

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

- Strategies for creating, decoding, and managing passwords to secure access to sensitive areas, like the lab for the cooling cells.



Students will make meaning of

- Why is it important to keep login information private.
- The reasons behind using passwords to secure critical areas and information, such as the cooling cells in the lab.



Students will be skilled at

- Connecting a Brain to a tablet or computer in VEXcode GO.
- Saving and naming projects in VEXcode GO.
- Changing parameters in VEXcode blocks.
- Starting and stopping a project in VEXcode GO.
- Creating and managing passwords using various techniques and technologies.

- Decoding a given password communicated through the lights on the LED Bumper.
- Altering code to change the password for their robot.
- Collaborating with peers to brainstorm and implement diverse methods for remembering passwords.



Students will know

- The role of passwords in securing sensitive information, such as cooling cells in a lab.

Objective(s)

Objective

1. Students will decode a given password communicated through the LED Bumper on the robot.
2. Students will create and manage their own passwords for their robots.

Activity

1. In Play Part 1, students will watch the patterns seen on the LED Bumper to decode their starter password. They will observe that the number of flashes of the LED Bumper corresponds to the number in the password.
2. In Play Part 2, students will use VEXcode GO to create their own passwords by changing the numbers in the **Repeat** loops and ensuring that all group members can remember the password without writing it down.

Assessment

1. In the Mid-Play Break, students will explain the process they used to decode the password and demonstrate their understanding of the code that generated it. In Play Part 2, students will edit the project to code their new password, and use VEX GO pieces as a strategy to help them remember it.
2. In Share, students will explain the steps they took to ensure password security and memorability for the password they have created.

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 are decoding and then creating their own passwords in this Lab. They will share with one another the techniques used to remember their new passwords and also techniques for keeping their password safe. Students use those varying perspectives in order to create and remember those new passwords.

Additional Standards

Computer Science Teachers Association (CSTA)

1A-IC-18: Keep login information private, and log off of devices appropriately.

How Standard is Achieved: In this Lab, students decode the 'default' password for entering the cooling cell lab on their robot, which is represented by a series of flashes of the LED Bumper. They then alter the password by modifying a VEXcode project to create their own secure passwords for each robot.

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 create a new password for their robot to enter the cooling cell lab together with their partner. They discuss password safety, and are tasked with the open-ended problem of creating a unique method to remember the numbers using pieces in the VEX GO Kit. Students then share their memory strategy with the teacher and code the LED Bumper to flash to represent the new password they created. Students demonstrate perseverance for dealing with ambiguity as they work to create a password and strategy that is unique to their own needs and perspectives.

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 Super Code Base 2.0 robot.	1 per group
Code Base Build Instructions: 3D or PDF	For groups to build the Code Base 2.0 robot.	1 per group
Super Code Base 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
Starter Password VEXcode GO project	To be downloaded and run to display the default password on the LED Bumper. The project will directly download to the device when the link is selected.	1 per group
Lab 2 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
Blueprint Worksheet Google Doc / .docx / .pdf	For students to record information about their passwords during the Lab.	1 per group
Pencils	For students to fill out worksheets.	1 per group
VEX GO Field Tiles and Walls	For testing the VEXcode GO projects.	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 edit their password VEXcode GO project.	1 per group

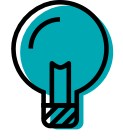
Engage

Begin the lab by engaging with the students.



Hook

Have you ever had to create and enter a password in order to use a website or app? Students will discuss their experiences with passwords online and learn about how the robots will use passwords to keep the cooling cells safe.



Leading Question

How do you think we can we code the robot to create and manage safe and secure passwords?



Build

Super Code Base 2.0

Play

Allow students to explore the concepts introduced.

Part 1

Students decode the starter password that was given to their robot. They will run the project and count the number of LED Bumper flashes in order to determine the three numbers in the password.

Mid-Play Break

As a class, students discuss the starter password and how they determined what numbers made up the password. The class looks at how the numbers in the password corresponds to their VEXcode GO project, to identify that the numbers in the password are the parameters in the **Repeat** blocks.

Part 2

Students create a new password and use pieces in the VEX GO Kit as a strategy to remember their password without writing it down. Students then edit the project in VEXcode GO so they can change the password that their robot will use to enter the lab. They come up with different strategies and techniques for memorizing their passwords.

Share

Allow students to discuss and display their learning.

Discussion Prompts

- What makes a password safe?
- What should you do if someone asks you to share a password?
- What strategies did your group use to remember your new password?
- How did you determine what numbers to use in your new password?

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. Discuss students' answers regarding their experiences using passwords.2. Continue the discussion about the need for passwords, listing ideas on the board.3. Show students the robot, drawing attention to the LED Bumper. Guide students to suggest that they could use it to flash a coded pattern to represent a password.4. Show students Field setup where they will test their projects. Show them VEXcode GO open on a tablet or computer, and the Super Code Base.	<ol style="list-style-type: none">1. Have you ever had to create and enter a password in order to use a website or app?2. Why do you think passwords are necessary?3. Now that the robots are able to successfully pick up and deliver cooling cells, we need to establish some security for the cooling cell lab, so only authorized cooling couriers can access them. How do you think we could use our Super Code Base robots to display a password?4. We are going to use the LED Bumper on our Super Code Base robots to create passwords for each of our robots. How do you think we can we code the robot to create and manage safe and secure passwords?

Getting the Students Ready to Build

Let's see how we can create a secure password with the LED Bumper on our Super Code Base! (If students do not have a pre-built Super Code Base 2.0 from the previous Lab, allow an extra 15-20 minutes for students to build it prior to the Lab activities.)

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

2

Distribute

Distribute one pre-built Super Code Base, a VEX GO Kit, and a tablet or computer with VEXcode GO to each group.



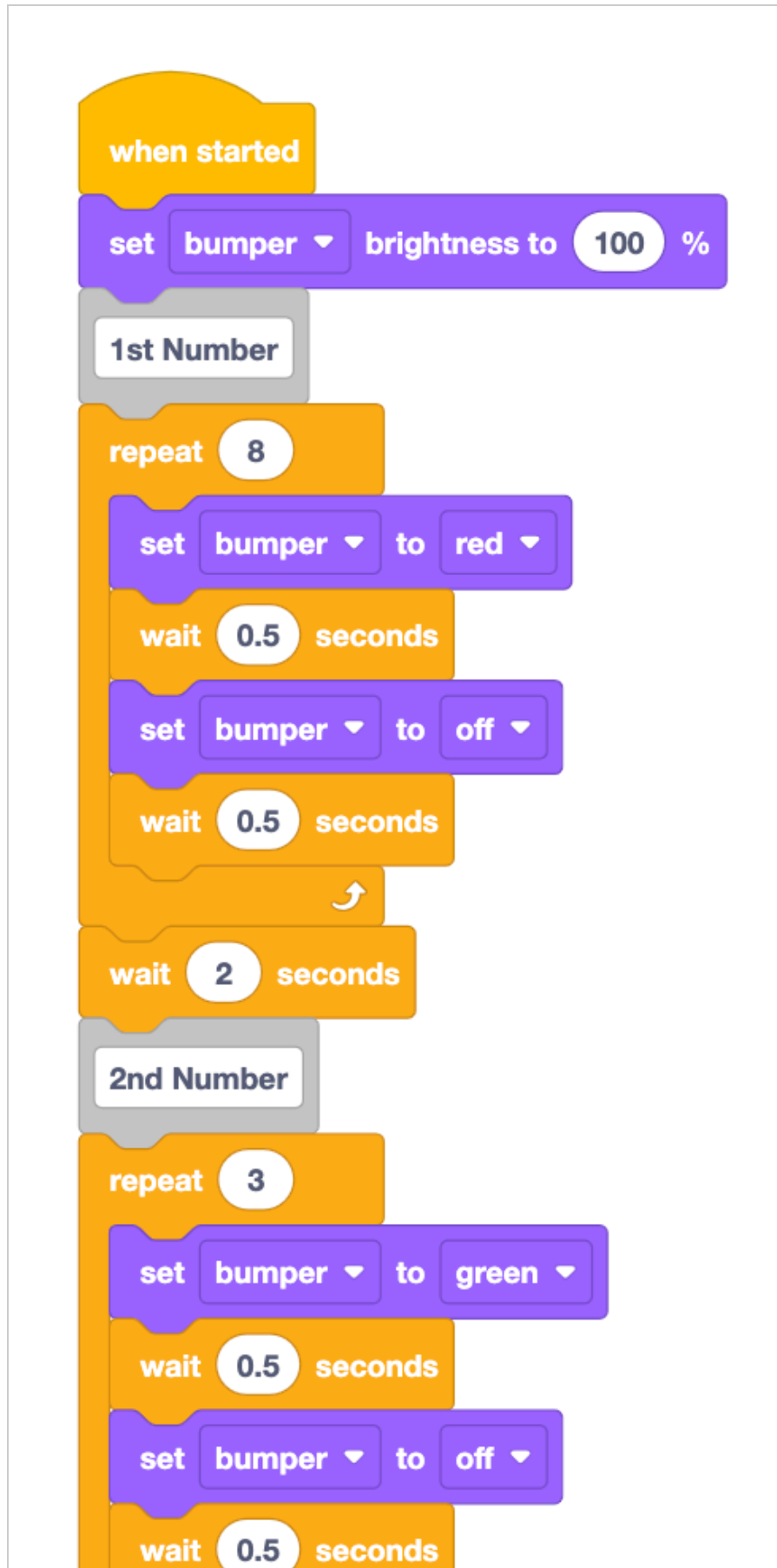
Super Code Base 2.0 build

Facilitate

3

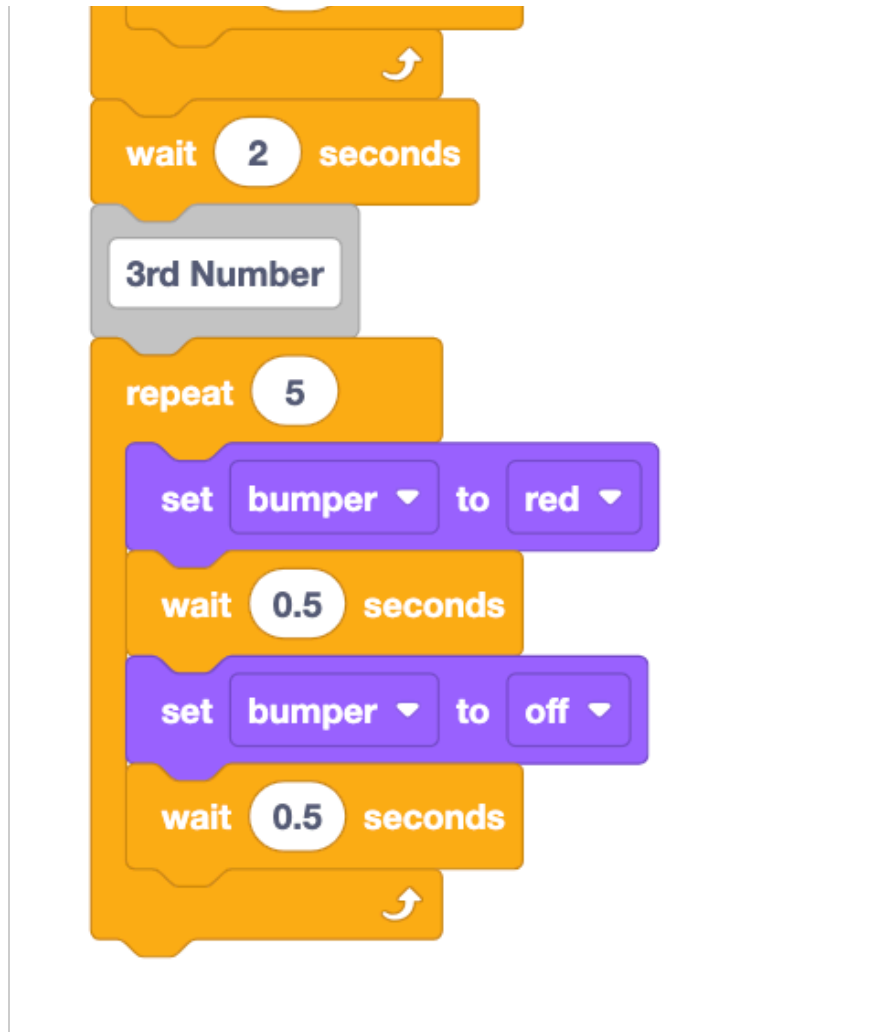
Facilitate students opening the Starter Password VEXcode GO project in VEXcode GO.

- **Note:** [This project](#) (also linked in the Materials List on the Summary page of the Lab) can be downloaded to students' devices prior to beginning the Lab. The project will directly download to your device when the link is selected.



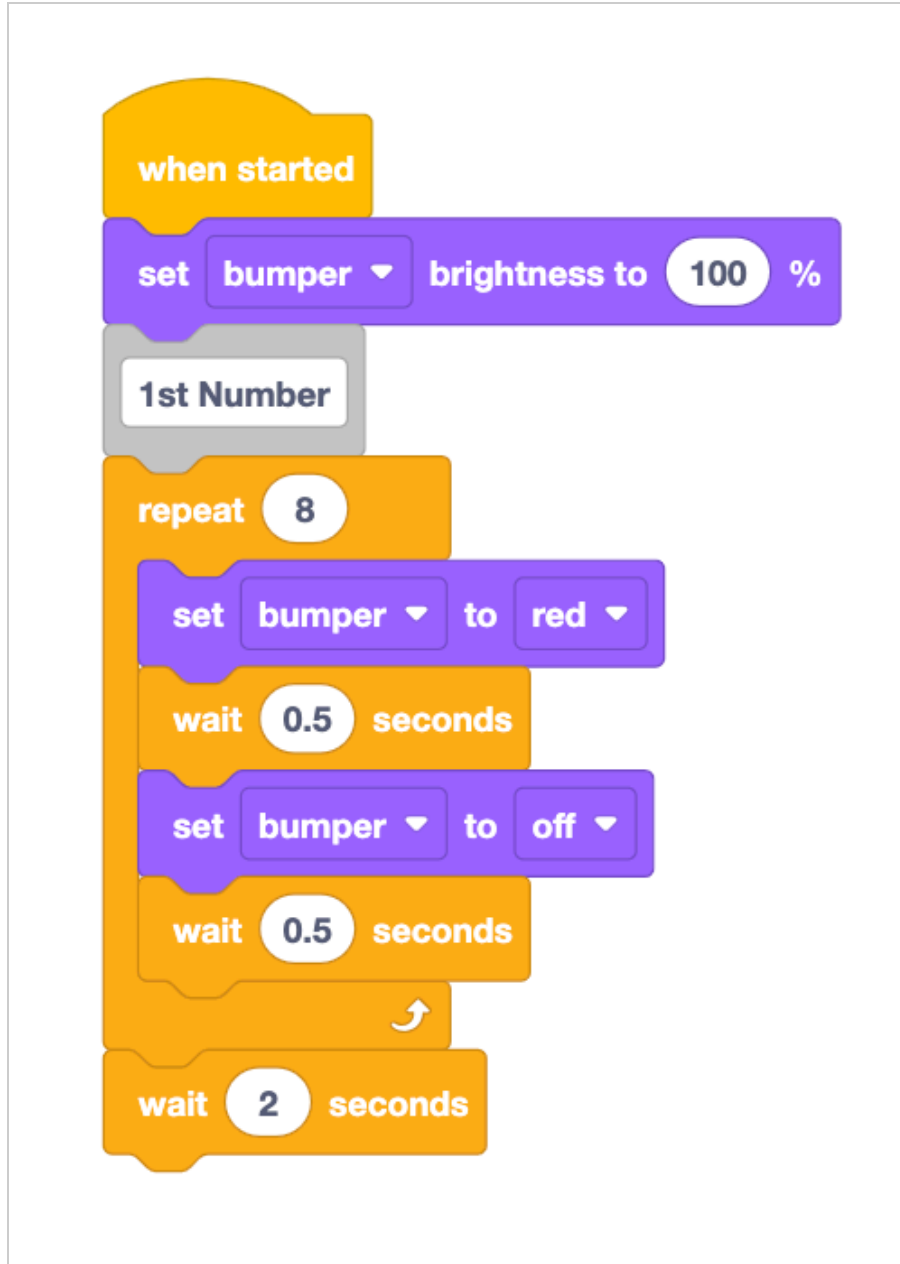
The image shows a Scratch script for controlling a VEX GO bumper. The script starts with a 'when started' block, followed by a 'set bumper brightness to 100%' block. A '1st Number' block is present, followed by a 'repeat 8' loop. Inside the loop, the bumper is set to red, waited for 0.5 seconds, set to off, and waited for 0.5 seconds. After the loop, there is a 'wait 2 seconds' block. A '2nd Number' block is present, followed by a 'repeat 3' loop. Inside the loop, the bumper is set to green, waited for 0.5 seconds, set to off, and waited for 0.5 seconds.

```
when started
  set bumper brightness to 100 %
  1st Number
  repeat 8
    set bumper to red
    wait 0.5 seconds
    set bumper to off
    wait 0.5 seconds
  wait 2 seconds
  2nd Number
  repeat 3
    set bumper to green
    wait 0.5 seconds
    set bumper to off
    wait 0.5 seconds
```



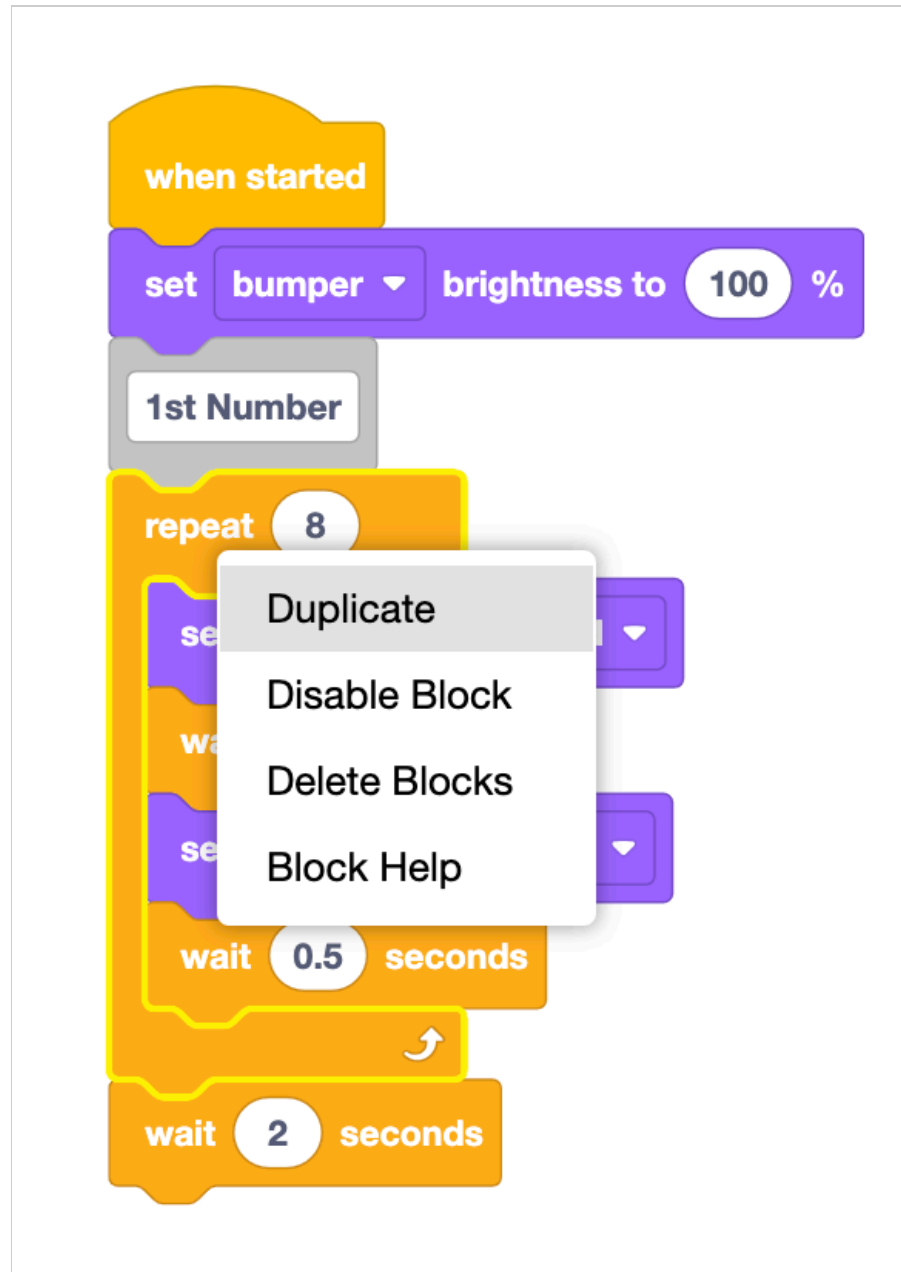
Starter Password Project

- If desired, build the project together with students. Begin by building the "1st Number" section of the project, then demonstrate how to right-click to duplicate blocks and change their parameters for the remaining sections.
 - Begin by building the "1st Number" section of the project, as shown here.



Building the "1st number" section of the project.

- Demonstrate how to right-click on the **Repeat** block to duplicate blocks and change their parameters to complete building the project.



Right click on the **Repeat** block to duplicate that section of blocks.

- Be sure to circulate through the room to monitor students as they are working to ensure each group has built the project correctly before moving on to the Play section of the Lab.
- When students have completed building their project, have them name their project *Starter Password* and save it to their device.

4

Offer

Offer positive reinforcement for students who are collaboratively engaging in the process of building the project. Remind students that they can take turns so that all students can have an opportunity to use VEXcode GO.

Teacher Troubleshooting

- If students' Starter Password projects are not displaying the correct colors of red and green flashes, check the parameters in the **Set bumper** and **Repeat** blocks in their projects to be sure they are set correctly.
- If students are struggling to choose a new password in their groups, have them reorder the numbers in the starter password as a jumping off point.

Facilitation Strategies

- To ensure all groups are building the project along with you correctly, circulate through the room and do a quick check of students' project after they add each section.
- **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.](#)
- The Starter Password project can be downloaded to student devices prior to beginning the Lab. View these device specific articles to learn more about opening an existing project in VEXcode GO: [Chrome Browser](#); [iPad](#); [Android](#); [Chromebook](#).
- **In the Starter Password project, the number of flashes of the LED Bumper corresponds to the digit in the password.** For example, if the LED Bumper flashes 4 times, that digit in the password is 4. The colors alternate from red to green to red, and the project pauses between each digit of the password to help show separation between the digits and make it easier to decode.
- Once students have edited their project to show their new passwords, have them name their project as *New Password* 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.](#)
- Complete Play Part 1 as a whole class experience to decode the starter password. This can help you to ensure that students understand the connection between the flashes of the LED Bumper and the numbers in the password.

Part 1 - Step by Step

1

Instruct

Instruct students that they will begin by decoding the starter password on the robot. This will help them learn about how the password is coded on the robot. Tell students that the starter password consists of three numbers. Show students the animation below, and ask them to observe the LED Bumper carefully.

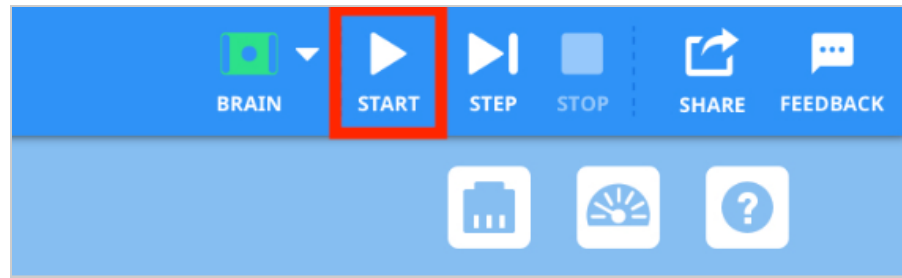
In the animation, the Code Base is sitting in the center of a Tile. The LED Bumper flashes red 8 times, green 3 times, and then red again 5 times.

2

Model

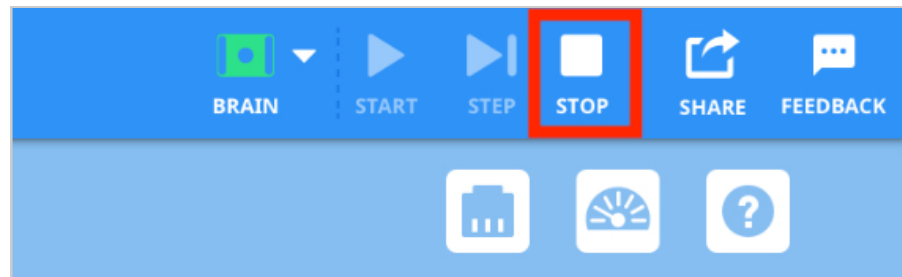
Model how to decode the first number in the password, using the flashes on the LED Bumper.

- Using the animation or one group's setup, have students watch one robot as the project is run. Be sure that all students can see the LED Bumper. Guide students to pay attention to the LED Bumper flash pattern using the questions like:
 - How do you think the LED Bumper can represent a number in the password?
 - What colors did the LED Bumper show in the animation? How do you think the colors align to numbers in the password?
 - The first set of flashes is red, which number in the password do you think that represents? Why?
 - How can we know which numbers are in the password? What can we count?
- Run the project, and call students' attention to counting the first set of red flashes on the LED Bumper.
 - 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.](#)
 - Select 'Start' in VEXcode GO to test the project.



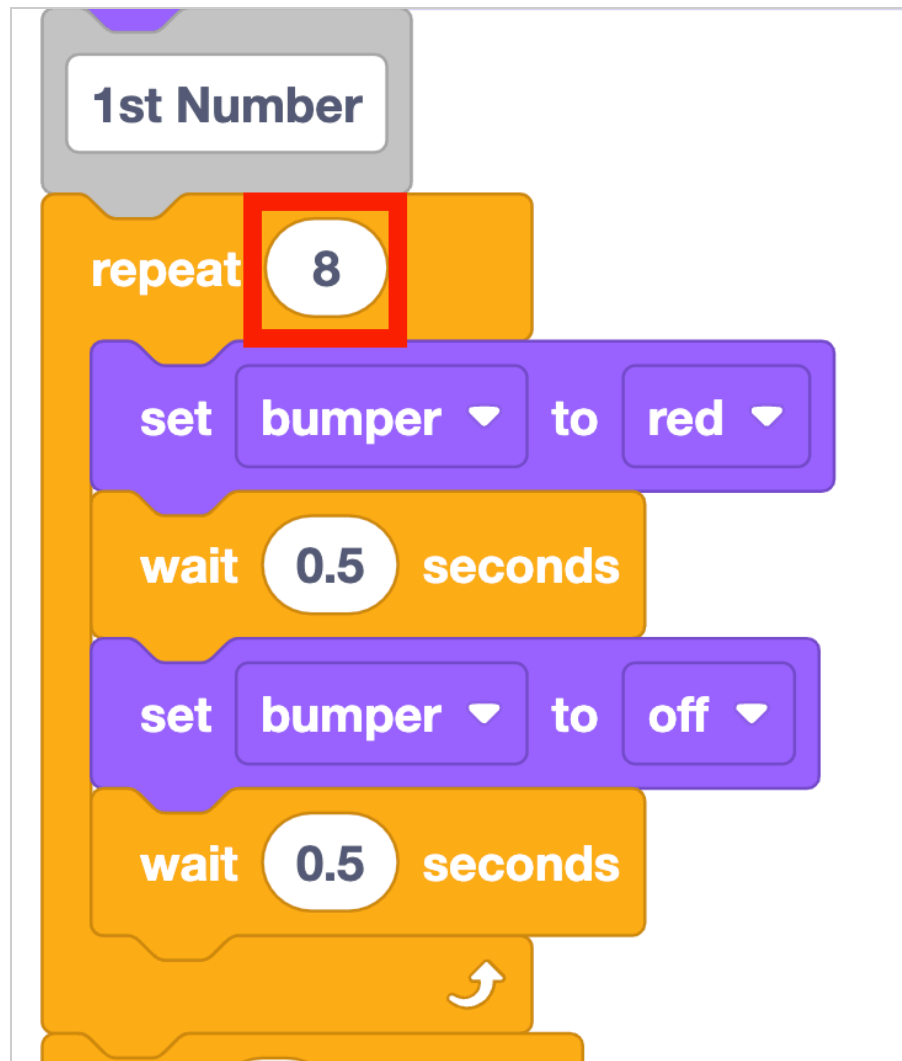
Select 'Start' to run the project

- Select 'Stop' to stop the project after the first **Repeat** block has run and shown the first number in the password.



Select 'Stop'

- Ask students what they think the first number in the password is, and why. Write the number(s) on the board as students share their answers.
- Run the project a second time to check the answer. This time, count the flashes together as a group while the project is running.
 - Stop the project after the first **Repeat** block is run, and the first set of red flashes has concluded.
 - The first number in the password is 8. The number matches the parameter in the first **Repeat** block in the project, as shown here.



First number in the password

- Now that students have decoded the first number in the password, have them find the remaining two numbers in their groups.

3

Facilitate

Facilitate students running the project and determining the starter password in their groups.



- Encourage students to pay attention to just one color of flashes at a time, as they run the project. Remind students to run the project multiple times so they can find the number, then check their answer. Ask questions to guide them through the decoding process:
 - Which color is the second number in the password?
 - How are you determining the number? What are you counting?

- If you and your partner disagree on the number, what will you do to help you determine the password together?
- If students are struggling to keep track of the numbers as the project is running, have them tally the flashes as the project is running to help them determine the password. Each number in the password should correspond to the tally marks, as shown in this example using a Blueprint Worksheet.

Blueprint Worksheet

Blueprint for: Password Protector

Name: _____ Date: _____

Red Flashes		8
Green Flashes		3
Red Flashes		

Example tally of flashes

- If students disagree about the numbers in the password, help them to reach consensus with strategies like:
 - Making a tally of the flashes while the project is run
 - Counting the flashes out loud together
 - Taking turns starting and stopping the project, and counting the flashes (so the attention is focused on one or the other)
 - Only counting one set of flashes at a time.
- **Teacher Tip:** The starter password is 8 - 3 - 5. If students are struggling to decode the correct numbers, check their project to be sure that they have the correct parameters in the **Repeat** blocks. The first **Repeat** block should have a parameter of 8, the second should read 3, and the final should read 5.
- Once students have figured out all three numbers, help them begin to connect their code to the numbers in the password. Ask questions like:

- Do you see the numbers you decoded in the project anywhere?
- What do you think the parameter of the **Repeat** block is doing?
- Why is the **Repeat** block parameter the same as the number in the password? What behaviors does that block control?

4

Remind

Remind students that they can start and stop the project as many times as needed to successfully decode the password in their groups.

5

Ask

Ask students to think about other passwords that they use in their daily lives. What strategies do they use to remember their passwords and keep them safe and secure?

Mid-Play Break & Group Discussion

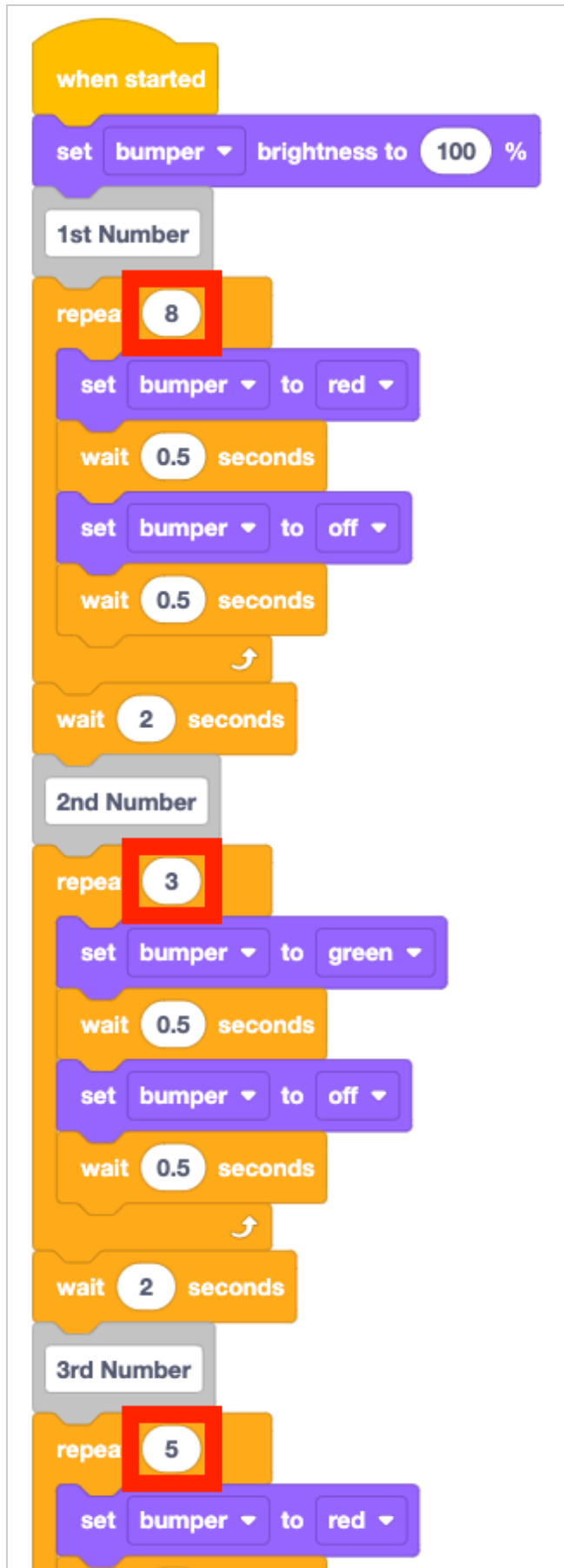
As soon as every group has decoded all three numbers of the starter password, come together for a brief conversation.

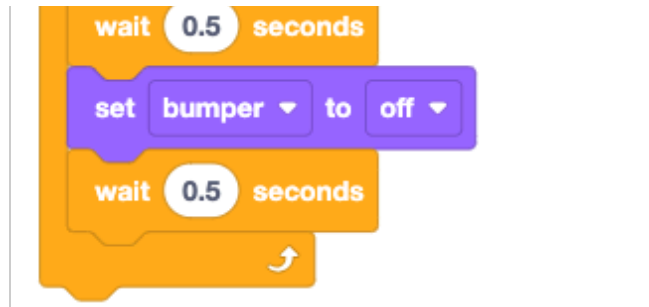
Have groups share the starter password that they decoded.

- You may want to have groups write the password they decoded, and hold them up for everyone to see at the same time, or go around the classroom so each group can share.
- If there are groups with differing passwords, run the project or show the animation again, to count all the flashes together as a class, to 'check' the password together.

Once the class has determined the password to be 8 - 3 - 5, connect the numbers in the starter password to the project.

- Now that we know the numbers in our starter password, let's connect them to our project. Where do you think the numbers 8, 3, and 5 will be? Why?
- Let's look together at the project. Where do you see the numbers in the password?





Password numbers correspond to the Repeat block parameters

- Why does the **Repeat** block parameter cause the LED Bumper to flash 8, 3, or 5 times? What behaviors does the **Repeat** block control?
- When we change our passwords to make them unique, which parameters will we need to change in the project? Why?

Talk about why students are going to change their passwords so they are different from one another.

- Right now, all of the cooling couriers have the same password to the lab. Is that a good idea? Why or why not?
- Why do you think it's important to have unique passwords to keep the cooling cell lab safe and secure?
- What if your password and another group's is similar? Is that ok? Why or why not?

Before we change our passwords in our projects, we need to choose a new password with our partner. Help students think about how to develop a safe, unique password collaboratively by asking questions like:

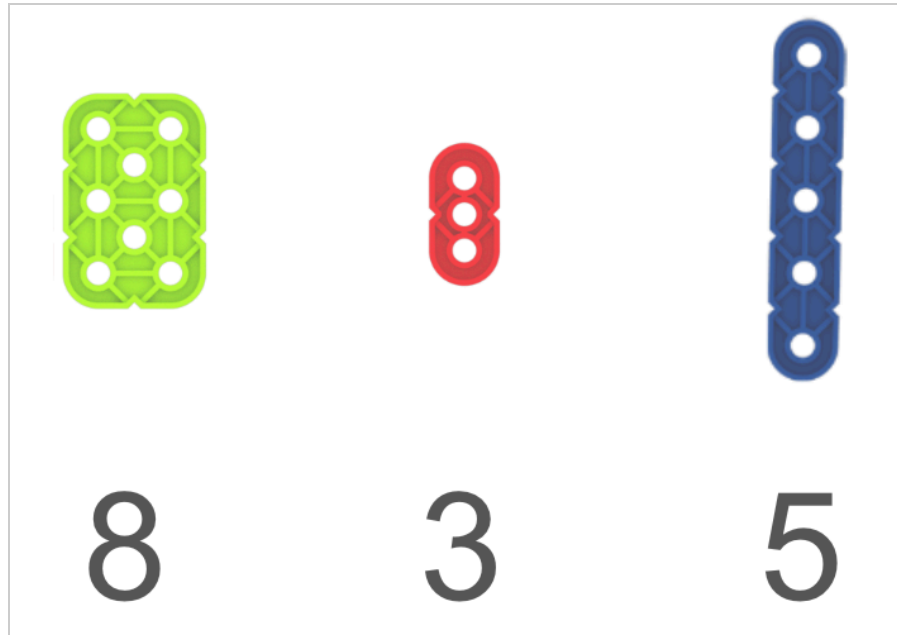
- What are some things we want to think about when choosing a password?
- Should our password be easy for anyone to guess? Why or why not?
- Should our password be easy for us to remember? Why or why not?
- What is a strategy your group can use to help you choose a password together? Why is it important for the group to agree on the password?
- Should you write your password down to help you remember it? Why or why not? What is something else you can do to remember a password and keep it safe?

Part 2 - Step by Step

1

Instruct

Instruct students that they will now code a new password for their robot. They will need to be able to remember the password without writing it down, so they will use their VEX GO Kits to help them do so. They will represent the numbers in the new password they choose using VEX GO pieces. Then they will edit their code to show the new password with the LED Bumper.



Example strategy with VEX GO pieces

2

Model

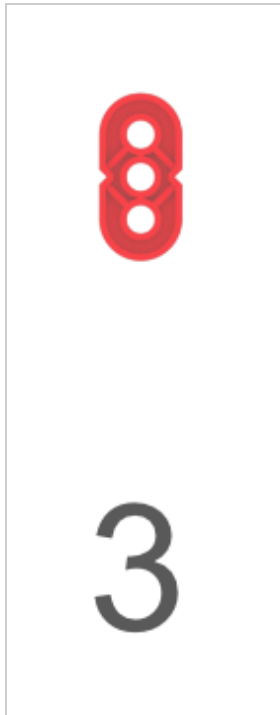
Model for students how to use pieces in the VEX GO Kit to help them remember a password without writing it down. In the example strategy, the password numbers are represented by the number of holes in each of the VEX GO pieces.

- Begin with the starter password, as the example. Show students the images in the Lab 2 Image Slideshow, and ask them why they think each of those pieces corresponds to the number beneath it. Ask questions to guide students to identifying the number of holes on each piece as the strategy, like:
 - This strategy uses the same feature on each of the pieces to represent the numbers in the password. What features do the pieces have in common?
 - Look at the first piece, the Green Large Beam. It corresponds to the number eight in the starter password. Does that piece have eight of something?



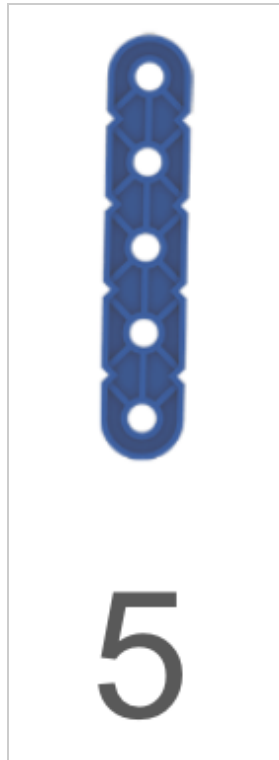
How does this piece represent the number 8?

- Look at the Red Beam, which corresponds to the number three. What does it have three of?



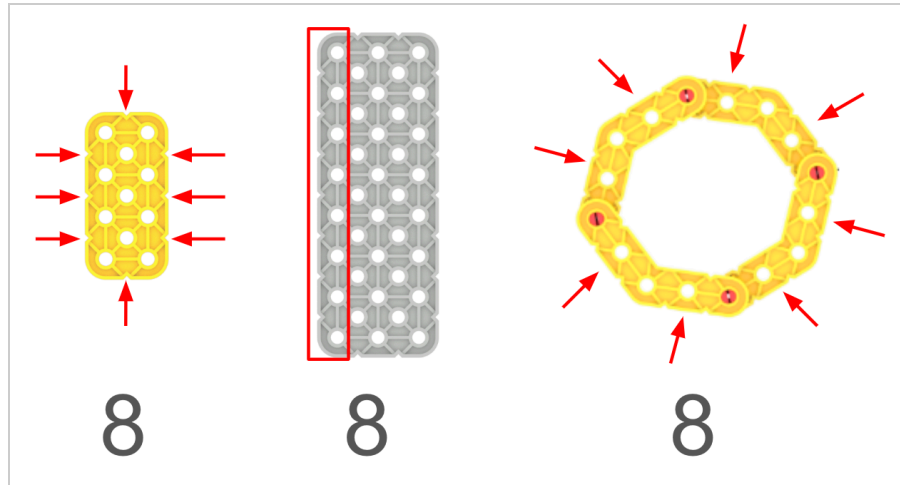
How does this piece represent the number 3?

- Do you notice five of something on the Blue Beam?



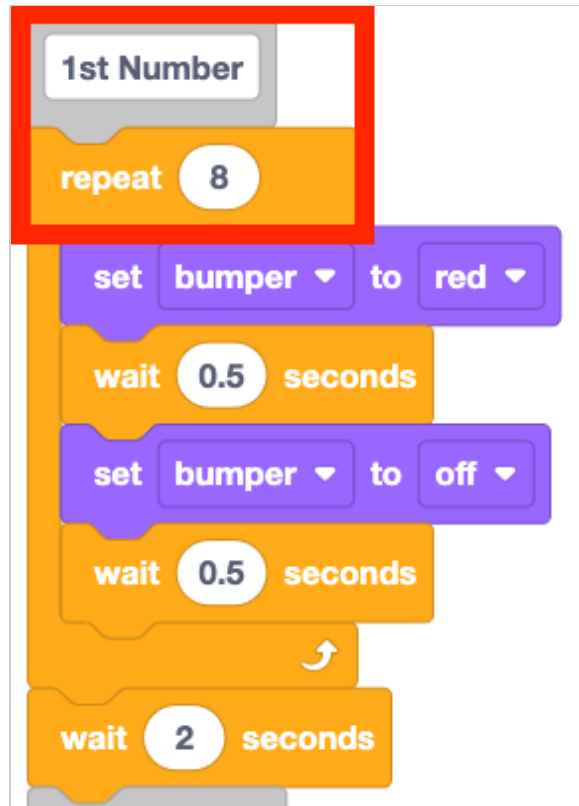
How does this piece represent the number 5?

- There are many strategies that can be used to represent numbers in a password with VEX GO pieces. Students will need to choose a strategy that works for their group. Give students an opportunity to explore this concept by identifying other pieces that could be used to represent the number eight.
 - Have students share their ideas and explain why they represent the number 8 to them.
 - The important thing about the strategies is that they are memorable to the students using them. Just as there were many ways to get the robot to deliver the cooling cells in the previous Lab, there will be many ways to represent a password with the VEX GO Kit.



Examples of representations of the number 8

- Have students work in their groups to choose new numbers for their password. They should then represent those numbers using VEX GO Kit pieces. Once each group has a new password chosen and represented with pieces, they should check in with you to explain their strategy, before editing their project.
- After checking in with you, groups can edit their project to show the new password with the LED Bumper.
 - They should edit the project, then run it to test it. Be sure groups are changing the parameters in each of the **Repeat** blocks to show the numbers in their password in the correct order.
 - Students can use the **Comment** blocks to help them find the associated **Repeat** parameter for each number in the password.



Use the comments to help edit the project

- Students can use the same method for decoding from Play Part 1, to ensure that the LED Bumper is flashing the correct number of times to represent the new password.
- Groups should check in with you to show you their completed password project. Remind students to rename and save their project to store their new password.

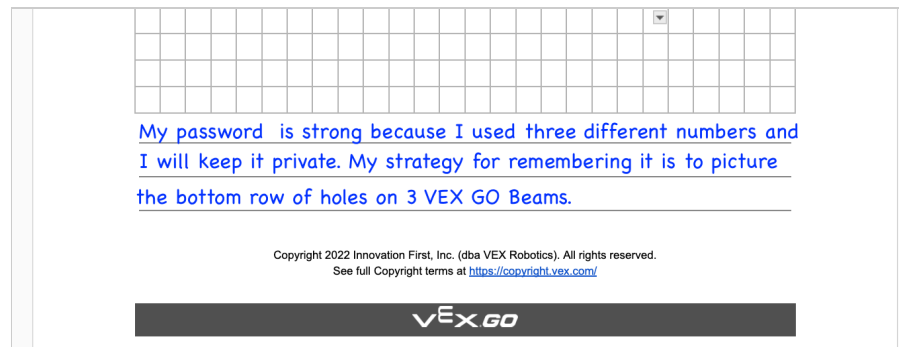
3

Facilitate

Facilitate students working in their groups to develop their new passwords and strategies for remembering them. Once students can effectively explain their strategy and how it connects to the numbers in their new password, then they can edit their projects.

- Facilitate conversations about how students are choosing the numbers in their new password. Remind them that the password should be something that is not easily guessed by others (like a birthdate), but something they can remember. Ask questions like:
 - How did you decide on the numbers in your password?
 - Do you think someone who knows you would be able to guess this password easily? Why or why not?

- Encourage students to be creative in their memory strategies. Remembering passwords is unique to everyone, so the strategy should make sense to the students using it, but does not need to be shared by multiple groups. Help students consider how password management strategies can be different for different people by asking questions like:
 - If you had a different partner, do you think you would use the same pieces to remember your password? Why or why not?
 - What if you needed to help someone who could not see remember the password? What pieces in the VEX GO Kit would you use to represent the password?
 - If you had another student join your group how would you explain your strategy? What would you do if they needed to have a different representation in order to remember the password? How could you learn about what their needs were to make a strategy that works for everyone?
- Have students check in with you again once they have coded their password. Be sure that the parameters of the **Repeat** block correspond to the numbers in their new password.
- Once students have finished coding their password, they should record the answers to the following questions on a Blueprint Worksheet. (Students can share their answers as part of the discussion in the Share section of the Lab.)
 - How do you know your password is secure?
 - What strategy did you use for remembering your password without writing it down?



Example of answers to password safety questions

- If students finish quickly and need an additional challenge, ask them to create a different password representation using the pieces in their Kit.
 - You could challenge them to think about people with diverse needs and abilities, and adapt their strategy to meet the needs of someone who:
 - has visual impairment

- has fine motor challenges and cannot build with VEX GO pieces themselves
- has auditory difficulties, and can't hear well

4

Remind

Remind students that remembering passwords without writing them down is important for keeping passwords safe and secure. This is a great opportunity to talk about sharing passwords as well. Ask questions like:

- As a cooling courier, what if someone asked you to share your password to the lab? Should you share it with them? Why or why not?
- What would you do if a grown up that you didn't know asked you for your password to a website you use at home? Should you share it with them? Why or why not?
- What should you do if a parent or teacher asks for a password to help you with a school assignment? Should you share it with them? Why or why not?

5

Ask

Ask students what other things they do to help manage their passwords and devices and keep them secure. You can talk about how strategies like logging out/off of a device when you finished with it, or using different passwords for different devices or logins is important.

Share

Show Your Learning

Discussion Prompts

Observing

- Describe how you know your password is secure. How do other groups answer that question? Are their answers similar or different to yours?
- Were the strategies to remember passwords all the same? Why or why not?
- Why is it important to have unique passwords to get into the lab as a cooling courier? Why isn't it a good idea for all of the cooling carriers to share a password?

Predicting

- What if you changed your password – would you change your strategy to remember it? Why or why not?

- How does your memory strategy help you to remember your password, but keep it secure so others don't know what it is?
- What if you were to use VEX GO pieces to help you remember a different password – what would you do?

Collaborating

- What did you and your partner do to create a password and strategy that made sense to both of you?
- What if you needed to train a new cooling courier – how would you explain the importance of remembering the lab password to them?
- We know that working with others honestly and kindly is important. How can we do that while still managing things like password safety? Should you share passwords within a group of friends or students? Why or why not?

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