

COURSE: Middle School

UNIT: Electronics/Coding

EXERCISE: Switch Programming Challenges

TIME FRAME: 2-3 Hours



PREPARATION: *Summary of “to do’s” that the teacher should understand and prepare before bringing this lesson to the classroom.*

Information:

Before starting this exercise, students should have an understanding of material covered in:

- ✓ Videos and Presentations in Content Knowledge section

Teachers will need to ensure that the proper supplies are available for students to build their solutions.

Materials:

- See supply list in the Electronics/Coding unit on the Stem site



SAFETY: *Summary of safety strategies in the lesson.*

Shock: Students will be working with electricity. Extra care should be observed when working with electricity.

S1

DESIRED RESULTS:

ESTABLISHED GOALS:

Problem Solving Techniques and Applications Standards:

Teachers should use the STEM Academy Standards Correlation System available in the STEM Connections area of a unit to extract specific standards and insert these standards here.

TRANSFER:

Students will be able to independently use their learning to...

- Become familiar with the Arduino board and associated components to learn the basics of computer science in order to use the tools to solve more complex problems.

MEANING:

UNDERSTANDINGS

Students will understand that...

- Microcontrollers are used for many different purposes
- Designs can incorporate microcontrollers to assist in solving problems

ESSENTIAL QUESTIONS

Students will keep considering...

- What other types of circuits and microcontrollers exist;
- What other characteristics a microcontroller should have

ACQUISITION OF KNOWLEDGE AND SKILL:

Students will know...

- Demonstrate how to turn a single LED on or off using an I/O port and button switch using hardware and coding software

Students will be skilled at...

- Proper handling and assembling of electrical components
- Proper programming of microcontrollers



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S2 EVIDENCE:

EVALUATIVE CRITERIA:

- Circuit constructed correctly
- Program uploaded correctly
- Program executed

ASSESSMENT EVIDENCE:

Performance Task(s):

Students will be assigned a series of experiments to complete in order to demonstrate their learning.

These exercises are:

1. Program an LED to light up when two switches are pressed at the same time, and NOT when one or the other is pressed.
2. Program a LED to light up when one switch OR the other is pressed but NOT both.
3. Program ONE LED to do the following: If one switch is pressed, blink the LED at 2 second intervals, If the other switch is pressed, blink the LED at 1 second intervals, If both switches are pressed the LED should blink at .25 second intervals. If neither switch is pressed, the LED should stay on.
4. Part 1: Arrange 5 LEDs in a row on your breadboard. When a switch is pressed the LEDS light from left to right. (Think traffic sign in the blink assignments) They should light at .5 second intervals. When the switch is NOT pressed, the LEDS light from right to left, also at .5 second intervals. Part 2: Add a second switch. This switch is Turbo mode. When this switch is pressed the lights move at .1 second intervals instead of .5 second intervals. The lights should still move in the same direction as Step 1.

Other Evidence:

- Activities
- Online Quiz

S3 LEARNING PLAN: *Summary of Key Learning Events and Instruction*

Outline:

1. Set Introduction
Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. Teachers and students use it to build low-cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments.
2. Activities
Program an LED to light up when two switches are pressed at the same time, and NOT when one or the other is pressed.
Program a LED to light up when one switch OR the other is pressed but NOT both.
Program ONE LED to do the following: If one switch is pressed, blink the LED at 2 second intervals, If the other switch is pressed, blink the LED at 1 second intervals, if both switches are pressed the LED should blink at .25 second intervals. If neither switch is pressed, the LED should stay on.

Part 1: Arrange 5 LEDs in a row on your breadboard. When a switch is pressed the LEDS light from left to right. (Think traffic sign in the blink assignments) They should light at .5 second intervals. When the switch is NOT pressed, the LEDS light from right to left, also at .5 second intervals.

Part 2: Add a second switch. This switch is Turbo mode. When this switch is pressed the lights move at .1 second intervals instead of .5 second intervals. The lights should still move in the same direction as Step 1.
3. Student Questions
Make yourself available for any questions any of your students may have.
4. Quiz
At the conclusion of the activity have your students complete the corresponding online quiz

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Progress Monitoring:

- The instructor will need to monitor the classroom, checking student's work and ensuring students are on task and following directions.
- Ensure students store their projects at the end of class and leave all materials in the room.
- At the end of the activity, post student projects in the room and provide appropriate feedback.



DIFFERENTIATION: *Summary of Key Differentiation Techniques*

Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom, therefore use the information below and experts in the area needed to design your plan for differentiation.

The ASCD Study Guide for Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe

Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe
ISBN-13: 978-1416602842
ISBN-10: 1416602844

Differentiating Reading Instruction
by Laura Robb.
ISBN13: 9780545022989

A Teacher's Guide to Differentiating Instruction
The Center for Comprehensive School Reform and Improvement



CAREER CONNECTIONS: *Summary of Career Opportunities Associated with this Lesson*

Good sources for career connections:

Occupational Outlook Handbook
<http://www.bls.gov/ooh>

The National Career Clusters® Framework
<http://www.careertech.org/career-clusters>



KEYWORDS: *Please Insert Keywords from this Lesson with their Definitions*

Digital Pins: How the pins work and what it means for them to be configured as inputs or outputs.

Analog Input Pins: Details about the analog-to-digital conversion and other uses of the pins.

PWM: How the analogWrite() function simulates an analog output using pulse-width modulation.

Memory: The various types of memory available on the Arduino board.

Use resources like dictionary.com to find definitions to your keywords