01. Follow a Path, Which Way Should We Go?

Quick Overview

Students need to be able to follow paths themselves before programming robots to follow paths or move to specific locations. This lesson includes a variety of activities to help students use standardized vocabulary to guide the teacher along paths, then to create paths for the teacher. Children move toward following directions along paths and giving directions/commands to others to follow paths.

Time:

Varies based the developmental needs of the learners. This is best in short, repeated experiences of fewer than 20 minutes.

Goals:

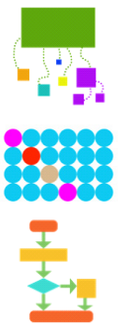
Students will be able to follow and create paths in their environment.

Students will begin to describe directions along a path, using standardized vocabulary (forward, backward, right turn, left turn, start, and stop).

Students will use mathematical reasoning and words like "more" or "farther" and "fewer" or "closer" to describe movements along a path.

Computational Thinking (Computer Science) Skills:

Students will be practicing Decomposition, Pattern Recognition, and Algorithm as they move along paths and give commands to help others move along paths.



DECOMPOSITION – Practiced by breaking apart the procedure of following a path into steps.

PATTERN RECOGNITION – Practiced when noticing that commands are repeated over and over, even if the goal point changes.

ALGORITHM – Practiced as students explore how many steps they take, and estimate the distance remaining and the number of steps it will take to reach a goal. (If we have not yet reached the goal what should our command be? If we have passed the goal, what should our command be?)

Curriculum Tie-ins:

LANGUAGE DEVELOPMENT – vocabulary, directionality (letters and reading left-to-right)

MATHEMATICS – numbers (one-to-one correspondence), distance (too far/not far enough), more/less, spatial awareness

PHYSICAL EDUCATION – balance (walking on lines or on paths), controlled movement

Theme Tie-ins:

Transportation Theme

Robot Theme

Related Children's Books:

Books with paths or simple mazes which can be drawn or reenacted.
(mostly appropriate for 4 year-olds and older):

Mapping Penny's World by Loreen Leedy
Mapping Sam by Joyce Hesselberth
As the Crow Flies by Gail Hartman
My Map Book by Sara Fanelli
Escargot by Dashka Slater

Materials:

Chalk or painters' tape
Room for movement
Toy cars and "roads," or blocks and toys to explore
Optional: tricycles and paths, right/left gloves, stamps, or wristbands

Vocabulary:

Command(s) – instructions given to a computer or robot
Debug (debugging) – correcting or improving commands or programs
Path
Forward
Backward
Stop
Start

Teacher Notes:

While it is exciting to have a robot to explore, in order to have the best results using a robot with young learners it is advisable to begin by practicing important skills in the first person. MatataBot is a robot which moves on a horizontal surface, so moving in specific directions and giving specific directional instructions are important skills to practice. (This is not a good time to practice paths on a chalkboard or other vertical surface because MatataBot does not move "up" or "down.")

Following a path (or road) is a developmentally appropriate skill for preschoolers to develop and practice. This usually leads to children creating paths/roads and even mazes which incorporate choices about which way to go to reach a desired goal.

Young students are likely still learning the difference between right and left. One way to support them is to provide something as a cue. A wristband or stamp on the right wrist can help. Because MatataBot displays blue lights for right turns, a blue wristband, stamp, or sticker can be helpful on the right wrist or foot/shoe.

There are several activities in this lesson, but you do not need to do all of them as long as your learners are comfortable with the skills and thinking involved

Activity 1 – Learners follow paths and lines:

Your youngest learners may need to practice walking on paths or following a line before the other activities in this lesson. Chalk paths outside, painters' tape paths in the classroom or hallway, or paper paths can be used to encourage children to walk on a path or line. You can also have children practice "path-following" with blocks, by painting paths with water on sidewalks outside, and of course by using "roads" or paths with tricycles or other ride-on toys.

Activity 2 – Teacher follows a path, forward and backward:

Stand in a location which has a path. This could be a hallway, a sidewalk or path outside, or a path you have created with chalk or tape. Ask your students to tell you how to get to a specific location/object on the path. (Start with an easy "forward" goal.)
Say: "Please help me get to the book on the floor. Which way should I go?" They may say things like "walk," "go," or even "go forward." Follow with one step in the direction they say. Repeat this process. Discuss what words helped you get to the location/object. As your students are ready, tell them you only understand some words, like "forward" and "backward".

Extension:

If your students are ready, you can ask them how many steps you should move each time and add a "play" command.

* The color blue is suggested here because the MatataBot controller displays blue lights for the command "right."

02. Follow a Path, Which Way Should We Go?

Quick Overview

Students need to be able to follow paths themselves before programming robots to follow paths or move to specific locations. This lesson moves from simple moving forward and backward along a path to making 90º turns.

Time:

Varies based on the number of activities used and the developmental needs of learners. Best in short, repeated experiences of about 20 minutes.

Goals:

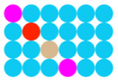
Students will begin to describe directions along a path using standardized vocabulary (forward, backward, right turn, left turn, start, and stop).

Students will use mathematical reasoning and words like "more" or "farther" and "fewer" or "closer" to describe movements along paths.

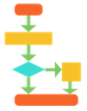
Computational Thinking (Computer Science) Skills:

Students will practice Decomposition, Pattern Recognition, and Algorithm as they move along paths and give commands to help others move along paths.

DECOMPOSITION – Practiced by breaking apart the procedure of following a path into steps.



PATTERN RECOGNITION – Practiced when noticing that commands are repeated over and over, even if the goal point changes.



ALGORITHM – Practiced as students explore how many steps they take, and estimate the distance remaining and the number of steps it will take to reach a goal. (If we have not yet reached the goal what should our command be? If we have passed the goal, what should our command be?)

Curriculum Tie-ins:

LANGUAGE DEVELOPMENT – vocabulary, directionality (letters and reading left-to-right)

MATHEMATICS – numbers (one-to-one correspondence), distance (too far/not far enough), more/less, spatial awareness

PHYSICAL EDUCATION – balance (walking on lines or on paths), controlled movement

Theme Tie-ins:

Transportation Theme

Robot Theme

Maps and Mapping

Related Children's Books:

Left or Right? By Karl Rehm and Kay Koike

Materials:

Chalk or painters' tape
Room for movement
Toy cars and "roads," or blocks and toys to explore
Optional: tricycles and paths, right/left gloves, stamps, or wristbands

Vocabulary:

Command(s) – instructions given to a computer or robot
Program – a series of commands to accomplish a task
Programmer – the person giving the commands to the robot
Right turn – 90º turn to the robot's right side
Left turn – 90º turn to the robot's left side
Debug (debugging) – correcting or improving commands or programs

Teacher Notes:

How robots turn is an important concept which children (and even adults) may struggle with at first. Robots do not **move** right, they **right** turn.

Your students are likely still learning which is right and which is left. One way to support them is to provide something as a cue. A wristband or stamp on the right wrist can help. Because MatataBot displays blue lights for right turns, a blue wristband, stamp or sticker can be helpful on the right wrist or foot/shoe.

Activity 1 – Turning right and turning left:

How robots turn is an important concept which children may struggle with at first. Robots do not **move** right, they **right** turn.

Demonstrate turning versus moving with yourself as a "robot." Have your students direct you to move on a path with opportunities for 90º right turns only. (You can add left turns as your learners are ready.) When your students seem comfortable with your turns, have a student move on the path while you and the other students give the commands and the student "robot" follows the commands. Use the term "right turn" instead of just "right." This is a good time to introduce and use the terms "commands" (the instructions you are giving to the "robot") and "programmers" (the people who are giving the instructions).

Extension:

Some of your students may be ready to begin using or following symbols for the commands. These could be arrows, cards with commands, images which match the MatataBot symbols, or simply little blobs of color (green=forward, red=backward, blue=right turn, yellow=left turn) similar to the lights on MatataBot.

Further Extension:

With your learners who are ready, make a multi-step "list" (it is actually a program or algorithm) using arrows, command cards, or other symbols, and use the list to plan ahead for multiple steps in the "program" (and to "debug" if the "robot" does not perform exactly as planned).

Activity 2 – Practicing Turns and Directions:

Introduce other ways and places to practice "forward," "backward," "right turn," and "left turn." Add a road to the block center, add chalk paths to outdoor play areas, or add painters' tape paths in your classroom. Encourage children to play with these and use the "commands" they have been learning. You may even whisper these commands as you walk down the hallway to the school library or another location.

Activity 3 – Wait, who is right?

As your learners become more comfortable with moving and turning, it's important to help them notice that directions/commands are relative to the thing moving, be that a robot or a person.

Teacher Note: This is a developmentally difficult step and will require lots of support. Not all children will be ready for this relativity from a developmental standpoint.

Start once again with yourself and the students facing the same direction. Then change your direction so you are facing the students. Ask them to tell you how to move "forward" (closer to them) and also "backward" (away). Then try the same experience with a few students standing in two lines facing each other. Have those who are not in these two lines give a direction/command to move either forward or backward. Observe and discuss.

Point-of-view is a difficult concept for little learners; provide a lot of support and opportunities to practice this. For some children, the directionality of the robot and the commands to give the robot will become easier with the actual MatataBots, while for others, the abstract nature of a non-human shape will make it more difficult. Helping children to practice "relative directionality" is important. Some additional things to try to encourage "relative directionality" are:

1) Give a command/direction and then, prior to students moving, ask the "robot" to point the way the direction is asking them to move so the "programmer"/command-giver can verify the results.

2) Model how to move your own position to help verify if the programming (command) is correct by standing or sitting alongside the "robot" and facing the same way as the "robot" to verify directions.

3) For some learners, having a paper robot is helpful because they can turn the paper robot to match the position of the "real robot" to make decisions about the robot's directionality and the needed commands.

* The color blue is suggested here because the MatataBot controller displays blue lights for the command "right."

03. What is a Robot?

Quick Overview

In this lesson, robots in general and the MatataBot in particular are introduced to your students. Learners will be learning how to turn the MatataBot on and off and also establishing rules for the care of MatataBot. The lesson culminates with students imagining a robot they would like to have.

Time:

This lesson could be broken into several parts, especially with younger children. Each activity could be a separate lesson and would require about 20 minutes each.

Goals:

Students will be able to talk about robots as non-living things.

Students will know that all robots require power.

Students will explore the MatataBot and discuss its features using words and/or gestures.

Students will be able to turn MatataBot on and off.

Students will draw, paint, or make a robot from their imagination or experience.

Computational Thinking (Computer Science) Skills:

Students will be practicing abstraction as they discuss the ways robots are similar while inventing or creating a robot.

ABSTRACTION – Practiced while discussing the similarities and differences in robots.

ABSTRACTION – Practiced when learners imagine their own robot based on what they know about robots.

Curriculum Tie-ins:

ART – creativity in designing their robot and adding important details
SCIENCE – living and non-living things
LITERACY – listening to and discussing stories; making connections from literature to self

Theme Tie-ins:

Robot Theme

Real and Make Believe

Related Children's Books:

Robots, Robots Everywhere by Sue Fliess
Robots by Gail Tuchman
Robots by Melissa Stewart
Robots at Home by Christine Zuchora-Walske
Robot Repairs by Jonathan Litton
If I had a Robot by Dan Yaccarino (for the inventive art activity)

Materials:

Pictures of robots
MatataBot (one or more)
Non-fiction book(s) about robots
Art materials for students to create images or models of pretend robots

Vocabulary:

Robot – A machine which can move and follow commands and algorithms (a series of instructions and rules.)
Power – All robots need power.
Button – Buttons are one way for people to interact with robots.
Living – Living things breathe, eat, and grow.
Non-living – Non-living things have never been alive, do not grow, and do not eat.
Port – Where something is plugged in or power port.
MatataBot – A robot