Testing Finch Robots
with the Scientific Method

Students will use the scientific method to discover some of the capabilities of the Finch robots.

AGE
- Gr. 3+
- Older grades will probably complete more of the challenges

OBJECTIVES
Curricular content:
- Curricular competencies from Science across many grade levels

Lesson objectives:
- Students will investigate what Finch robots can do.
- They will practice using some of the principles of the scientific method: observation, hypothesis, testing, and falsifiability.

MATERIALS
- Finch robots with microbits
- A few computers & micro-USB cords
- Paper & pencils

SET UP
- Load the microbits with the first challenge
- Prepare a few computers with all the challenge files, for students to load the next challenges on their microbits
- Put students in groups of 2/3

ACTIVITY OUTLINE
Overview and Suggested Timeline:

Introduction	10 minutes
Testing	30 minutes
Reflection and Wrap-Up	5 minutes

Introduction
- We have some robots and we want to discover how they work. We're going to test them and see what they do!
- To experiment with the robots, we're going to use the scientific method.
- Let's start by making some **observations.**
  - *Pass out the Finch robots, WITHOUT the microbits.*

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Additionally, we gratefully acknowledge the support of the YP Heung Foundation, The McLean Foundation, and the Province of British Columbia.

    - *With older grades, make students write down all their notes (observations, questions, hypotheses, and test results)*
    - What can you observe about these robots?
        - Wheels, hole in the middle, "eyes" on the front, power button on the bottom, etc.
    - These robots are controlled by microbits. What do you observe about them?
        - Lights on the front, buttons A & B, etc.
    - What **questions** do you have about what the robot can do?
- With machines like these robots, there may be a lot that they *can* do, but nothing that they *will* do until we tell it to. We do that by coding them. For today, we're going to use some different programs that are already coded, that use the different capabilities of these robots.
    - For each program, the **question** will be "what has this robot been coded to do, and how can I make it do that?"
    - You need to start by **observing** what has changed. Sometimes, you might need to play with the robot a bit to make observations. Make a **hypothesis**: what do you think the robot has been coded to do? Then **test** your hypothesis. Are you right? If you're wrong, what is your new hypothesis?
        - Your hypothesis needs to be **falsifiable**. This means that part of how you test your hypothesis is by trying to prove it *wrong.*

Testing

- We're going to start with challenge 1.
- After you've solved a challenge, you can load the next one onto your microbit.
    - *Depending on the grade and student independence, they could either tell you the solution to get your permission to load the next challenge, or you could let them load the next one after they* think *they've solved it, and at the end go over them as a class together.*
    - *Show the students how to load code onto the microbits.*
- *Give them time to work through the challenges.*

Challenges:

- 1: Finch moves forward 10cm when you press Button A
- 2: Finch moves forward 10cm only when it has at least 15cm of space in front
- 3: Finch moves forward when you press Button A. Pressing Button B changes how many cm it moves.
- 4: Finch moves in a square when you press Button A. Flipping it upside down changes how many squares it makes. The beeping speeds up as you turn the Finch, as a clue to turn it over.
- 5: Finch moves towards light.
- 6: Finch speeds up as sound gets louder.

Reflection and Wrap-Up

- Put away robots before asking reflection questions
- Share challenges and successes from the activity with each other
- Ask the reflection questions (below)

REFLECTION QUESTIONS

- What are some of the things the Finch did? Did any of it surprise you?
- Why did the Finch do different things in the different programs? For example, pressing Button A made different things happen. Why?
- Did you have to modify your hypotheses based on the outcome of a test?

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- Why do scientists use this process to try to understand things?
- Where else in your life do you use a process of observing, asking questions, and testing out your guess?
- These robots can be coded to do lots of things. Where might it be useful to have a robot that can do something from one of the challenges today?

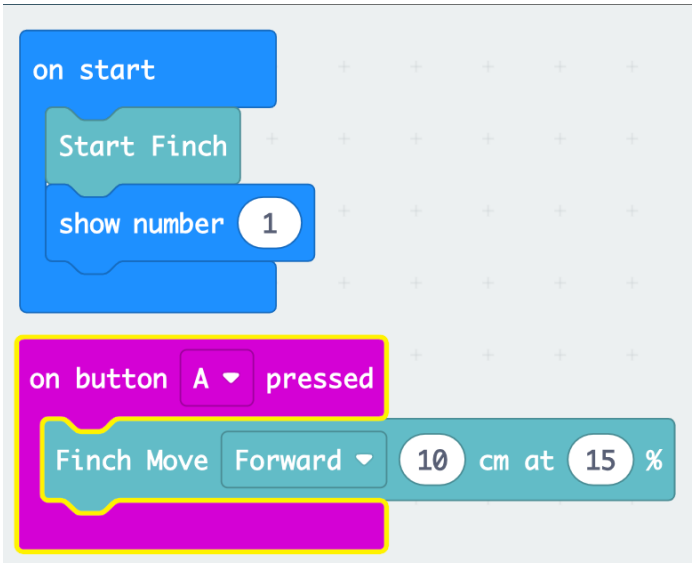
TROUBLESHOOTING TIPS

- When doing the initial observations, I recommend separating the Finches and the microbits because otherwise when the students try pressing the power button on the Finch, it'll turn on and they'll be able to test Challenge 1 before you want them to.
- Challenge 4 is the hardest.
- Challenge 5 needs to have sufficient light/dark space.
- Challenge 6 is not too difficult, but doesn't work well in a loud room.
- 5 & 6 both make the Finch move constantly. To stop the robot, you have to fully power off the Finch (black button on bottom)

ADDITIONAL RESOURCES

- Please feel free to add additional challenges that you've programmed, or ignore some of the ones that won't work for your class. The pre-made 6 are chosen to scaffold on each other, but also to cover a breadth of the options with the robots.

SAMPLE SOLUTIONS



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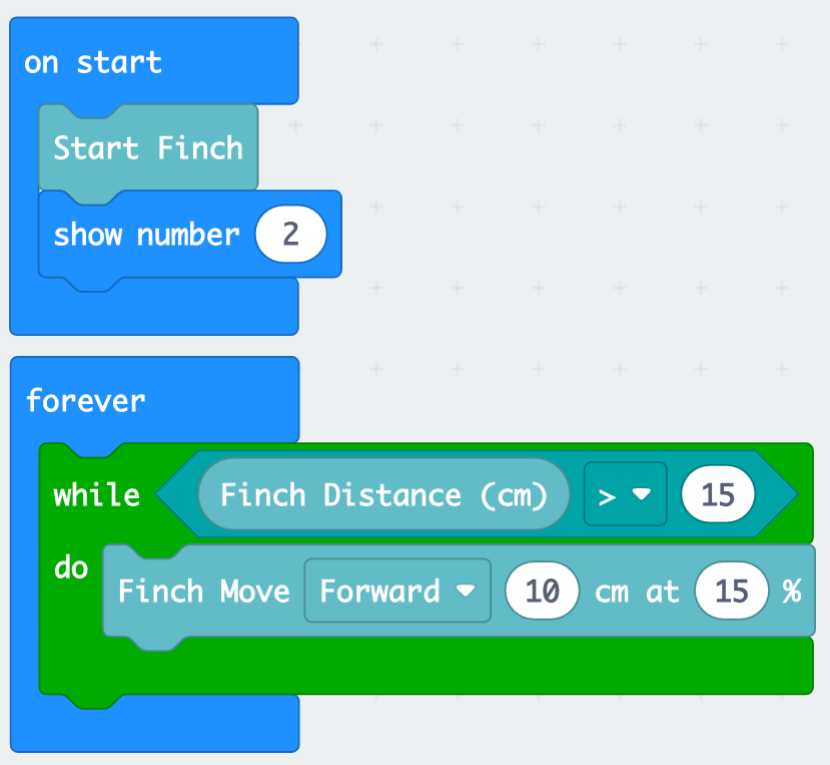

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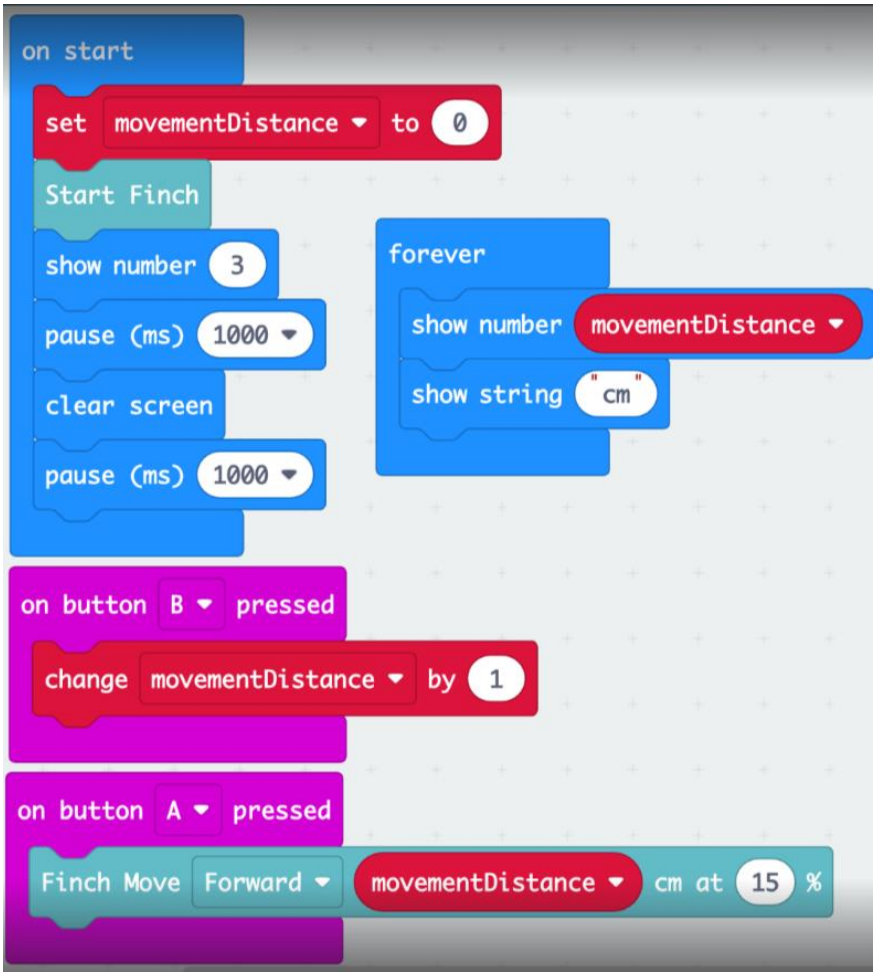

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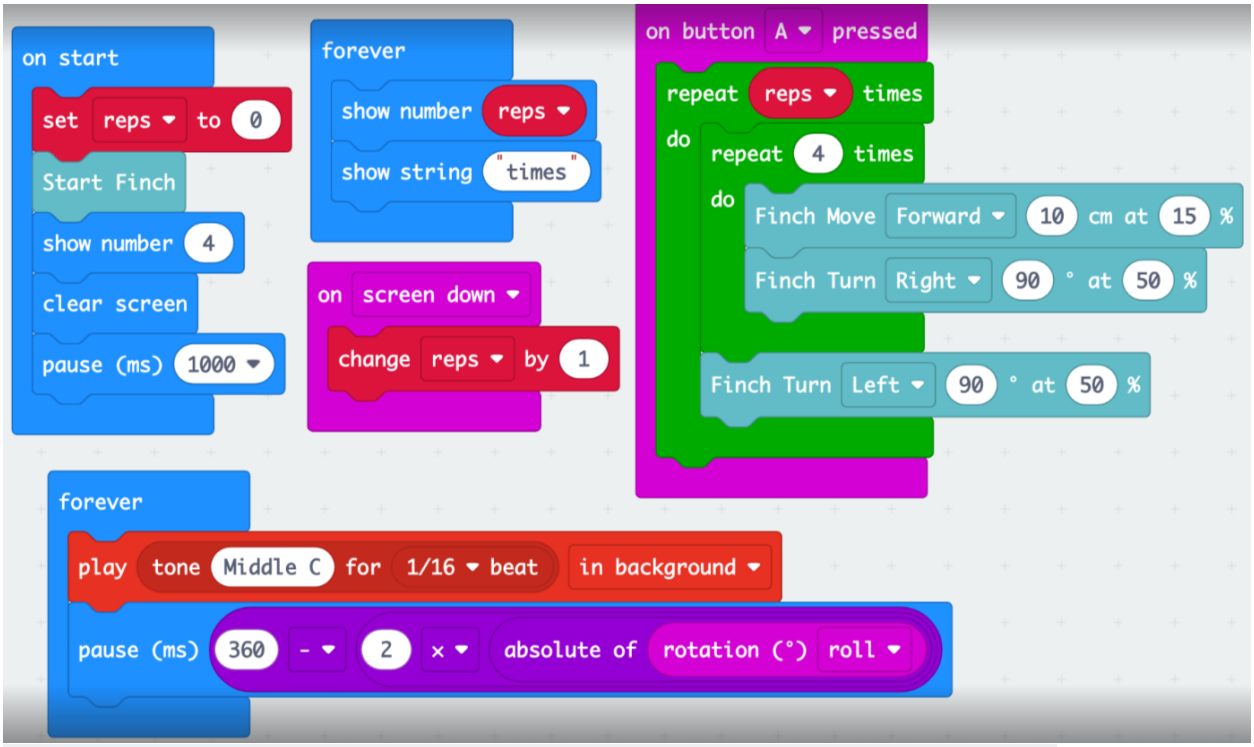

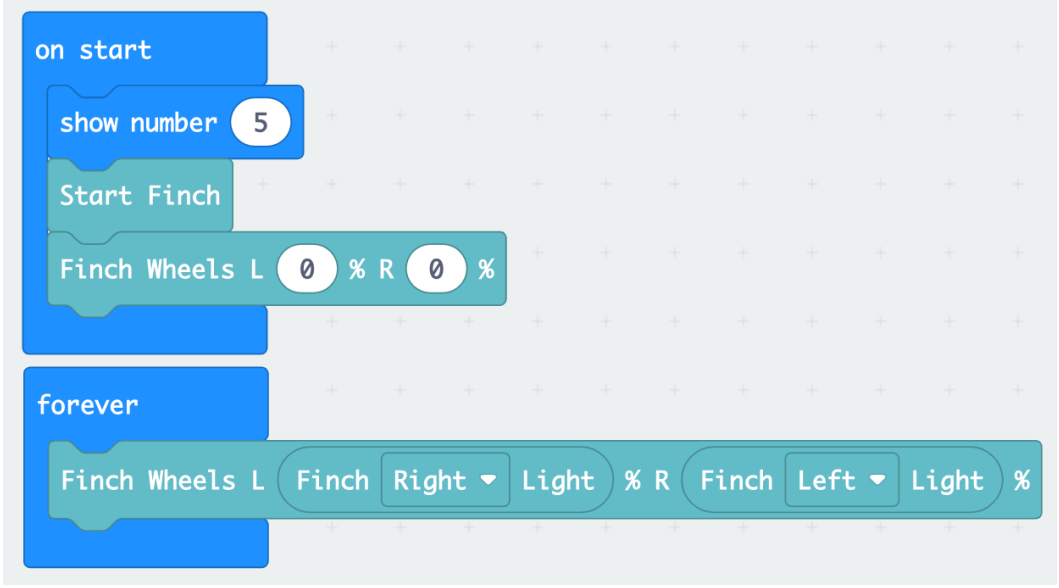

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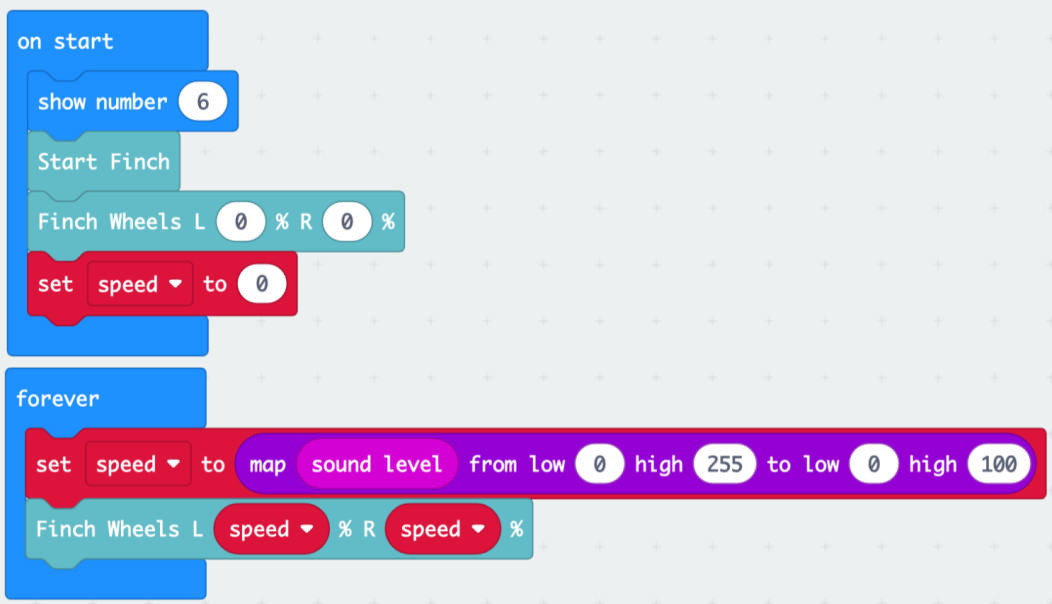

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