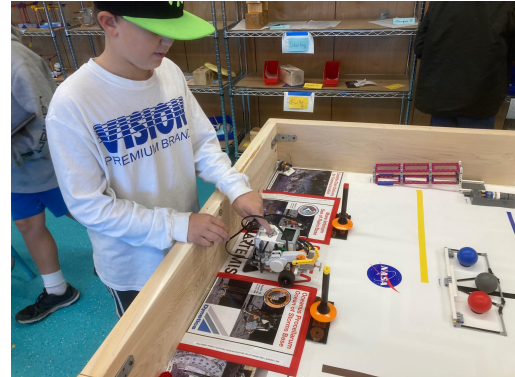


Lego EV3 and Makecode Engineering and Maze Challenge V1 - Artemis Moon Base

Grade level(s) I use with: this is the next step in robotics and coding for 7th / 8th graders after they have been successful with Edison robots in 5th / 6th



Lesson Overview: - the challenges on this table are some of my favorites from the 2003/4 Lego First Mission to Mars season as well as the 2018/19 Into Orbit challenge. I've modified the table so that the EV3 robots can start from any of two starting positions on either end and the board



itself is a mirror image set of challenges so that I can keep 16 students, each running an individual robot engaged on the board. I love the EV3 as a next step after Edison since it opens up the possibilities of using basic sensors as well as adding / coding an extra motor for a robotic arm. This moves the work to involve both coding to get the robot to move around the board as well as some engineering to create attachments to accomplish the various tasks.

I try to create a nice mix of simple projects that can be done with dead reckoning, as well as a few that will really benefit from color sensors and robotic arms.

We are fortunate to have collected a set of 20 EV3's

(mostly purchased on Ebay for about \$50 each) so that this can be a 1:1 coding activity. We use the Makecode.org EV3 Scratch platform since allows them to be coded using Chromebooks - the process can be a little clunky at times since it involves downloading the code first to the chromebook and then over to the EV3 which shows up as a USB external drive but students quickly figure it out. It does require that your EV3's all be updated to firmware version 1.10 - and this does require a PC or Mac computer to run the original Mindstorms Education Version software to run the firmware update. There is no way to delete the uploaded code files from Makecode so at the end of each cycle with kids I reset the firmware to clean them off.



have all the bots set up as the same configuration as well - this allows students to use different bots each day. My favorite is the Discovery bot from this site: <https://ev3lessons.com/en/RobotDesigns.html> since it is pretty robust and has simple attachments to add multiple sensors. Having identical robots also allows me to give them code for the basic moves of driving straight for 5 inches (tank motors for 3 rotations) as well as a 90

degree turn (steer motors with a turn ratio of 100 for 1.4 rotations). Since I try to limit this work to a 5 day week I find that avoiding having them change the tires or basic robot construction keeps things moving and there is still plenty of engineering possibilities by adding robotic arms and attachments.

For assessment I ask each student to make a flipgrid anytime they successfully complete a challenge and explain both their strategy and how they coded it.

Related links:

Download for Lego Mindstorms software necessary to configure the firmware on EV3's (also can use for coding if you have sets of laptops):

<https://education.lego.com/en-us/downloads/retiredproducts/mindstorms-ev3-lab/software/>

The Version 1.10E firmware that you need to run Makecode.org EV3 Scratch can be downloaded at the bottom of this page:

<https://education.lego.com/en-gb/product-resources/mindstorms-ev3/downloads/firmware-update/>

I do find that there is a glitch in the upload process that requires to hard reset each EV3 one time after doing a firmware upload / update in order to get the chromebooks to register the EV3 as an external drive. You do this by holding down the center - left and back keys simultaneously (about 3 seconds) until the bot force restarts.

I also occasionally have EV3's that stop registering with the chromebooks. Usually this just means that the student chromebooks are overwhelmed and need to be restarted, but occasionally it won't even connect with my PC. The solution to this is a forced firmware update - hook up to your pc and open the Firmware Update menu, then with the EV3 hooked up by USB hold down center - right and back buttons, once it reboots release the back button first and it will go right into the firmware update mode.

Ongoing questions: I do find using a classroom set of EV3's to be a lot more effort than using the Edisons which are basically bullet proof - but the feedback from students has been that they really enjoy the additional challenges and they definitely learn a lot more about coding than I think I could teach with the simpler Edison. Not sure how much longer the Makecode.org site will be supported - that's probably my biggest concern going forward as eventually, since Lego has moved on to the SpikePrime platform this set will become obsolete like my old collection of NXT's or even older RCX's.