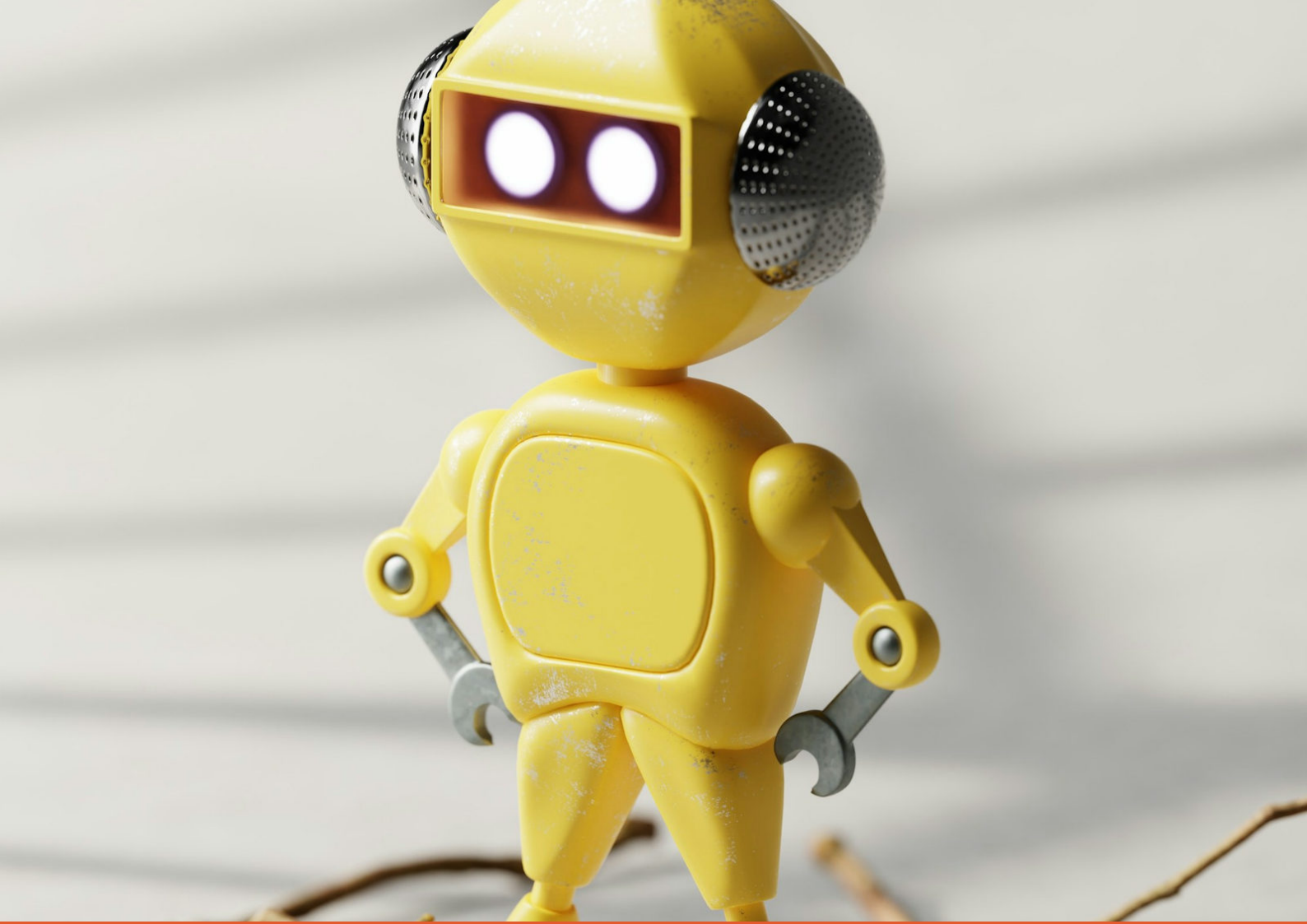




EduTrend Contents

EDUTECH · INTRODUCTION TO ROBOTICS · MIDDLE SCHOOL

Why Did It Stop Short?

Calibrate a robot's movement using wheel circumference and measurement

Ages 12–14

Level: Intermediate

60 minutes

Pairs · up to 30

Activity 04

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 04 · AT A GLANCE

Why Did It Stop Short?

Pairs program a robot to drive one metre and measure how far it actually goes. They measure the wheel diameter, calculate the circumference ($\pi \times \text{diameter}$) and work out how many rotations one metre needs. They adjust the program, retest, and discuss remaining errors such as wheel slip and battery level.

Learning outcomes

By the end of the session students can:

- measure actual versus intended distance;
- calculate wheel circumference;
- calibrate a program;
- explain sources of error.

KEY WORDS

calibration · circumference · rotation · error · slip · accuracy

CURRICULUM LINKS

Maths: circles and π . Science: friction. Engineering: precision.

1**SENSE**

What can it detect?

2**THINK**

What should it decide?

3**ACT**

What should it do?

4**TEST**

Run it

5**DEBUG**

Find and fix

6**IMPROVE**

Make it better

Materials (per pair)

- Robot with wheel rotation control
- Tape measure
- Ruler
- Calculator
- Worksheets 1, 2 and 3

Before the session

- Mark a start line and 1 m target.
- Check batteries.
- Prepare starter code.
- Print worksheets.

SAFETY

Keep the test track clear. Handle robots gently when stopping them.

ACTIVITY 04 · SESSION PLAN

Step by step

Test on the same surface each time; carpet and tiles give different results.

Time	What happens	Say or ask
0–8 min Hook	Drive to 1 m target.	<i>"Why did it stop short?"</i>
8–20 min Measure	Repeat three times.	<i>"How far did it go?"</i>
20–32 min Calculate	Circumference and rotations.	<i>"How many rotations for 1 m?"</i>
32–48 min Calibrate	Adjust and retest.	<i>"How close now?"</i>
48–60 min Evaluate	Remaining errors.	<i>"What else causes error?"</i>

CHALLENGE CARD (print or copy onto the board)

Calibrate a robot to stop within 2 cm of a 1 m target using wheel circumference, and explain the remaining sources of error.

ACTIVITY 04 · FACILITATOR NOTES

The robotics know-how in brief

Each full wheel rotation moves the robot forward by one circumference, $\pi \times \text{diameter}$, if the wheel does not slip. A 5.6 cm wheel travels about 17.6 cm per rotation.

Calibration compares intended and actual results and adjusts the program. Remaining errors come from wheel slip, uneven surfaces, battery level and measurement precision.

Common ideas to listen for

- “The robot is broken.” It needs calibration.
- “Seconds are enough to control distance.” Speed varies with battery.
- “Calibration is done once.” Surfaces change results.

Adapting the activity

Support

Provide the circumference formula worked through.

Stretch

Calibrate a 90° turn using wheel spacing.

WORKSHEET 1

First tests

Name: _____

Class: _____ Date: _____

Before calibration.

First tests

Trial	Intended (cm)	Actual (cm)	Error (cm)
1			
2			
3			

WORKSHEET 2

Calculation

Work it out.

Calculation

Step	Value
Wheel diameter	
Circumference	
Rotations for 100 cm	

WORKSHEET 3

Errors

Explain remaining error.

What still causes error and how to reduce it

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Measures error	Calculates rotations	Explains error sources

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Why Did It Stop Short? is a sample activity from the EduTrend Contents Edutech Introduction to Robotics programme (middle school, level: intermediate). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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