Walk This Way
Grades K-2

Splash of Math

The Big Idea

It's one thing to take a walk. It's another to follow someone else's instructions telling you where to walk! Today we'll take turns writing "code" for "robots" (you and your friends) to follow. Let's see what funny robot moves the coders have in store!

Supplies You Provide

- ★ Pencils: 1 per kid
- ★ Scrap paper: 8-10 sheets total
- ★ **To print**: 4 copies Radical Robot Commands (page 6)
- ★ **To print**: If you have pre-readers in your club, print 4 copies of the Radical Robot Commands for Pre-Readers (page 7)

Room Set-up

- ★ You'll want to clear the room of desks, or better yet, find a large open space like a gym. That will maximize the fun!

Other Key Prep

- ★ **Print** 4 copies of the Radical Robot Commands sheet or 4 copies of the Radical Robot Commands for Pre-Readers

What's the Math?

- ★ Sequencing and logic
- ★ Distance and scale
- ★ Spatial skills, e.g. object rotation
- ★ Patterns

Kickoff

Intro to the kids: "How many of you have a robot in the house, or anything that works like a robot? What *is* a robot, anyway?" (Discuss.) "It's a programmable machine, meaning people write a set of instructions, or a **program**, that tells it what to do. A lot of robots look like weird clunky humans. Today you get to be a robot – and follow the exact instructions your friends give you!"

Simon Says – for Robots (5 minutes)

Intro to the kids: "First, let's see what it feels like to follow a **program**. Follow these instructions as exactly as you can."

1. Have the kids **stand in 2-3 rows** with space in front of each.
2. Give the following instructions:
★ Step one foot forward
★ Step other foot forward
★ Raise hand
★ Put hand on head
★ Lift hand up and down on head 3 times
★ Yell "Panda parade!"

Ask the kids:
★ "How did that feel to follow the instructions step by step?"
★ "What do we normally call picking up your hand and putting it back down on your head?" (Discuss.) "We call it patting yourself on the head. But robots only understand actions that are listed step by step in specific 'code,' which is a special set of words and symbols that a computer can understand. You may have heard the term 'coding'; that's another way of saying that you're writing a program."

★ "Why do you think a program has to list everything so carefully?" (Discuss. A program helps <u>every</u> robot follow the program **the same way**.) "In the real world, 4 robotic arms putting doors on cars in a factory all have to do it the exact same way or else we'd have funny-looking cars!"

Radical Robots (20-25 minutes)

Intro to the kids: "Now you're going to **program each other**! As a robot you only understand certain commands, so you'll have to use the moves listed on the **Radical Robot Commands** list. You may list them in whatever order you want. When you're done writing your program, each group will try it on a robot from **another group**! Keep in mind that we all have to do the steps exactly the same, so when a command reads: 'step forward' or 'skip forward' it means one normal step or skip, not a gigantic one!"

1. Split the kids into 4 groups. Give each group some scrap paper, a pencil and a copy of the Radical Robot Commands list. (If you're using the Radical Robot Commands for Pre-Readers kids won't need scrap paper and can skip the next step.)
2. Ask each group to write the robot's final position (e.g. "sitting on the floor next to the 2nd desk" or "standing on left foot in the corner by the doorway") on the bottom of their paper. They should work quietly to keep the final position a secret!
3. The group should spend 5-7 minutes writing a funny routine to get the robot to its final position using the specific language on the Radical Robot Commands list. If you have a very young group, you can work together to create a program for YOU!
4. Give the kids a 2-minute warning if they are very engrossed!
5. When time's up, each group should choose 1 volunteer to be a robot for the 1st round. Each of the 4 robot volunteers rotates to another group. Make sure groups know to **keep the final position a secret** from the visiting robot!

6. Next, each group reads its instructions to the visiting robot. The robot follows the steps as given. See what unexpected things happen!

Ask the kids:

★ "For how many groups did the robot end up in the **correct spot**?" (Take a show of hands and discuss!)

★ "Now that you've seen a robot do your program, do you think you know what steps to write differently?" (Discuss. It could be that the robot didn't take enough steps to go a distance, or the robot turned too much or too little, etc.)

★ "Sometimes machines stop working because of an error in the program called a 'bug.' Finding and fixing bugs is called **debugging** in computer science. We're now going to debug our programs and have a new robot try it!"

6. Have each group – including its visiting robot – talk through anything that went unexpectedly, and what steps should change to enable any robot to reach its goal.

7. The group writes up the program again from start to finish.

8. Each group now **picks a new person** to be a robot. Each of the 4 new robots rotates again to yet another new group.

9. Each group reads the debugged program to the new robot. See if the program works better this time!

10. Feel free to continue debugging, robot-rotating and program-running as time allows – but be sure to leave enough time to do the next activity. If there's not enough time for every kid to be a robot, let them know they'll get a chance in the next activity!

Party Fun Fact: In real life, it is really hard to program a robot to walk like a person without falling down. In the DARPA competitions in 2015, robots competed to open a door and walk through it – and it took the machines about 2 hours just to do that!

Revenge of the Robots (20-25 minutes)

Intro to the kids: "If you really want to know if a program works, you need multiple robots to try it. Remember, the program has to give the same result no matter what machine runs it. We're now going to take turns programming multiple robots at once!"

1. Split the kids into 2 groups.
2. Each group **works together** for 2 minutes to code one new routine, mixing in everyone's favorite moves from the earlier programs. The code has to follow these 2 guidelines:
    ★ The code should direct the robots to move across the room to a secret landmark, but **not** a mark on the floor!
    ★ When the robots reach their final destination, they should sit down and drum the floor with their hands.
4. At the end of 2 minutes of coding, each group should select one volunteer to be the **Code Commander**.
5. Ask the first group to line up at one end of the room to be the robot volunteers.
6. On "Go!" the **Code Commander** of the second group reads his/her group's code step by step to the volunteer robots.
7. See if all the robots follow the program the same way – and also see which robot ended up closest to the secret landmark!
8. Then switch groups so everyone gets a chance to be robots!

A Touch of Class: "Today you wrote a program – and you did exactly what real-life programmers do! You wrote code, tried the program, saw some things go wrong, and fixed them."

Radical Robots Commands

Use the commands below to create a program for your robot. You can write down the number of times you'd like your robot to perform that move and give it some direction: up, down, left, right, forward, backward, all the way around, half-way, one-quarter.

Hop on one foot
Hop on both feet
Lift left arm
Lift right arm
Lift both arms
Sit down
Skip forward
Step left foot
Step right foot
Turn

Radical Robots Commands for Pre-Readers

Put a number in the box next to the photo to create a program for your robot. 1 is the first move, 2 is the second move, 3 is the third move and so on to 10!

	Hop on one foot	Sit down	
	Hop on both feet	Skip forward	
	Lift left arm	Step left foot	
	Lift right arm	Step right foot	
	Lift both arms	Turn around	