VEX GO - Digital Citizens

Lab 1 - Cooling Courier

Teacher Portal

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 ask permission and give attribution when incorporating others' ideas into a project.
- How to collaborate with others to create the most efficient project to move cooling cells.

Students will make meaning of

- Why it is important to ask permission and provide attribution when using the ideas of others.
- How the sharing of ideas with a diverse group of people leads to better projects.

Students will be skilled at

- Using build instructions to build the Super Code Base 2.0.
- 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.

- Using Drivetrain blocks in a project to have the Code Base drive to a specific location.
- Using the **Energize electromagnet** block to pick up and drop off a Disk.
- Changing parameters in VEXcode blocks.
- Starting and stopping a project in VEXcode GO.
- Giving attribution to other groups when using their ideas.
- Collaborating with members of their group and other groups.
- Applying feedback from those with differing perspectives to improve a project.

Students will know

- How incorporating others' ideas through collaboration helps to create more efficient projects to move cooling cells.

Objective(s)

Objective

1. Students will cite and attribute ideas that come from other groups when those ideas are used in a VEXcode GO project.
2. Students will develop a collaborative VEXcode GO project to pick up and deliver cooling cells.

Activity

1. In Play Part 2, students will ask permission to incorporate the feedback and ideas of others into their projects, and give attribution where needed.
2. In Play Part 1, students will collaborate within their groups to develop a VEXcode GO project to pick up and deliver cooling cells.

Assessment

1. In Share, students will explain what ideas they used that came from other groups and how they attributed those ideas to the other groups.
2. In the Mid-Play Break, students will share the projects they created and tested in Play Part 1. In Play Part 2, students will then collaborate with other groups to try and make their project more efficient.

Connections to Standards

Showcase Standards

Computer Science Teachers Association (CSTA)

1B-IC-20: Seek diverse perspectives for the purpose of improving computational artifacts.

How Standard is Achieved: Students brainstorm and plan the path the Super Code Base needs to take in order to deliver cooling cells. They discuss their plan with other groups and share ideas on how to make the delivery of the cooling cells quicker. The teacher facilitates these discussions so students have guidance on how to seek those differing perspectives from other groups in order to improve their VEXcode GO projects.

Additional Standards

Computer Science Teachers Association (CSTA)

1B-IC-19: Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

How Standard is Achieved: Students learn about the people living in the desert climate who need cooling cells delivered to their homes in order to live comfortably. Students brainstorm and plan the path the Super Code Base needs to take in order to deliver these cooling cells. They discuss how using the robot improves the accessibility of buildings in this society for people who need to stay cool in order to stay healthy and safe.

Additional Standards

International Society for Technology in Education (ISTE)

1.2c: Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.

How Standard is Achieved: As students discuss their plans for coding the Super Code Base to deliver cooling cells, they may be inspired by ideas from other students and groups. Students learn how to give attribution for the ideas of other students and discuss how they are respecting their fellow classmates by asking permission and giving attribution when they use those ideas.

Additional Standards

International Society for Technology in Education (ISTE)

1.4d: Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems

How Standard is Achieved: In this Lab, students are presented with the open-ended challenge to code the Super Code Base to pick up and deliver cooling cells. They decide the path the robot should take through the course of the challenge. As they complete this coding activity, students show their perseverance for dealing with ambiguity and failure as they edit and refine their VEXcode GO projects.

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 to build the Code Base 2.0 robot.	1 per group
Code Base 2.0 Build Instructions: 3D or PDF	For students to follow to build the Code Base 2.0.	1 per group
Super Code Base 2.0 Build Instructions: 3D or PDF	To add the Electromagnet, Eye Sensor, and LED Bumper to the Code Base 2.0 build.	1 per group
Tablet or Computer	For students to use VEXcode GO.	1 per group
Lab 1 Image Slideshow Google doc / .pptx / .pdf	For visual aids while teaching.	1 for class to view
Robotics Roles and Routines Google Doc / .docx / .pdf	Editable Google Doc for organizing group work and best practices for using the VEX GO Kit.	1 per group
Lab 1 Worksheet Google doc / .docx / .pdf	For students to plan their VEXcode GO projects.	1 per student
Pencils	For students to fill out worksheets.	1 per student
VEX GO Field Tiles and Walls	To use as a testing area for the robots.	5 Tiles and 10 Walls per Field for testing
Pin Tool	To help remove pins or pry beams apart.	1 per group
VEXcode GO	For students to build projects for the Code Base - LED Bumper Top.	1 per group

Engage

Begin the lab by engaging with the students.

Hook

What would life be like in an area where the temperature is extremely hot? Students hear the story about the town that requires cooling cells to be delivered to the buildings in order for the people to live there comfortably.

Leading Question

How do you think we can work together to come up with the best way to code our robots to pick up and deliver cooling cells to the citizens who need them?

Build

Super Code Base 2.0

Play

Allow students to explore the concepts introduced.

Part 1

Students will create a VEXcode GO project for their Super Code Base to drive to the lab, pick up a cooling cell, then take the cooling cell to the neighborhood.

Mid-Play Break

Students will share their coding projects with the class. The teacher will facilitate a conversation about how students can incorporate ideas from other groups into their own projects, but only after getting permission to use the idea and attributing the idea to that group.

Part 2

Students will improve on their projects to deliver the cooling cells faster. They create these improvements by gathering ideas from other groups, getting permission to use those ideas, and then giving attribution to the groups whose ideas they have used in the project plan.

Share

Allow students to discuss and display their learning.

Discussion Prompts

- How did your group plan your VEXcode GO project together?
- How did you use ideas from other groups when you modified your VEXcode GO project?
- Why is a robot needed to deliver the cooling cells from the lab to the neighborhood? What would happen if humans were to deliver those cells?

Engage

Launch the Engage Section

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

ACTS	ASKS
1. List students' ideas about what life in a desert climate is like. 2. Read the story from the Image Slideshow (slide 3) that explains the situation. Answer any questions students may have about the scenario. 3. Take student suggestions about why they think a robot is needed to deliver the cooling cells. 4. List student suggestions about dirty, dull and dangerous jobs on the board. 5. Show students the Field setup where they will test their projects. Show them VEXcode GO open on a tablet or computer, and the Super Code Base robot.	1. Imagine you are living in a very hot desert climate. What would life be like in an area where the temperature is extremely hot? 2. The people in the city normally keep themselves cool using special cooling cells, but they have a serious problem they must solve. 3. Why do you think it is necessary to have a robot deliver the cells instead of people? 4. Robots are often used to do dirty, dull and dangerous jobs. Can you think of any jobs like this that robots do in our society? 5. In order to have the robots deliver the cooling cells to citizens, people of all backgrounds will need to work together. You will need to collaborate with others to code the robot to deliver the cells. How do you think we can work together to come up with the best way to code our robots to pick up and deliver cooling cells to the citizens who need them?

Getting the Students Ready to Build

Before the students can plan their projects for the robot to pick up and deliver cooling cells, they must first build the Super 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.

Super Code Base 2.0 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 buildings process, and remind students to follow their Role Responsibilities if they need help taking turns.

4

Offer

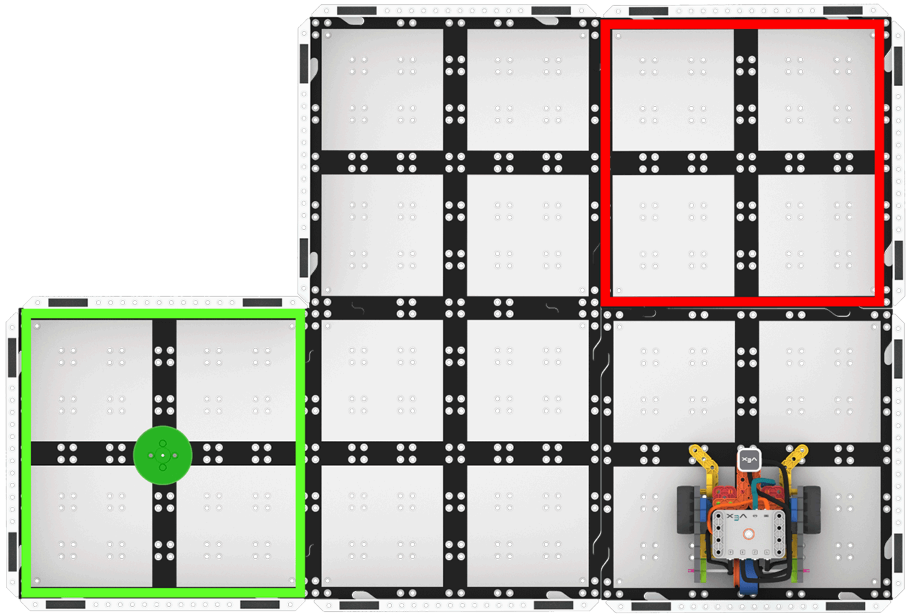
Offer suggestions and note positive team building and problem solving strategies as groups build together.

Teacher Troubleshooting

- If the wires seem to be getting in the way of the robot's drivetrain, 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 Super Code Base as it moves during the Lab.
- Mark the starting location for the robot on the Field. It will be important that students place the robot in the same location each time they test their projects. Marking the location with tape or a wet erase marker can help make that process simpler.

Facilitation Strategies

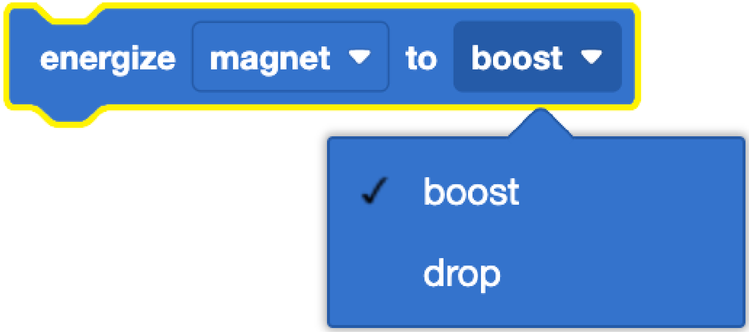
- To make the boundaries of the cooling cell lab area and the neighborhood drop off area more clear, mark them with colored tape or a wet erase marker.



- If students are having trouble getting started planning a path for the robot, encourage them to use the path in the animation at the top of Play Part 1 as a jumping off point.
- Remind students that the **Set drive velocity** block can be used to increase or decrease the speed of the robot.

Set drive velocity block

- The **Energize electromagnet** block is used to pick up and drop off disks. Remind students to use the drop down menu in the block to change the parameter from boost (pick up the magnet) to drop (release the magnet).



- To help students give and receive feedback respectfully, model providing feedback in a positive or neutral way, or role play with students to make sure the expectations for those interactions are clear.
- The goal of this Lab is about student collaboration to complete a challenge, not precision robot movements. As long as the robot gets anywhere within the pick up and drop off areas, the project is considered successful. That way if the robot gets knocked off course accidentally (like when the cooling cell is placed on it), the project can still function as intended and students can collaborate to improve the project.
- You can keep the Super Code Base built at the end of the Lab, as students will continue using the same robot in Lab 2.

Play

Part 1 - Step by Step

1

Instruct

Instruct students that they are going to code their robots to drive to the lab, pick up the cooling cell with the Electromagnet, and deliver it to the neighborhood. They will first plan where their robot will drive to accomplish the task, and will then build and test their projects iteratively to successfully deliver the cooling cell.

The following animation shows one possible way that the Super Code Base could be coded to pick up and deliver the cooling cell. The Code Base 2.0 starts in the bottom right corner of the Field, turns left, and drives to the lab on the far left side of the Field. It picks up the cooling cell with the electromagnet, turns right 180 degrees and drives back to the far right side of the Field. The Code Base 2.0 then turns left 90 degrees, drives forward, and drops off the cooling cell in the neighborhood.

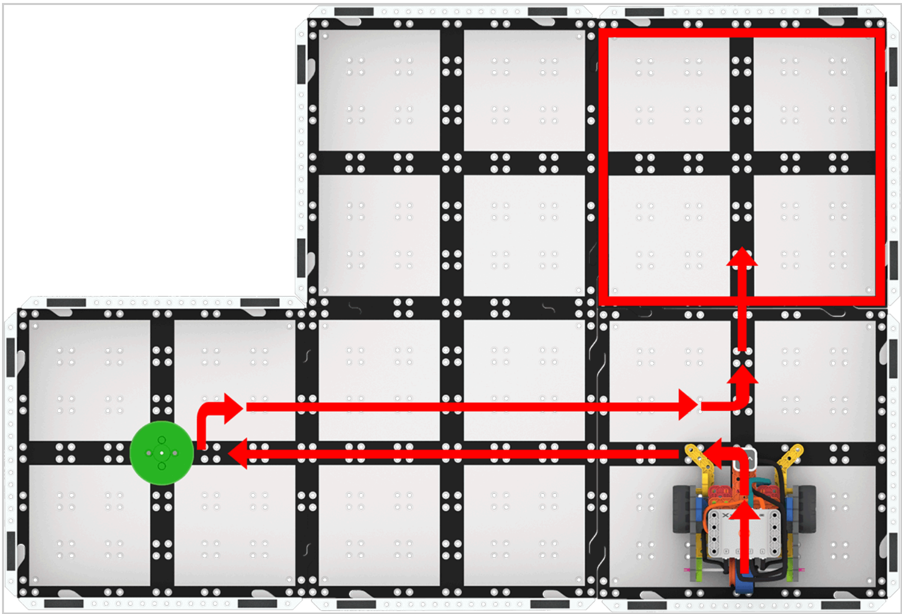
- Distribute a Lab 1 Worksheet to each student, with pencils, so they are ready for the next step.

2

Model

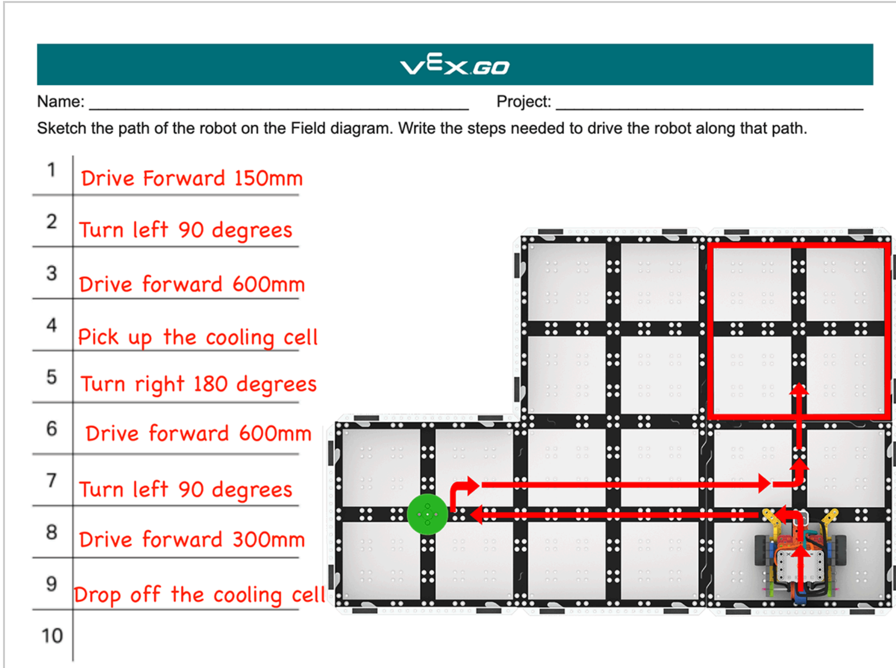
Model for students how to get started with their projects in VEXcode GO. There are many different ways to pick up and deliver a cooling cell to the neighborhood. Each group can approach this challenge in their own way.

- Model for students how to collaboratively decide on how the robot should move on the Field to pick up and drop off the cooling cell to the neighborhood.
    - Within their groups, each student should think of an idea for where and how the robot should move to accomplish the task. Each student should draw the path on the Lab 1 Worksheet, like the example in this image.



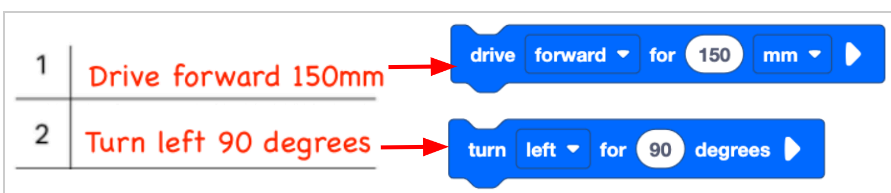
Example sketch of a robot path

    - Once they have their ideas sketched out, each student should take a turn sharing and describing their sketch to their partner. Students can find the similarities and differences between their ideas, and explain their thinking.
    - Each group should decide on one path to start with, or create a compromise by combining parts of both plans. Once they have agreed upon a path, be sure that path is sketched on a Lab 1 Worksheet. (Distribute additional Lab 1 Worksheets as needed.)
    - Remind students that there are many ways to solve the challenge, and that different ideas and perspectives will make the cooling cell delivery even more successful!
- Model for students how to write the steps needed to carry out the path they sketched.
    - Look at the sketch and break it down into the smallest possible steps needed to move the robot to follow the sketch.
    - Write the steps on the Lab 1 Worksheet, like the example in this image.



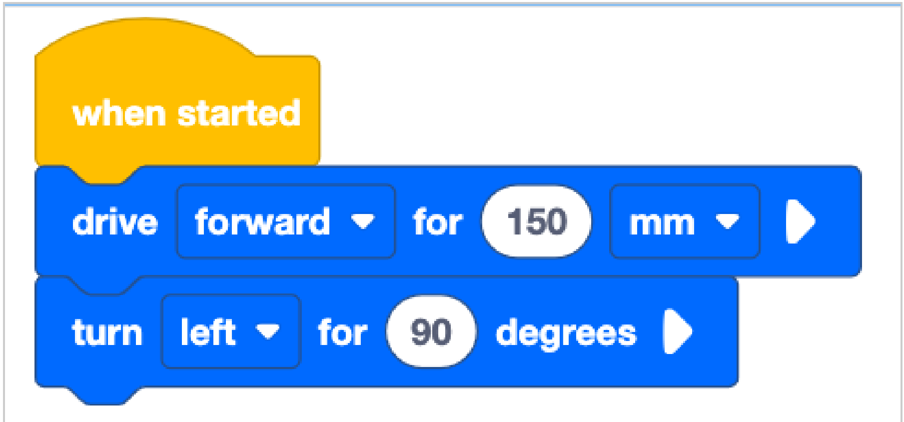
Example of written steps

- Model for students how to begin building and testing their project from their plan.
  - Students should look at the Toolbox in VEXcode GO to choose the blocks needed to complete the first steps of the plan. For instance, in the example steps, 'Drive forward 150mm' connects to a **Drive for** block, and 'Turn left 90 degrees' aligns to a **Turn for** block.



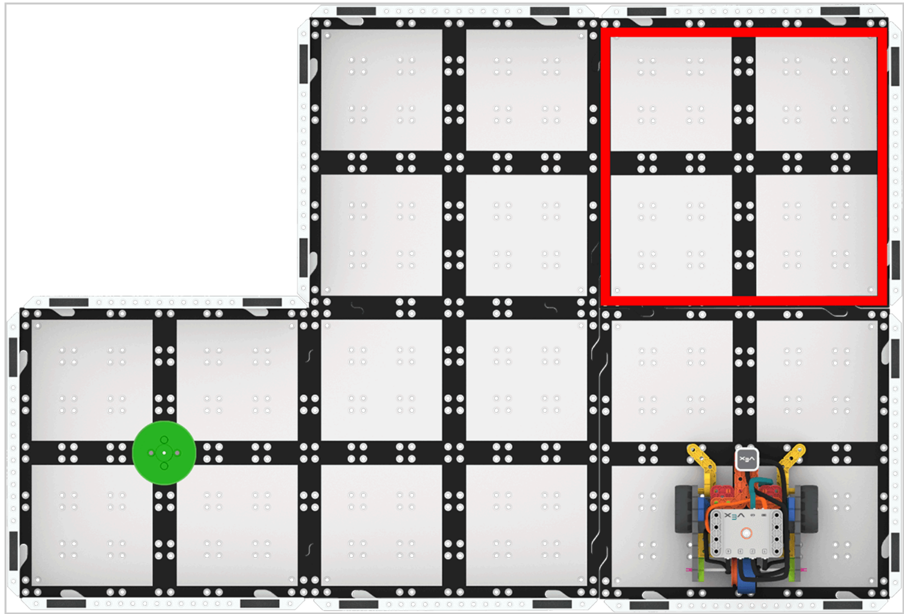
Find VEXcode GO blocks that align to each step

  - Students should build and test their projects in small increments, to be sure that they are working as intended.



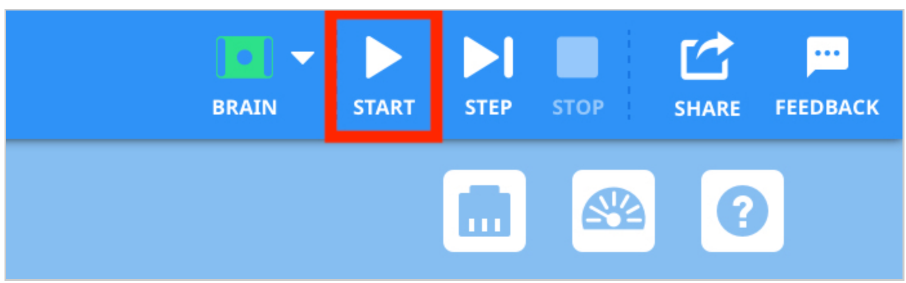
Example of a started VEXcode GO project to complete the first two steps

  - If necessary, show students how to connect the Brain on their Super 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 Super 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.
  - Have students name their project as *Deliver Cooling Cell* 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.
- If necessary, model for students how to test their project on the Field.
  - Show them how to place the Super Code Base on the starting location, as shown here.



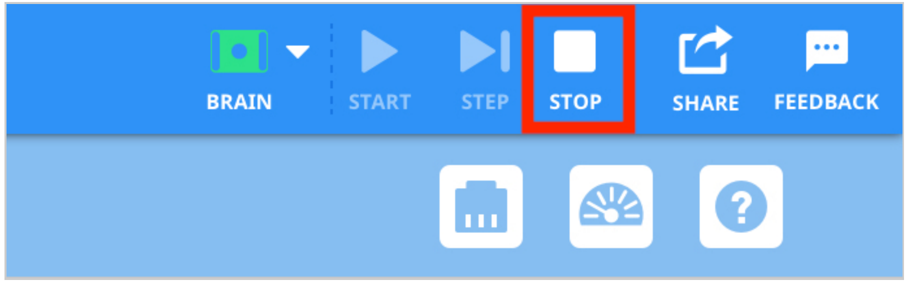
Place robot in the starting location

- Select 'Start' in VEXcode GO to test the project.



Select 'Start' to test the project

- Students' projects should pick up the cooling cell using the Electromagnet when they reach the pick up area.
- Students will need to select the 'Stop' button in the VEXcode GO Toolbar to stop the project.



Select 'Stop'

  - Have students apply what they have learned in other Labs to continue to collaboratively build and test their project to have the robot pick up and deliver the cooling cell to the neighborhood successfully. They will need to add blocks and change parameters, then test their projects on the Field.

3

Facilitate

Facilitate students collaboratively building and testing their projects in their groups.

- Talk to students about how they came to consensus about their project, to help them think about their collaborative processes. Ask questions like:
  - Were your initial ideas similar or different? How did you compromise to work together?
  - Which part of this project did you each come up with? How would you attribute the parts of the project?
  - Are there any strategies you've learned to help make decisions collaboratively that helped you today?
- Encourage students to think about how their different perspectives on the challenge helped them to build a successful project. Ask questions like:
  - How do you think this project is different than it would be if you were working on it alone?
  - Do you think every group is going to have the same project? Why or why not?
  - What if you were partnered with a different student? Do you think your project would turn out the same or different? Why?
- Help students continue to collaborate as they build and test their projects, reminding them of roles they can take on to work together.

    - One student can add the to the project in VEXcode while the other reads the written steps to make sure the blocks align to their ideas.
    - Students can take turns building the project and placing the robot on the Field to test.
- If students are struggling to get started, have them use the movements of the robot shown in the animation and images as a jumping off point. Ask questions like:
    - Does the robot accomplish the task when it moves along this path? How can you tell?
    - When you watch the robot move, is there something you thought it would do differently? If not, can you agree to start with that idea? If yes, can you explain what is different?
    - Can you sketch your idea to help you describe it?

4

Remind
Remind students that their project may be different from another in the classroom, and that is a good thing. The more ideas we have for how to solve the problem of delivering cooling cells to the neighborhood, the better off we will be. The more diversity of ideas and perspectives we have, the more solutions we can come up with together.

5

Ask
Ask students about other projects they have worked on collaboratively. How did they work together to complete the project? Were there times that they had to make a decision collaboratively? Is there anything from that experience that can help them code their robot together?

Mid-Play Break & Group Discussion

As soon as every group has successfully picked up and delivered a cooling cell to the neighborhood, come together for a brief conversation.

Tell students that they are now going to try to improve their projects to make them more efficient, but in order to do this, they will need to get more ideas from others in the class. Invite a few groups with differing projects to share or describe them for the class. Engage in a discussion about sharing ideas with the class, asking questions like:

- How does learning about different approaches to the challenge affect your ideas about the project?
- What did you like about the project we heard about? Why do you think that was a successful idea?
- If you were going to do the challenge again, are there any ideas you've learned about that you'd incorporate into your project?

Ask students to think about what would be a good strategy to incorporate others' ideas into their projects. Use questions like:

- If you wanted to use someone else's idea in your project, how could you do that respectfully?
- Do you think it is responsible to use someone's idea without asking them? Why or why not?
- How could you give credit to someone who helped you when using their idea in your project?
- Why is giving credit, or attribution, a respectful and responsible thing to do when working collaboratively?

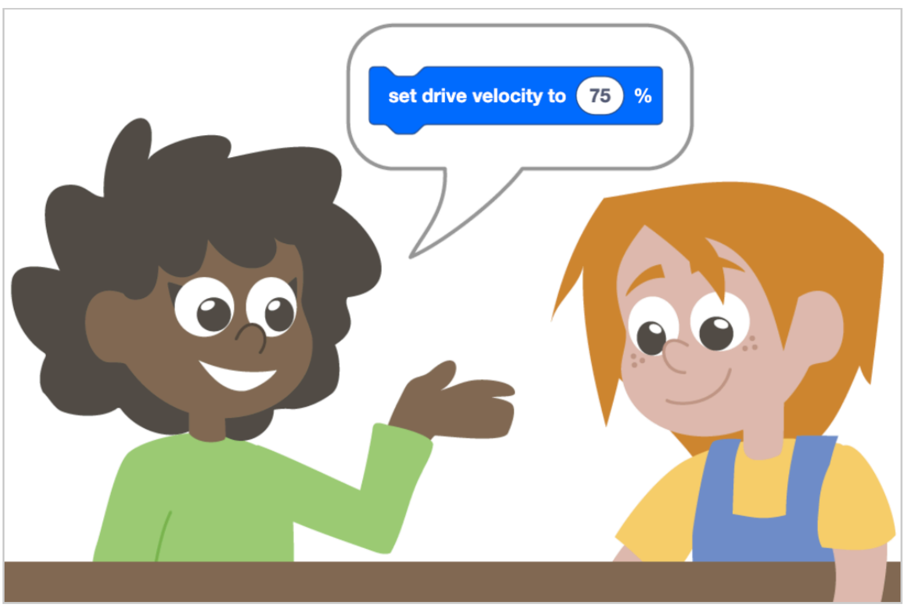
Remind students that the sharing of ideas helps us all to be more creative problem solvers, and that learning about different ideas and perspectives is an important part of learning. As long as we can work collaboratively with respect and responsibility, we can all improve our projects by sharing our ideas.

Part 2 - Step by Step

1

Instruct

Instruct students that they are going to share their projects with another group, and ask questions to get more ideas about how to solve the challenge. They will then improve their project based on those ideas, in order to deliver the cooling cells more quickly.



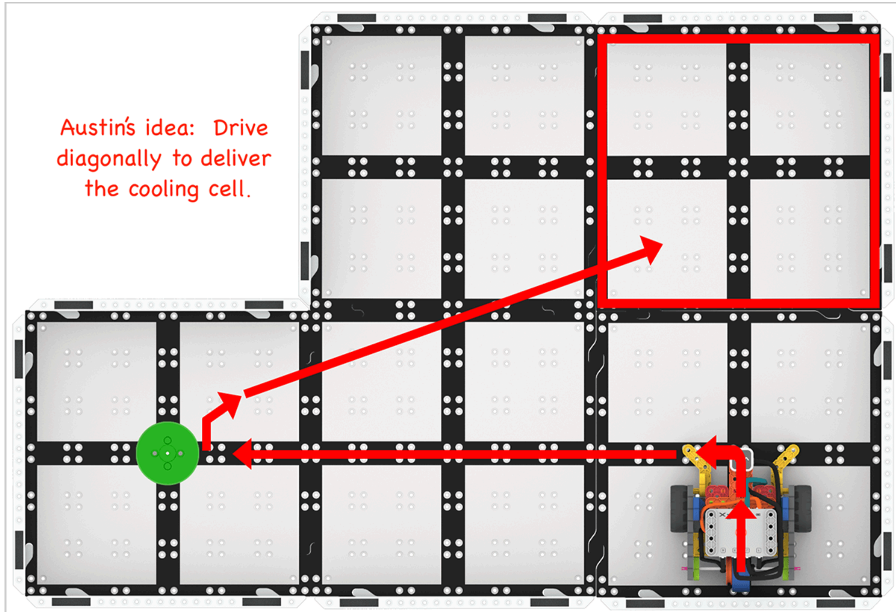
Students sharing ideas

Model

2

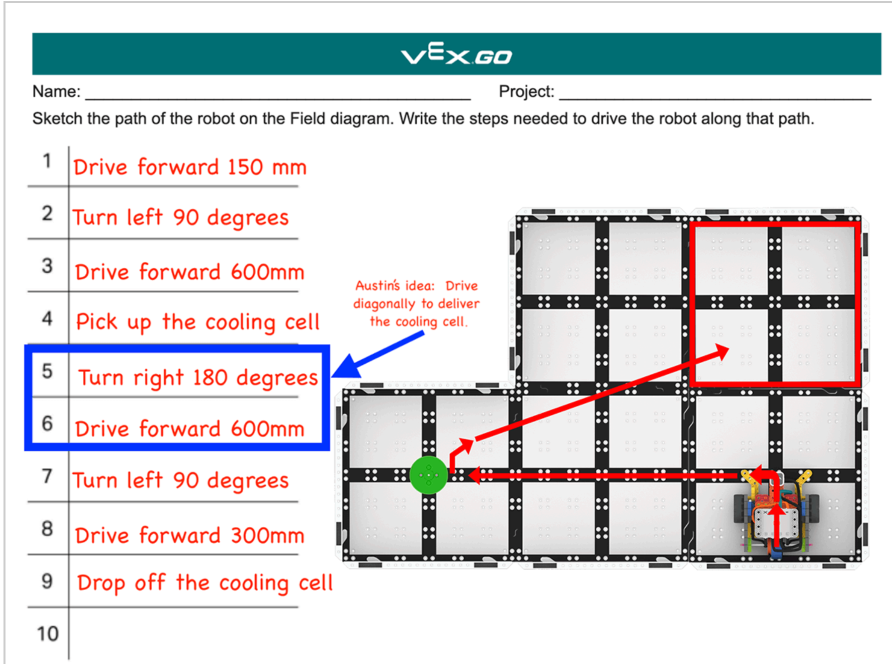
Model for students how to engage in collaborative learning with a different group. Using one group's setup, model how to have a discussion to learn about their project and approach to the challenge.

- Gather students around one group's setup. Have the group run or describe their project, and explain their thinking behind why they chose to move the robot in that particular path. Then ask questions to highlight the similarities and differences between projects and rationales.
    - Does this project look similar or different to yours? Can you describe a difference?
    - Did you see anything in the project that surprised you? What and why?
- Encourage students to think about the speed or efficiency with which the cooling cell was delivered. Ask questions like:
    - What was successful about this project? Did it deliver the cooling cell as fast as possible?
    - Do you think your project is faster or slower than this one? Could your project be more efficient? In what way?
    - If you were to do this challenge again, would you do anything differently? What and why?
- Model for students how to ask permission to use an idea that they learn about, and how to give attribution for that idea. **Note:** The attribution should include whose idea students are using, and how they are incorporating it. Guide students to identify respectful attribution using questions like:
    - If I wanted to use an idea I saw here in my project, what could I do to make sure that I do that respectfully?
    - Once I asked permission to use the idea, how could I give attribution? Is there something I could write down so that when I share my project with the class, I can give credit to my collaborators?
        - Show students an example of how they could attribute using the Lab 1 Worksheet. There are many ways to do this, here is one example using a sketch.



Example of giving attribution for an idea

- Show students how to take the new idea and incorporate it into their project.
  - Look at the steps listed. Which steps are the same, and which would need to change to add in the new idea?
  - Identify which steps need to change, like the example shown here.



Identify the steps that need to change

- Students would then build and test their project, as they did in Play Part 1, to try out the new idea.

- Pair groups together that have different projects, and facilitate students engaging in a project sharing, permission and attribution discussion as they work to improve their projects to deliver cooling cells to the neighborhood more quickly.
    - Distribute additional Lab 1 Worksheets to groups if needed, to document their project changes and attributions.

3

Facilitate

Facilitate students sharing their projects and giving ideas and feedback about how to make their projects deliver cooling cells more quickly.

- If students are struggling to come up with an improvement for their project, remind them that there is always a way to make a project better. Offer a few ideas to help get them started:
    - Can your robot drive and turn more quickly on the Field?
    - Can you pick up or deliver the cooling cell more quickly?

- Is there a more direct path that you could take to pick up or deliver the cooling cell?

- If students have a lot of ideas they want to try, encourage them to choose **one** new idea to incorporate into their project at a time.
    - Students can note multiple ideas on their Lab 1 Worksheet, but remind them to change only one thing at a time in their project.
    - Students can try multiple ideas out as class time allows. The goal is that they are continuing to iterate and apply the diverse perspectives of others in the class to solve the challenge.
- Encourage students to be honest and open in their feedback and project sharing discussions. This is not a competition, we are all trying to accomplish the challenge in the most efficient way possible.
    - Students can also offer new ideas that are not present in either project, that could help make a project better.
    - It is ok if student's projects end up looking more similar to one another as they engage in this process. For instance, if both groups adjust the robot's velocity that's alright. The important part is that they came to that idea collaboratively.
- Ask students about how they are getting permission and giving attribution for new ideas. Use questions like:
    - Can you describe the new idea you want to incorporate? Where did this idea come from?
    - How did you get permission to incorporate that idea into your project?
    - Can you show me how you attributed that idea on your Lab 1 Worksheet?
- To extend this Lab, challenge students to incorporate the Optical Sensor into their project. Create a second neighborhood on the Field, and have students create a project to deliver a red Disk (cooling cell) to the original neighborhood, and a green Disk to the new neighborhood.

4

Remind

Remind students that there is always something they can do to make their project better. This is a good thing! It means that we can always keep trying things out and learning from them, and from those around us.

Ask

5 Ask students to think about other coding projects that they have done previously. How might talking about the challenge and possible solutions with other students have helped them be successful? How could they use that strategy in the future to help them problem solve more collaboratively and creatively?

Share

Show Your Learning

Discussion Prompts

Observing

- We were all working on the same challenge of picking up and delivering a cooling cell to the neighborhood. Why weren't our projects all the same?
- How did seeing other group's project help you to think about how to improve your own?
- If you were in charge of choosing a project for all the robots to follow, which would you pick and why?

Predicting

- What if you had to pick up and deliver a cooling cell to a different location on the Field – what could you apply from this project to help you accomplish the new task?
- If you were going to do this project again, what is another idea you would want to incorporate to make your project even better?
- If you got an idea from someone about a future project, how can you make sure that you're getting permission and using their idea respectfully and responsibly?

Collaborating

- What did you learn about working with collaborators to improve your project? How did talking with another group help to make your project better?
- What is something that you learned today that you can bring into our next collaborative VEX GO project?
- How did it feel to give ideas to another group to help them improve? How did it feel to incorporate someone else's idea into your project? How can you make sure that you are engaging in respectful collaboration moving forward?