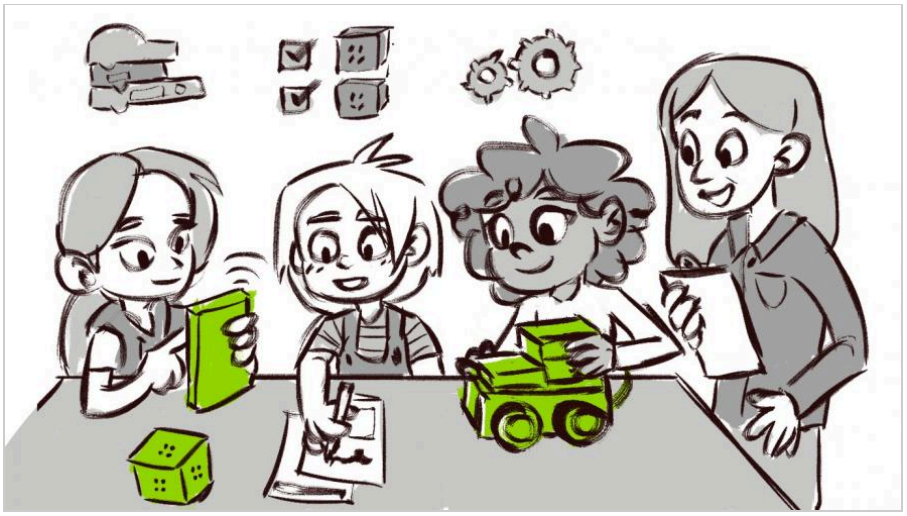
- Model for students how to start the project in order to test it.

3

Facilitate

Facilitate a discussion as students create their projects in VEXcode GO by asking the following:

1. Before you start your project, where do you think the Code Base will end up? Why?
2. What parts of the Drivetrain are moving as your Code Base turns?
3. What number of degrees did you use in your project for the Code Base? If you made that number higher next time, what do you think would happen?
4. Are you stuck? What can you try next? Where can you find information to get “unstuck?”



Group Discussion

4

Remind

Remind students that learning new concepts may take multiple tries and encourage them to try again as they create projects.

5

Ask

Ask students to think about what kinds of robot jobs would need accurate turns. Are there any dirty, dull, or dangerous jobs that would require a robot to make turns? Which ones?

Mid-Play Break & Group Discussion

As soon as every group as soon as each group has turned their Code Base robot left and right, come together for a brief conversation.

- Did the Code Base end up where you thought it would? How close were you?
- When your Code Base turned, how did the wheels move?
- What was the main difference between the two projects you created?

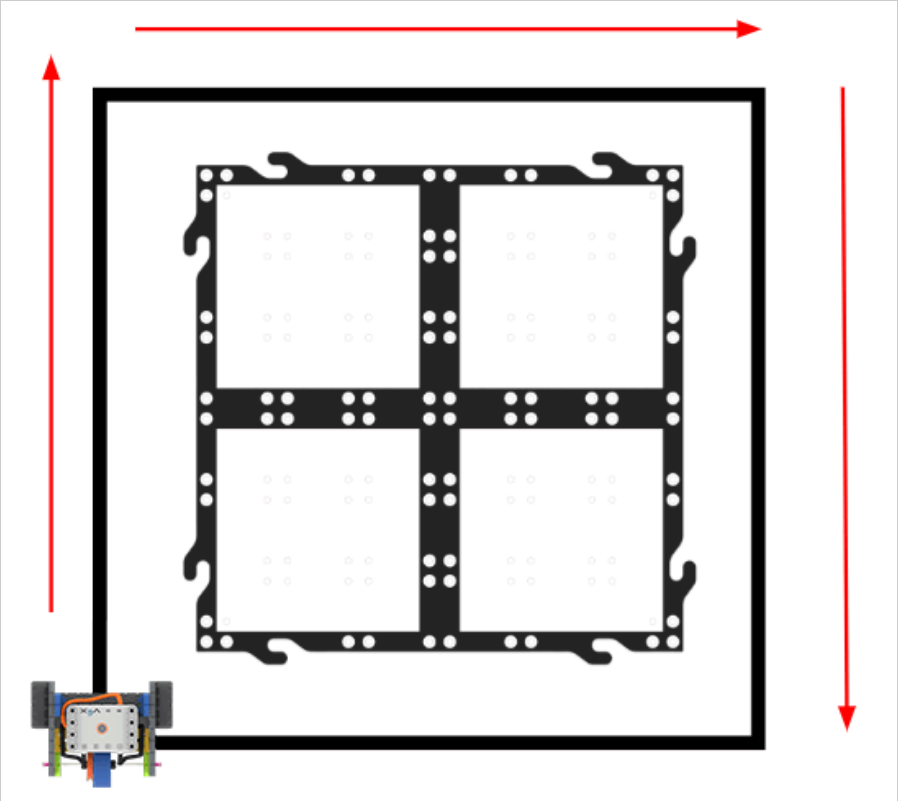
Part 2 - Step by Step

1

Instruct

Instruct students that they are going to combine all the information they learned about creating a project for the Code Base to instruct it to drive in a square around a warehouse. They will use a VEX GO Tile to establish the boundary of the warehouse.

To begin, each group should have a device, a VEX GO Tile, VEXcode GO software, and a built Code Base.



Code Base in the Warehouse Challenge

2

Model

Model using a group's device and VEXcode GO. Show which blocks students will use to create their project and successfully complete the challenge. Show students that they will need to drive forward and turn four different times to make a square, as shown in the animation below. In the animation, the Code Base begins to the lower left corner away from the tile. It drives forward to the other side of the tile, then turns right, and repeats these behaviors to drive in a square around the tile.

Model for students how to change the parameters of the blocks in order to change the distance and degrees. Tell students that the blocks should be connected to the {When started} block, as that block is always first.

- Show students following blocks:
    - {When started}

{When started} Block

    - [Drive for]

[Drive for] Block

- [Turn for]

[Turn for] Block

- Show students how to place GO Tile and map out the Code Base robot's path around the square. They should measure the distance that it will need to travel on each side.
- Show students how to input the degrees for the turns in the [Turn for] block.

- Model for students how to start their project in order to test it.

3

Facilitate

Facilitate a discussion with groups as you circle the classroom. Ask students to describe the steps to create a square. This allows the students to start to think about the way they will list the commands in their project. You can follow along with their instructions with pencil and paper or on the board.

1. What is the first step to draw a square?
2. When will I turn?
3. How do these instructions you are giving me relate to the commands for the Code Base?
4. Did something go wrong? Great! How can you use this mistake to improve your project?

4

Remind

Remind groups that the Code Base robot may not go in a square the first time but to keep trying! Students may not think that each side of the square and each turn should be the same measurements. Remind students to keep this in mind as they are coding.

5

Ask

Ask students to think about what their Code Base robot is doing and if it would relate to a dirty, dull, or dangerous job? Which ones?

Optional: If possible, keep the Code Base assembled for other Labs in this Unit.

Share

Show Your Learning

Discussion Prompts

Observing

- What commands did you use to code your Code Base robot to drive in a square?
- Could you rearrange the sequence of the VEXcode GO commands and get the same result? Why or Why not?
- Do you think that Code Base turns exactly 90 degrees? Why or why not?

- How does each wheel turn in order for the Code Base to turn right? Left?

Predicting

- What if you attached two GO tiles together? How would you change your project to instruct the Code Base robot to drive around the tiles?
- What would happen if the commands were in a different order? Would the Code Base still drive in a square?

Collaborating

- How did your group work together to create your project?
- How did your group decide which blocks to use? And which order the commands would go?
- How did your group deal with frustration if there was any?