Unit 3: BRIGHTNESS, IF, and WHILE | **Skill Builder 3: BRIGHTNESS and COLOR**

In this lesson, we'll make use of the BRIGHTNESS value to control the COLOR LED.

Objectives:

- Read the light sensor and control either the COLOR LED brightness or the sound coming out of the speaker
- Use conversion formulas to change from BRIGHTNESS values to COLOR values

We will build a product that reacts to the brightness in the room. The brighter the room lighting, the brighter the COLOR LED. The tricky part here is *converting* the BRIGHTNESS value into an appropriate COLOR value.

BRIGHTNESS **B** *ranges* from *0 to 100.*

COLOR **C** (all three channels) can vary from 0 to 255.

How do we convert from B to C?

Teacher Tip: Answer: 2.55*B → C will work, but, in general this type of conversion is a great application of the slope of a line between (0,0) and (100,255).

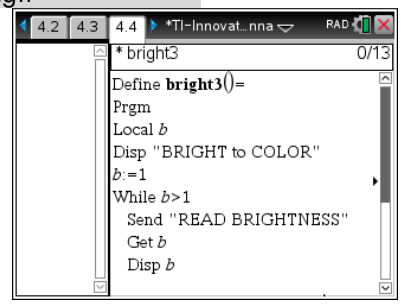
(255-0) / (100-0)→M: M*B→C.

If we deal with sound then the points could be (0,100) and (55,880) (a reasonable range of audio frequencies). But if we want to deal only with 'musical notes', then (15,75) represents roughly the 'middle' 60 keys on a piano. We then use this converted value in 2^(C/12) to get the right note.

There's a LOT of mathematics going on here, and that's the beauty of coding!!

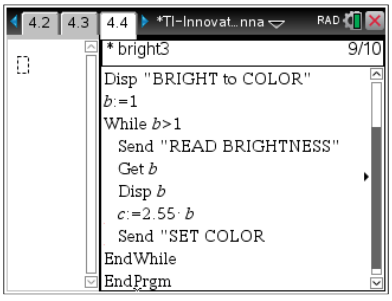
Setting up the Program:

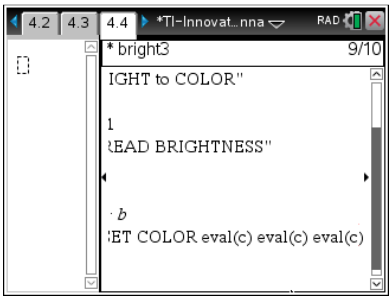
1. Start a new program, and name it BRIGHT3.
2. Add a **Disp**, a double set of quotation marks, and the text BRIGHT to COLOR.
3. Set the variable **b** as shown.
4. Add a **While…EndWhile** loop to read the brightness using **Send "READ BRIGHTNESS"** and get the brightness variable with **Get b**.



We will leave the converting part for last.

5. Use the variable ***c*** to represent a COLOR value that we'll send to *all three channels* of the COLOR LED. The conversion factor is 2.55. That is, **c:=2.55*b**.
6. Check this formula with the two pairs of values given. When b=0, then c=2.55*0=0; and when b=100, then c=2.55*100=255.
7. Add a **Send "SET COLOR** statement before the **End** of the loop. This statement will control the brightness of the color LED.





8. Finally, complete the SET COLOR command by using **eval(C)** three times (once for each of the three color channels).
   - When all three channels have the same value then the color of the LED is white, and the brightness of the LED changes depending on that value.
9. Connect the TI-Innovator Hub, and run the program.
10. Change the brightness by pointing the light sensor at different things. Watch the intensity of the COLOR LED on the Hub.

You might want to add some **Disp** statements to your program to see the values of **b** and **c**.

Teacher Tip: When the COLOR LED goes off, it comes on as a green light indicating a 'ready' state.

But wait! The effect is wrong! The darker the room lighting, the brighter the LED should be! How can you reverse the effect?

Another Challenge: How about changing the program so that different brightness values produce different colors?

Teacher Tip: Use **c:=2.55*(100-b)** to reverse the effect.