



<BUILD. LEARN. TEACH. INSPIRE>

CODING THROUGH ROBOTICS

The Robot Creations Series

Projects For Young Inventors

Revision 1.00

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- 1.00: First revision

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Coding Through Robotics

COURSE OVERVIEW

Course Description

This curriculum is aimed at students in grades 3-5 with no prior knowledge of robotics content. This course is intended for 12 sessions. The goal is to create a game on the computer using mBlock which is based on Scratch. The computer game will use external robotics parts (i.e. light an LED or spin a motor).

Prerequisites

There are no prerequisites for this course.

Background

This curriculum was designed with grade levels with 3rd through 5th graders in mind. This course will teach students programming concepts using block based programming but it will also teach students about robotics linking the program to external robotics parts.

Topics Covered

Programming with mBlocks, conditional statements, logic, circuits, LED, servo motor, designing a computer game, coordinates.

Key Vocabulary: mBlocks, block-based programming, X-Y coordinates, degrees in a circle, external robotics parts, robotics, circuits, LED, servo motor, wires, computer game design.

Life Skills: patience, focus, logic, troubleshooting, listening to instructions, fine motor skills, think out of the box.

Full Course Materials List

Below is a list of all materials required for this course along with sources to purchase and estimated costs per student: (Materials listed are to build one robot.)

Item	Qty	Notes	How To Purchase
Barnabas Robotics journal	1	Notes and drawings	
Servo Motor	1		
AA battery	5		
coupling	1		
Battery holder for 5 batteries	1		
Cardboard (8inx8in)	1	For the base.	
Cardboard (small, 2inx2in approximately)	8	4 pieces needed for motor platform; 4 pieces needed for SSM platform (see pictures below in curriculum)	
Cardboard (3inx3in)	1	Back for drawing of hand/face/flag etc	
Sound Sensor Module	1		
Chop stick	1	To hold drawing of hand	
Construction Paper (different colors))	1	To draw a hand (face, flag, etc.) on. Please include different colors.	
LED w 470 ohm resistor	1		
Wires (male/female)	4	To wire LED to Arduino Uno - preferably 2 red (or orange), 2 black (or brown)	
Wires (male/male) - red,black,yellow	3	To wire servo motor (preferably 1 red (or orange), 1 black (or brown), 1 yellow	
Arduino Uno	1		
Sticky foam	20	To assemble platforms for SSM and motor, to attach components to cardboard and chopstick	
Blue USB cable	1	Standard regular-B for Uno	
The items below are not part of the kit.			
Markers and pencils	many	To draw hand or other waving object (usually teacher has those)	
Masking tape	1	Teacher has this in his/her box	

laptop	1	Teacher will provide 1 laptop per student.
projector	1	Should available in classroom



CODING THROUGH ROBOTICS [Session 1 of 12]

Lesson Overview - Session 1

Topics Covered

Welcome and introduction of instructor and students, importance of journals, classroom values and rules, the goal of the class, computer training, concepts training, introduction to mBlock, 3 programming challenges.

Disciplinary Core Ideas

Engineering Design (K-5th Grade)

- ETS1.A: Defining and Delimiting Engineering Problems

Learning Target(s)

Technical Skills

-

Life Skills

-

Lesson Materials

- ☐ Journals
- ☐ Charged laptops
- ☐ Pencils

Key Vocabulary - Session 1

- X-Y coordinates: point in a grid
- Degrees in a circle: 0, 90, 180, 270 and 360 degrees
- mBlock: block-based programming language based on Scratch

Lesson Plan

Instructor Mindset

Project Steps

Project Objective

In this course the students will learn the necessary tools to create a game on the computer using mBlock which is based on Scratch. The computer game will use external robotics parts (i.e. light an LED or spin a motor).

Anticipatory Set (2 min)

Have you ever played a computer game? (wait for answers). Have you ever asked yourselves how the game was made and who thought about the story of the game? (wait for answers). Making a computer game requires lots of different skills including creativity, design, programming, patience - AND ROBOTICS! Yes, you will create a computer game that will make an external robot move or light up!

Introduction (15 min)

Welcome (10 min)

- Hand out the Barnabas Robotics journals and tell the students to use it to write down ideas or to take notes and draw pictures or diagrams.
- Tell the students that the goal of this class is to create a game on the computer
- Introduce yourself and tell your story (briefly)
- Ask the students to say their names and their favorite superhero and then write it into their journal on the first page.

Classroom Values + Rules (5 min)

- Respect your teacher
- Respect each other
- Respect the materials (i.e. laptops, furniture, etc.)
- A means to quieting down when they hear a cue

Computer Training (5 min)

Hand out the laptops and explain that each laptop has a protective pouch and that the number on the laptop and the number on the pouch are the same (i.e. BA44). Have the students write the number of their laptop on the first page of their journal!

Teach the students the following skills:

- Turn on the laptop and - if necessary - type in the password (1234).
- How to maneuver the cursor (either with the touchpad or with a mouse).
- Select with the left mouse button or by pressing on the lower left of the laptop's touchpad.
- Open mBlock on their laptop by left double clicking onto the mBlock icon.
- Do not walk around with the laptop in their hands.
- How to save a file when they are done.
- How to shutdown the computer and put it back into its pouch.

Concepts Training (10 min)

The students will need two important skills to be able to make their character move around in the computer game: X-Y coordinates and degrees in a circle.

To explain X-Y coordinates, draw a 10 x 10 grid on the whiteboard and label each horizontal line with the numbers 0, 1, 2, ..., 9 and 10. Also label each vertical line with 0, 1, 2, ..., 9 and 10. Demonstrate that a point on the grid has a pair of coordinates. For example, point A with coordinates (3,5) sits on the vertical line labeled 3 and the horizontal line labeled 5. You can then draw several points into the grid and ask the students to identify them as coordinate pairs.

I will insert a picture of a 10 x 10 grid and some points with coordinates here!

Ask the students if they know how many degrees there are in a circle (360 degrees). How many degrees are there in half a circle (180 degrees). Draw a circle on the board and show 0, 90, 180, 270 and 360 degrees. You can then play a game where you have a student (say Joe) come to the front and ask the other students to tell Joe where to go (for example, "go straight", "turn 90 degrees and walk 3 steps", "turn 270 degrees and jump", etc.)

I will insert a picture of a circle with degrees 0, 90, 180, 270 and 360 degrees here!

Introduction to mBlock (20 min)

Supporting Materials



NOTE to Instructor:

If you are unfamiliar with mBlock, you can watch the following video (to be created!)

Step 1: The basics (5 min)

- Double click on the mBlock icon
- Select (left click on) SPRITES (default is the panda bear)
- Select the yellow circle (Events) and then drag 'when green flag clicked' into the work window. ==> This will always be the first line in your program.
- Select the blue circle (Motion) and drag one of the blue blocks into the work window.
- Click on the green flag and show the students what happens to the panda bear!
- Point out that the blue 'Motion' blocks make use of what we just learned: X-Y coordinates and degrees!
- Save your program by clicking on 'FILE' ⇒ 'SAVE AS' ⇒ and giving your program a name.
- To open a saved program click on 'FILE' ⇒ 'OPEN' ⇒ select the program name you want to open ⇒ click OK on the bottom right corner.
- Point out some other blocks under 'Motion'.
- Point out the Repeat block in the orange circle 'Control'.
- Let the students play with mBlock by giving them these 3 challenges (one at a time).

Step 2: Challenge #1 ⇒ Moving the Panda to the middle

- Click and drag the panda to the side
- Add a when "flag" clicked control block
- Go to (0,0)

Step 3: Challenge #2 ⇒ Make him walk across the screen

- Move block
- Wait block
- Start him at (-240,0)
- Hint: use the Repeat block

Step 4: Challenge #3 ⇒ Walk in a box

- Point in 90 degrees
- Turn -90 degrees

Step 5: Decorate our Sprite

If the students finish all three challenges, you can let them decorate their Sprite. Save your work at the end and give your project a meaningful name so that you can find it easily. Explain that as the class moves on, we might have several different projects. Therefore, the name should be descriptive.



REFLECTION

Clean Up and Reflection (3 min)

1. What did you learn today?
2. What was hard?
3. What was easy?