creativity lab

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PRO-BOTS

A Guide from the Creativity Lab

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Based on
Lessons developed by Emily Smith and Robbie Torney.

About This Project

Pro-Bots are physical computing devices that utilize the Logo programming language. Simply put, they are small, mobile machines that, once programmed, draw whatever students can design.

Through them, students as young as five can learn the building blocks of computer programming, and explore concepts like angles and shapes. This project is structured such that teachers provide minimal instruction, and students learn through the process of design, test, and redesign. We encourage you to customize this project to the needs of your class, but maintain the ideal of students learning through exploring.

This guide begins with begins with a tutorial on how to use Pro-Bots to build basic programs. It continues with a series of exercises that build on each other, for helping students to explore programming on their own, then synthesize their discoveries to build increasingly complex programs.

Probots can be purchased here.

Our Story

At Lighthouse, we use Pro-Bots in kindergarten classes to reinforce the learning and practice of measurements, angles, and shapes. After learning basic commands on the Pro-Bot, these young students create their own "rulers" and design a path for the yellow car to follow.

At Lodestar, these have been introduced during free-making time, where students work to complete a Challenge Sheet with tasks such as:

"I can make the Pro-Bot go backwards"
"I can make the Pro-Bot turn around"
"I can create my own shape"

Materials & Tools

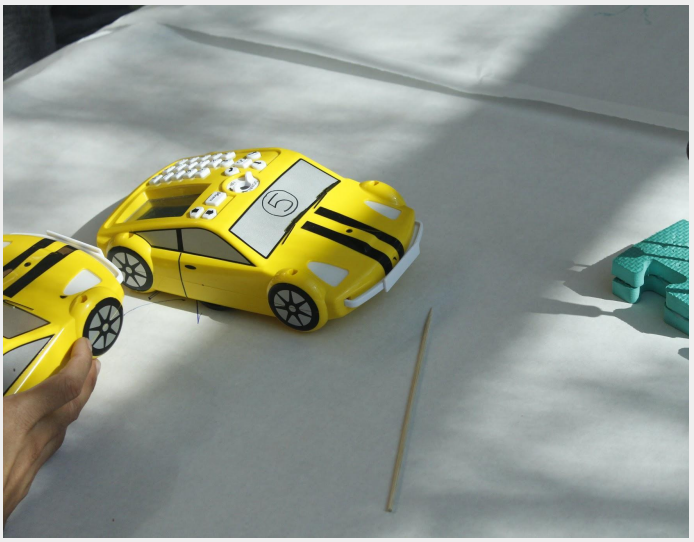
MATERIALS

- Probots (One for every 2-3 students)
- Thin markers or pens
- Chart paper
- Rulers
- AA batteries

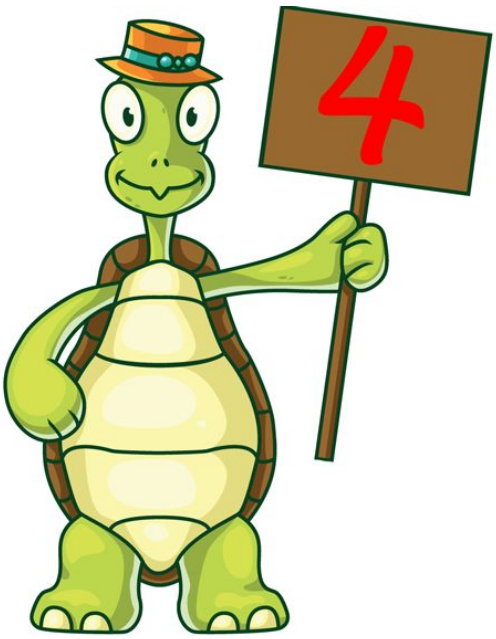
Learning Targets

- I can think critically and learn through observation.
- I can make a simple program.
- I can use a ruler to measure distances.
- I can document and share my work with others.
- I can learn from mistakes and follow unintended paths.
- I can reach beyond my current capacities through playful exploration.
- I can test designed solutions to defined problems and take next steps on the basis of my testing.

TIME: 1 class period



Context: Before we make...



Although Pro-Bots and their associated activities are more of a focused project, they open the door to so many other methods of programming. Pro-Bots have accompanying software, Terrapin Logo, in which students can plan out their program before putting the Pro-Bot to paper. The on-screen buttons match the Pro-Bot buttons, so students already know the relationship between each button and its movement.

These tiny yellow cars reinforce many topics learned in math, ranging from the basics of length and line segments to complicated angles and shapes.

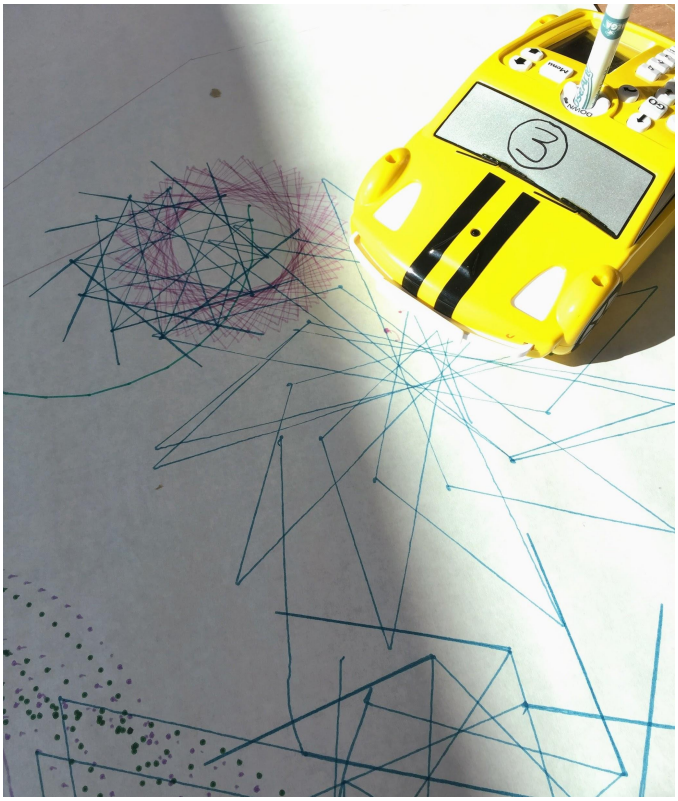
Additionally, there is no minimum or maximum age for this activity - projects can easily be scaled up or down.

Material Management

When starting out with Pro-Bots, it can be beneficial to wait to introduce the markers. Have students explore the relationships between each button and the movement of the car. Here, it can be helpful to have class "challenges", where students figure out how to make the car turn right, or go backwards. If some students or groups complete all the challenges, they can help others who may be struggling.

After students have used the Pro-Bots for a little while, transition them to areas covered with butcher paper, poster paper, or even newsprint. For young students, they might want to roll around on the floor with the cars, but consider placing them at tables covered with paper - this gives them a defined area to work in.

Students can work individually or in pairs / small groups. Consider what will work best for your class and lesson plan.



Looking Closely

Observation

As a class, identify different buttons on the Pro-Bots. What do students think will happen when the ↑ is pushed? Try it, out as a group. Have students explain what happened. What do they think will happen with the →? Try it. Was this different from what they expected? At this point, forego using numbers to quantify angles and distances. Keep it simple by using the defaults.

Exploration

Students can work in small groups. Let students explore and discover on their own (30 minutes). Try not to instruct during this time. Come back together as a group. What did students discover?

As students program their cars to follow their roads, have them draw the corresponding arrow for each piece of their program on a separate sheet of paper e.g. if their program begins with a forward command, have them draw a at the side of their paper to indicate this, before moving on.

After students have traced their entire roads, have them test their completed programs by using a marker in their cars on a clean sheet of paper. Did their program work correctly?

When their program is complete, have students label their documented program by drawing the shape of their road above it. Students can now share and test each other's programs.

Extend

Once students have examined the Pro-Bots and discovered the basic commands, have them try to make a square. Since the default angle is 90 degrees, this can be accomplished with just arrows. After this is accomplished, challenge students to create a square using the Repeat button. Next, have students create a triangle. This shape is more challenging, as it requires changing the angle that the Pro-Bot turns.

Have students use a ruler to draw roads for their cars to follow. Roads should be divided into segments, 25 cm in length. If students don't have experience using a ruler, have them measure the length of a single forward command, and mark that distance on their rulers to create their own segments. Turns should all be at 90-degree angles. It isn't necessary that they be perfect for the purposes of this exercise. Have students place their cars at the start of their road. (Do not use a marker in the Pro-Bot for this exercise.) See if students can program their cars to follow the roads. Students can program their cars one movement at a time. Have them begin with the first command, then hit Go. Once it arrives at their intended destination, they can add the next step.

When students have shown comprehension with the default distances and angles, let them add complexity by adding values. Students don't need to have a complete comprehension of angles to discover how to make different shapes. If they make a road map with a 65-degree angle, they should be able to use trial and error to discover if the quantities they enter are too big or too small, and adjust accordingly until they settle on 65-degrees.

Step-By-Step Guide

1. Turn the Pro-Bot on. Insert a skinny marker into the Pro-Bot.

2. Push the ↑ located above **Go**. This command will appear on the screen. Now hit **Go**. The Pro-Bot will move forward 25 centimeters, then stop. This is a basic program.

3. Hit **Clear** to erase that program. Enter →, then hit **Go**. This time, rather than travelling any distance, the Pro-Bot rotates 90 degrees to the right.

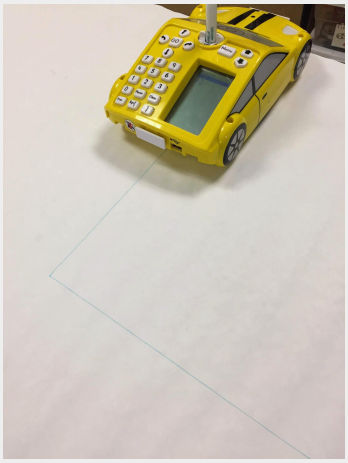
4. You can combine a series of movements into a single program. Enter ↑ → ↑. Press **Go**, and the Pro-Bot will follow each command in turn.

5. The default distance for every ↑ and ↓ is 25 centimeters, and default angle for every → and ← is 90 degrees. However, you can customize these amounts, by entering a different number after each command. Press ↑ 100, followed by → 180. Now the Pro-Bot will move 100 centimeters, and turn right 180 degrees.

1.

2.

3.



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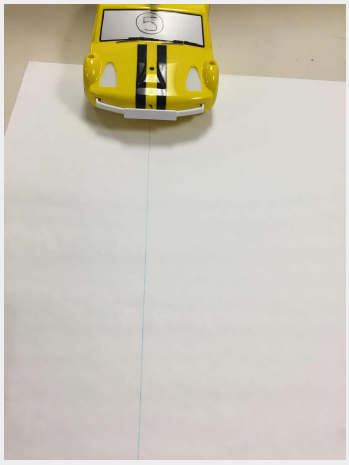


5.

Pro-Bots with Older Students

We've used this activity in professional development sessions, where we introduce local educators to Pro-Bots in a similar manner to the one described in this guide. We ask them to move them forward, turn them around, etc. After teachers have had time to explore, we prompt them to create shapes, starting with a square, and figure out how to incorporate some of the more complicated buttons.

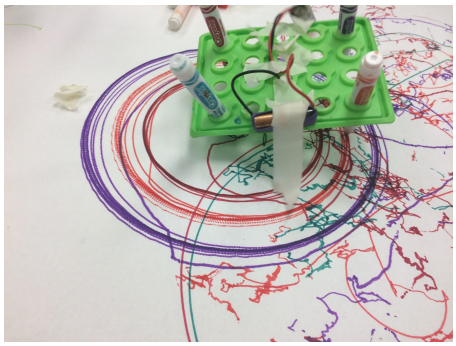
In this time, we've seen educators create circles, multi-pointed stars, and spirograph-like shapes and patterns.

If older students and adults have time in their exploration of the Pro-Bots, they can incorporate some of the more complex features into their code. To design larger shapes and structures, they can utilize subprocedures to practice writing clean code.

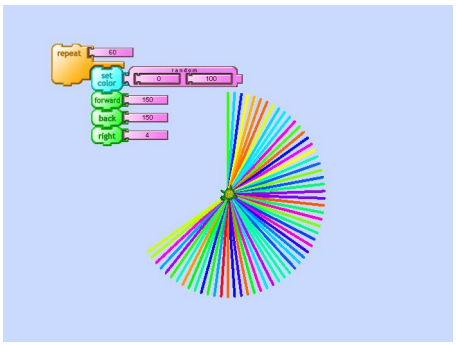
Additionally, each Pro-Bot has touch, sound, and light sensors. The front and back bumpers are touch sensors, and you can challenge students to have the Pro-Bot turn around when it encounters an obstacle.

There are many ways to add complexity when using Pro-Bots with older students - consider the scope of your projects and your "definition of done".

Related Extension Projects



[Scribble Machines]



[Turtle Art]