To: Bits and Bots Curriculum Designers
From: Kevin Luo
Date: 18-4-2016
RE: Curriculum Feedback

Hey guys, here's my collated feedback on the lessons, I've made a few notes for each lesson and put some general notes at the end. Now that we've had experience teaching the material, I want to advocate for some fairly dramatic changes. From what I can tell, we would do better with a complete redesign using experience from this season as a guide.

Lesson 1-2 Introduction to movement and programming:

There are a few basic concepts we neglected to mention. They're pretty intuitive for the most part, but some kids missed them:
- the robot needs to be plugged in to be programmed
- which buttons in EV3 program the robot: notably, the play button runs the program but does not save it to the robot
- how to run a program when the robot is disconnected, how projects are organized on the robot

We should introduce some problem solving skills too: making and observing changes to the robot. A few groups got concepts fairly quickly, but we responded by rushing the other groups.

Lesson 3 - working with the proximity sensor:

This is waaaay too hard, especially without pictures, the smartest groups got the right behavior, but only with a lot of help from the volunteers:
- the proximity sensor is definitely something we want to introduce way later: the interface is difficult and what it does is non intuitive
- when we do, it might be a fun cross disciplinary talk about how it functions physically.
- The loop is a fairly complex control statement to introduce early. I think we'll have more luck doing waits and switches before loops

Lesson 4 - dumptruck:

This one didn't work too well because we forgot to bring the lego tires. Some problems were still evident:
- This lesson needs to be a lot more physical, as the kids weren't very engaged, I'm thinking we can make it into a game of some sort
- this is a good opportunity to teach basic debugging: getting the claw stuck trying to close on an object is a good opportunity to teach them about the control flow in EV3
- getting the robot to drive in a square is difficult and not interesting

Lesson 5 - maze:

- This lesson went well, though the kids were familiar enough with movement to progress through it fairly quickly. I'd recommend doing something like this earlier.

Lesson 6 & 7 - Drawing Patterns:

- This lesson also went well. This kids got a good understanding of loops

- A demo is especially important for this one, the kids were inspired by each other's work
- The more advanced groups complained that 7 was too similar to 6, and I agree. We could introduce variables, and consequently wires in 7.

Dr. Freeman's Advice:
I dug up some of the notes I took during my meeting with Dr. Freeman last semester, here's a few I think are particularly important to consider after a semester of the program:
- The demonstration is crucial, there should be one or more every lesson
- For some more complex concepts, like control statements and beyond, it might be better to give the kids some working code with a known function, and to let them tinker with it, rather than requiring them to write it themselves
    - *It would be especially intuitive if this could be the same as the demo*
- It's very likely that individual groups will progress at very different rates: ideally groups will be independent, and not rush or slow down each other
    - *If independent lessons aren't possible, I'm thinking this can be solved with more volunteers.*
- The ideal team size is 2-3, more than 5 causes some to be left out
    - *We're approaching this limit, and with better advertising next year, I think we can expect as many kids, if not more.*
- Finally, apparently, we may be expecting too much of the kids with our current plan, we should stay flexible and accommodate their abilities. They'll get discouraged if we set goals for them that they are unable to attain.

Miscellaneous notes:
- We're not getting much from having lesson plans on github, it would be more practical to have them on github and more effective to have them on an outward facing website.
    - we need separate documents for the kids and the volunteers, to highlight some sticking points on the curriculum
- challenges that are too difficult, especially in engaging ways, tend to make the kids lose interest fairly quickly
    - Driving around in a square is difficult and unrewarding
- We really need to test the challenges, ideally on volunteers
    - this is really important: it's hard to gauge the difficulty without actually doing them
    - eg. getting the robot to turn exactly a right angle for drawing a rectangle

I'm also working on a lit review of current robotics curricula online
Here's the best of what I've found: I'm thinking we could use these as a basis for rewriting the curriculum, and in a few cases, as a template for how we want to present the research portion of the work to the public.
http://www.legoengineering.com
http://education.rec.ri.cmu.edu
http://ev3lessons.com
http://stemrobotics.cs.pdx.edu