

Activity 3 - Lesson Plan

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An additional resource: www.jodyculkin.com/wp-content/uploads/2014/03/arduino-comic-2014.pdf

Learning Outcomes

Students will,

1. Wire a breadboard RGB LED circuit to an [Arduino UNO](#) microcontroller board
2. Program the Arduino to make each colour turn on in sequence

This activity should take 1 hour to complete. It assumes free access to a black-and-white printer, a classroom with a whiteboard, blackboard, or chart-paper, and computers capable of connecting to the Arduino with a USB cable and running two programs¹. Both programs can be run in a web browser, or downloaded for offline use. At least one computer per three students is recommended.

Materials and Cost Per Student

Item	Qty.	Cost per Student ²	Expendable ³	Supplier
LED RGB Common Cathode	1	0.04	y	Aliexpress
Resistors 220 ohm, 1/4 watt	3	0.02	y	Aliexpress
Jumper cables MM 10cm	4	0.08	y	Aliexpress
Breadboard 400 point	1	1.49	n	Aliexpress
Arduino UNO with cable	1	6.62	n	Aliexpress
Total Cost per Student		\$8.25 CAD		

Lesson

Before class: install necessary software¹ on the computers and confirm that the Arduino UNO is recognized by the computer when plugged in. Assemble the RGB LED light circuits shown on the student handout, leaving them disconnected from the Arduino.

1. Review the LED light circuit
2. Review digital output pins on the Arduino UNO and how they relate to the rock-slide analogy of electricity
3. Review programming concepts (sequential execution, loops, functions), the two blocks (functions) used in Activity 2, and the blinking program
4. Introduce the RGB LED (sketch circuit diagram from student handout) and connect to the digital outputs of the Arduino
5. Relate the three positive pins of the RGB LED to the blinking program from step 3; the goal is to make a program that changes colour of the LED from red, to green, to blue
6. Students form groups and connect the RGB LED breadboard circuit to the Arduino
7. Check the students' connections
8. Students use [BlocklyDuino](#) to make a program that changes colour of the LED from red, to green, to blue
9. For students who get the light blinking, present them with an [exploration challenge](#).

Review

In the last activity, we were introduced to the Arduino UNO microcontroller board

- The Arduino is a small computer that we can program
- It has digital output pins that we can set to be either ON (5V) or OFF (GND)
- Our programs (instructions for the Arduino) run from top to bottom, and loop back to the top to run continuously
- We used BlocklyDuino to write a program that makes an LED blink
- The digitalWrite block sets the value of a digital output pin

- The delay block makes the Arduino program stop for a certain number of milliseconds

Today we're going to use the Arduino to light up a special three-coloured LED. We're going to program the Arduino to control each of the colours separately.

RGB LEDs

An RGB LED contains three LEDs in one package, one red, one green, and one blue (draw circuit diagram and pinout from student handout). The LEDs inside the part share the (-) pin. However, we can control each LED individually using separate (+) pins. For example, we could use a button and resistor in front of each pin to control them. But what if we want to have each light turn on for one second, one after the other, without needing to press the buttons? We can do this using three digital output pins from the Arduino, one to control each colour. Today, you're going to write a program to switch the LED colour from red, to green, to blue.

Challenge and Explore

Evaluate the students' understanding of the learning objectives by asking them to try the following:

- If the light turns off between colours, can you make the colour change without any off-time in between?
 - Skill: controlling multiple digital IO pins
- Can you change the time that each light is on for?
 - Skill: understand function inputs
- Can you change the order of the light sequence to blue, green, then red?
 - Skill: RGB LED circuit wiring and corresponding representation of pins in the program
 - Skill: control multiple digital IO pins
- Can you make the LED alternate between purple, orange/yellow, white?
 - Skill: control multiple digital IO pins
 - Skill: understand the RGB LED circuit and use it to mix colours (RB, RG, RGB)
- Can you change the brightness of the colours? (introduce analogWrite() function)
 - Skill: analog output from "digital" pins with a tilde (~) in front of the pin number, to prime the students for discussing analog, digital, and PWM.

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1. [Arduino IDE](#) and [BlocklyDuino](#), or a similar visual programming tool for the Arduino. ↩
 2. Currency is CAD, 2017-06-10. Assuming one set of parts per student. ↩
 3. Likely to be broken or lost during the activity. ↩