Basic "Learn to Program" Workshop
Takes approximately 1 hour with pre-built robots

This workshop is used for teaching some basic sensor use (colour, touch, and ultrasonic) and loops to beginners. Generally, Acadia Robotics runs this workshop in hour long sessions using pre-built robots. The workshop begins with an explanation on how to start a new project using the EV3 Classroom software. Once that is complete, we ask the teams to follow the four mini lessons until they can get them to work. Groups are then given time to explore the programming software to make the robots do a variety of things. This is done in a free play environment. A "show and tell" is done during the last 10 minutes of the workshop where participants show off what they programmed the robot to do.

In a team or class setting, this workshop can be modified into a two-day meeting. On day one, the group can build the robot using the EV3 Core Set. Day two would be the programming day. Depending on how long of a meeting time is available, the group may need to finish up building the robot on day two.

You can find the EV3 Classroom software here: https://education.lego.com/en-us/downloads/mindstorms-ev3/software

Building instructions for the "body" of the robot can be found here: https://le-www-live-s.legocdn.com/sc/media/lessons/mindstorms-ev3/building-instructions/ev3-rem-driving-base-79bebfc16bd491186ea9c9069842155e.pdf

Building instructions for the ultrasonic sensor attachment: https://le-www-live-s.legocdn.com/sc/media/lessons/mindstorms-ev3/building-instructions/ev3-ultrasonic-sensor-driving-base-61ffdfa461aee2470b8ddbeab16e2070.pdf

Building instructions for the colour sensor attachment: https://le-www-live-s.legocdn.com/sc/media/lessons/mindstorms-ev3/building-instructions/ev3-rem-color-sensor-down-driving-base-d30ed30610c3d6647d56e17bc64cf6e2.pdf

Building instructions for the touch sensor attachment: https://le-www-live-s.legocdn.com/sc/media/lessons/mindstorms-ev3/building-instructions/ev3-rem-color-sensor-down-driving-base-d30ed30610c3d6647d56e17bc64cf6e2.pdf

***Note where you plug in the connector cords on the brick. This may differ from what is shown in the mini lesson examples and will need to be adjusted when programming.**

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Learn to Program Workshop

This script assumes you are starting with a fully built and charged robot. This may be done with one robot in a team setting or with multiple robots in a classroom setting. If using this workshop in a classroom setting, try to keep groups of 2-4 students per robot. In both settings, encourage the participants to share programming so that everyone gets a turn. Give EV3 Classroom download link in advance of the workshop if participants are using their personal computers.

The script is also written to have the teacher/coach show the group what to do with a projector displaying his/her computer screen. This can be done without a projector in a smaller group.

Introduction: Today we are going to learn how to program EV3 Mindstorms robots using the EV3 Classroom software. Everyone, please open EV3 Classroom on your computers. To start a new project, you can click "New Project" on the Home window. This will start a fresh project tab at the top of your screen.

You can rename the project tab. It is strongly recommended you do this. It will make it much easier to test your programs on the robot later. Click the three dots beside the words "Project 1" and select "Rename". EV3 Classroom automatically saves your work when you close the tab or the application.
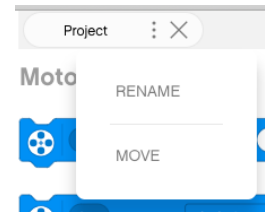
Your program will usually start with the light orange block that has a "play" sign on it. This is the start block. Do not worry if you delete this block by mistake. You can get another one in the light orange tab labeled Events on the left-hand side of your screen. Each of these tabs contains the blocks you will use to program. They are:

Blue-Motors (contains single motor actions)
Pink-Movement (contains blocks using two motors at a time)
Dark Purple-Display (contains display blocks for your robot screen)
Light Purple-Sound
Light Orange-Events (starting blocks)
Orange-Control (contains loops, wait, and switches)
Light Blue-Sensors
Green-Operators
Dark Orange and Red are for if you wish to create a block or variable

Today we will be mostly using blocks in the pink, orange, and light blue tabs. However, you are welcome to explore the other tabs after the first part of this workshop is complete.

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To add a block to your program, you simply click and drag it to where you want to attach it. **Select first block in the 'stop after touch' example** This is one controls both of your robot's motors at the same time. You can change the direction by adjusting the arrow when you click on the button labeled "straight: 0" and speed can be adjusted by clicking on the "50" beside it. Fifty is really fast for the robots to move. I usually start by setting my robots to 25% of their speed. **Click these areas to show menu and how to change**
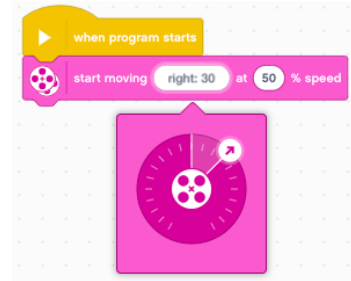
Add next block in example This is a wait block. It will tell your robot to wait for something to happen. In this case, the robot will move until "something" happens. You can set the "something" by adding a sensor block in the hexagon. **Drag hexagon shaped block into the hexagon on the wait block** Notice how the shapes of the blocks we are adding fit each other like a puzzle. This will help you choose the right blocks as you program.
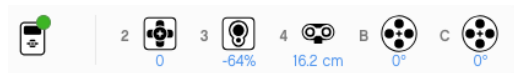
To remove a block, you click it and press delete on your keyboard. **Show to the group**

You will need to add a stop block from the Control tab if you want your robot to stop running the program when it is done. This is used in your first example. You do not need a stop block if you are using a forever loop. The forever loop will continue until you press the stop button on the robot's brick. This is the rectangle shaped button under the robots screen.

Now I know you are very excited to get started. We just have a few more things to go over before you start programming.

Plug your robot into the computer with the download cord and turn it on. All of the sensors and motors on the robot are displayed at the top of your screen. There is a letter or number beside each part. This is associated with the ports on the robot's brick. When programming, make sure to note what motor or sensor is attached where. This can be adjusted on the programming blocks by clicking the letters/numbers on each block.

Back to the motors/sensors. Look under each sensor. Under the ultrasonic sensor, you will see a number. That is the distance in centimeters between an object and the sensor. You can try with your hand. **Pause a minute to let them try** Does anyone know what echolocation is? **Give description of echolocation if they do not know** The ultrasonic sensor works the same

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way. It sends out a signal that we cannot hear. The signal bounces off of objects and back to the sensor. The robot then turns this into the distance reading you see on the screen.

The light sensor is giving you a reflected light value. This will change depending on the colour it is over. The lighter the colour, the higher the number. Darker colours have lower number values. This allows you to program the robot to find colours two ways. You can select colours from the preset list (red, blue, etc.) in some light sensor blocks. Or you can select a reflected value for the robot to look for in other blocks.

We have gone over the basics on how to pull up blocks, adjust settings, and find readings with the sensors. Once you have created a program, you then need to download it to the robot and test it. In the bottom right-hand corner, there is a circle with an arrow pointed down. This is the download button. When you click the button, it will make noise showing that the program has downloaded. You can unplug the download cable when the noise stops.

Moving to the robot's screen. Press the button on the right to move over to the next screen. You can then move down the list to select the program you want to run with the up and down buttons. Press the button in the middle to run the program or start the robot. The rectangle button below the screen will stop the program before it reaches the end or if you are running a forever loop. This same button can be used to turn the robot off.

Now it is time for you to get programming. Try to recreate the example programs you have been given. Keep an eye on what ports the sensors and motors are actually plugged into. They may differ from the example. Once you can do all four examples successfully, explore programming and see what else you can do on your own. At the end we will show each other what you have programmed the robot to do. Remember, test the robots on the floor! You do not want them to fall off of a table.

Things that might affect how the robots perform:
Floor/table colour- Dark tables and floors can read as black sometimes
Lighting in a room- Lighting can affect how the colour sensor reads colours

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