Build and Program Our Robot: A STEAM Mission Through Creativity, Coding and Collaboration

1. About the Activity

Is it possible to learn programming without computers, tablets or electronic robots? Absolutely! All you need is some cardboard, a few recycled materials, a grid and a willingness to experiment.

In this activity, children will build a robot using a shoebox and program it with a sequence of instructions represented by illustrated cards. The robot will move around a grid, reach a destination, avoid obstacles and complete different missions. Children will work in small groups so that everyone can contribute ideas, take part in decisions and try out different roles.

The project brings together unplugged coding, design, construction, spatial awareness, logic and creativity, while encouraging discussion and collaboration.

2. Age Group and Organisation

The activity is designed for preschool and primary school children, with appropriate adaptations. The missions can be simplified or made progressively more challenging according to the children's ages and abilities.

Suggested organisation: small groups of 3–5 children, with each group building one robot. A class can build two or three robots, depending on the number of pupils, the available space and the materials.

Suggested duration: 3–5 sessions of about one hour each, adaptable to the children's ages and the activities selected.

3. Learning Objectives

By the end of the activity, children will be encouraged to:

- understand that a program is an ordered sequence of instructions;
- recognise and use directional commands;
- plan a route before carrying it out;
- develop logical and computational thinking;
- identify and correct errors through debugging;
- design and build an object using recycled materials;
- collaborate, listen to others' ideas and make shared decisions;
- describe their choices verbally and explain the strategies they used;
- tackle a problem through trial, testing and improvement.

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4. Materials Needed

To build the robots:

- shoeboxes, preferably of similar sizes;
- coloured card and scrap paper;
- glue, adhesive tape and scissors;
- markers, pencils and decorating materials;
- bottle caps, cardboard tubes and other small recycled materials;
- wiggly eyes or optional decorative elements.

To program and play:

- a floor grid made with masking tape, or a large board;
- command cards to cut out;
- picture cards showing settings and destinations;
- optional obstacle cards;
- mission cards.

5. Stage 1 Design and Build the Robot

Before starting, each group looks at the available materials and discusses how to make its robot. The teacher encourages the children to share ideas by asking questions such as:

How can we turn this box into a robot? How will we identify its front? How can we decorate it using the materials available? How can we move and turn it easily on the grid?

The children agree on a design, choose the materials and work together to build the robot. Everyone should have a chance to contribute: some children may suggest solutions, others prepare the parts, decorate the robot or check that it is stable and easy to handle.

The robot does not need to be technologically sophisticated. A simply decorated box is enough, as long as its orientation is easy to recognise.

Important: the front of the robot must be clearly visible. When the robot turns, its orientation changes, just as a vehicle changes direction.

6. Stage 2 Set Up the Grid

The grid is the playing area on which the robot will move. It can be made on the floor using masking tape or prepared on a large sheet of card. The squares must be large enough for the box to be moved easily.

To begin, a grid with 4 × 4 or 5 × 5 squares is recommended. The grid can be made larger later to introduce more complex routes.

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Place the following on the grid:

- the starting square;
- the finishing square;
- pictures representing the settings or stages of the mission;
- any obstacles to avoid.

Place the robot on the starting square, with its front facing an agreed direction. Before starting, the teacher checks that everyone understands the difference between moving forward and turning.

7. Stage 3 Learn the Robot's Language

The robot cannot interpret what the programmers mean: it can only follow the instructions it is given. Illustrated command cards are therefore used to represent the commands.

FORWARD: the robot moves one square in the direction it is facing.

TURN RIGHT: the robot rotates a quarter turn to the right.

TURN LEFT: the robot rotates a quarter turn to the left.

The cards are placed in sequence, from left to right, to create the program.

Before moving the robot, the programmers must look at the sequence and predict the result.

8. Stage 4 Organise the Game

Divide the children into teams. To begin with, two main roles can be assigned.

The programming team: looks at the grid, identifies the destination, plans the route and arranges the cards in the correct order. Before the program is run, the team checks it and explains its choices.

The robot team: looks at the cards and physically moves the robot, following each instruction in the specified order. It must not add commands, change direction independently or correct the program while it is running. If the robot does not reach its destination, the teams retrace the route together and look for the possible error.

After each mission, the teams swap roles. This gives everyone the opportunity to experience both programming and execution.

If there are three teams, a third team can act as observers: it checks the sequence, predicts the outcome and verifies whether the robot follows the instructions correctly.

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9. First Mission: Little Red Riding Hood

The robot must help Little Red Riding Hood reach her grandmother's house by travelling through the forest.

Place pictures of Little Red Riding Hood's house, the forest, the wolf and Grandma's house on the grid. The arrangement of the pictures determines the route to be followed.

The teacher introduces the mission: Little Red Riding Hood must reach her grandmother's house. The route goes through the forest, and some paths are blocked. The programmers must find the right way and prepare instructions that will guide the robot to its destination without entering any forbidden squares.

The team studies the grid, plans the route and lays out the command cards. Before the robot starts moving, the children describe their sequence aloud. The robot then follows all the instructions. If it reaches the destination, the mission is complete. If it ends up on the wrong square, the children must identify the command that caused the error and modify the program. The mission can be repeated with different obstacles or a new destination.

Story variation: the pictures can represent different scenes from the story. The children must reach the scenes in the correct order, linking programming with sequencing and reading comprehension.

10. Debugging - Learning from Mistakes

In coding, a program does not always produce the expected result. When this happens, the instructions must be checked to identify where something went wrong.

The teacher does not immediately give the solution, but guides the children with questions:

Where is the robot now? Where should it have ended up? Which instruction made it change direction? Can we change just one part of the program?

The children compare the planned route with the route actually taken, identify the error and correct the sequence. The program is then run again to check whether the change has produced the expected result.

A mistake is not a failure: it is useful information that helps us improve the solution.

11. New Missions

Once the basic commands have been learned, the teacher can introduce new challenges.

Obstacle course: the robot must reach a destination while avoiding forbidden squares.

The delivery robot: the robot must symbolically collect or reach an object and then deliver it to its destination by following a programmed route.

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The shortest route: the programmers must find a route to the destination using as few moves as possible.

Mystery program: the teacher prepares a sequence of commands, and the children predict where the robot will end up before running it.

Rebuild the story: the teams must reach different pictures in the correct order to recreate a familiar story.

For older children, repeated sequences can be introduced, such as three consecutive FORWARD commands, followed by cards representing a repeat. Conditions can also be introduced through explicit rules, such as: if the next square is occupied, choose an alternative route.

These extensions require the new instructions to be explained clearly and should only be introduced once the basic commands have been mastered.

12. Observation and Assessment

The teacher observes the working process, not just the final result.

Things to look for include the children's ability to understand and follow instructions, plan a sequence, predict the route, recognise an error and suggest a correction.

Particular attention is paid to collaboration: listening to classmates' suggestions, explaining their own choices, taking part in decisions and respecting the rotation of roles.

Assessment can be carried out through systematic observation, short discussions with the teams and a final reflection on the experience.

13. Final Reflection

At the end of the activity, the teacher invites the children to talk about what they have discovered.

Which part of building the robot was most difficult? How did we decide on the route? What happened when the robot went the wrong way? How did we find a solution? Did our classmates' ideas help us improve our work?

The activity ends with the understanding that programming means designing, communicating precise instructions, checking results and improving solutions.

Materials Provided with the Guide

The guide is accompanied by a set of matching printable resources:

Command cards: forward, turn right, turn left and further extensions.

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Little Red Riding Hood mission: pictures to cut out, settings and instructions.

Observation sheet: indicators for documenting individual and collaborative work.

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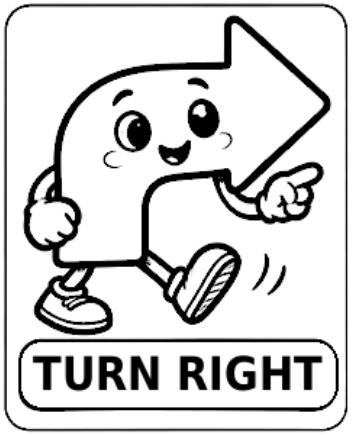

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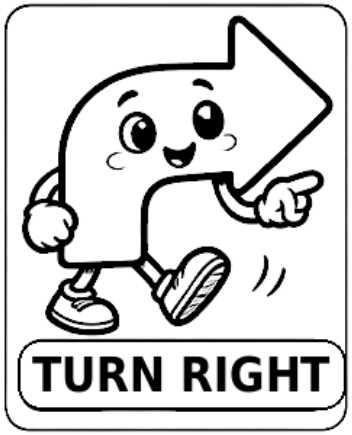

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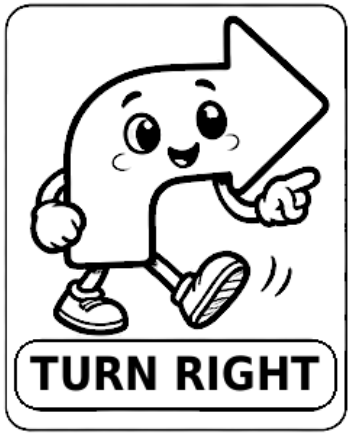

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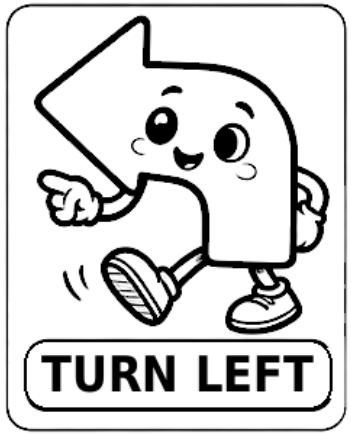

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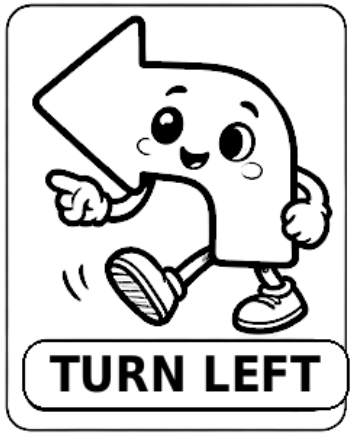

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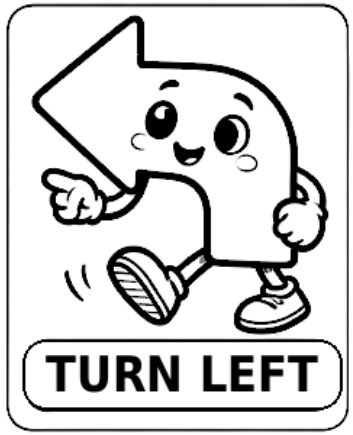

TURN RIGHT

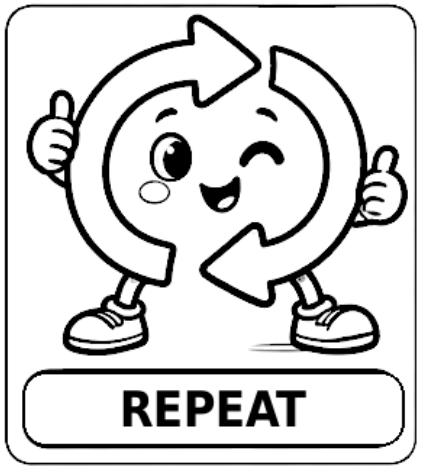

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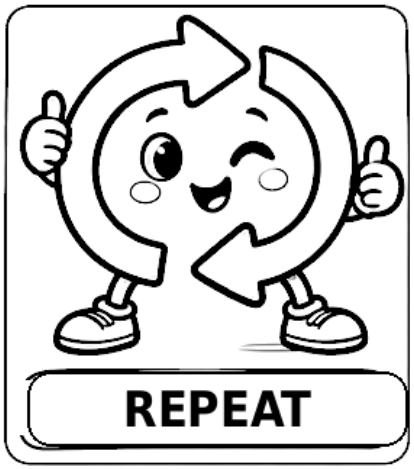

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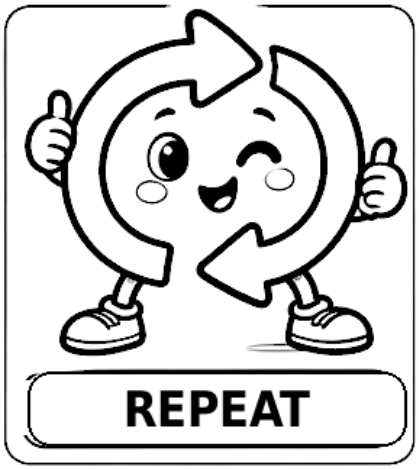

TURN LEFT

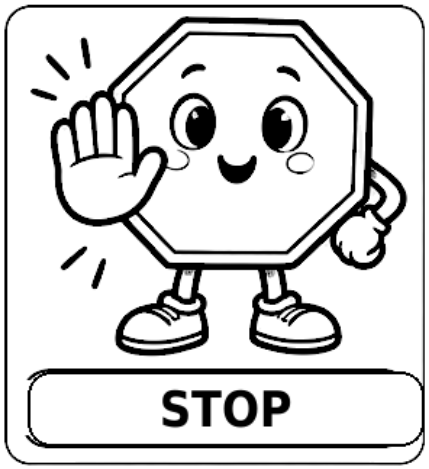

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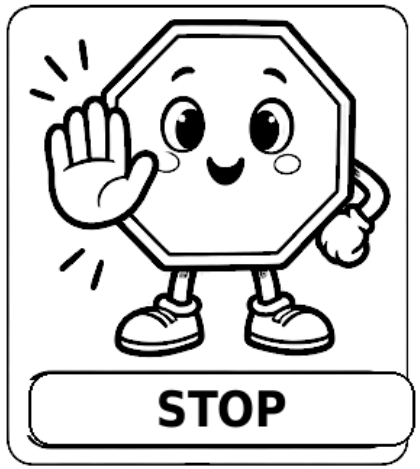

TURN LEFT


REPEAT


REPEAT


REPEAT

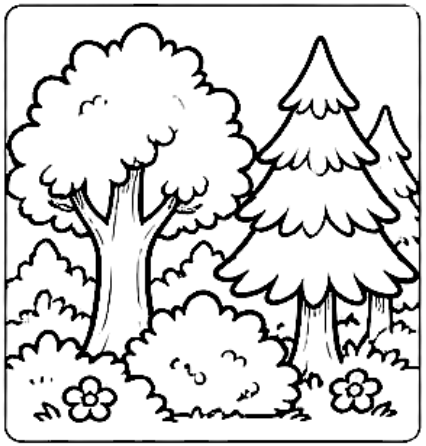

STOP


STOP

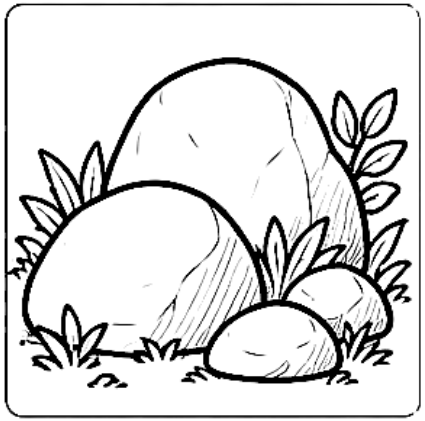
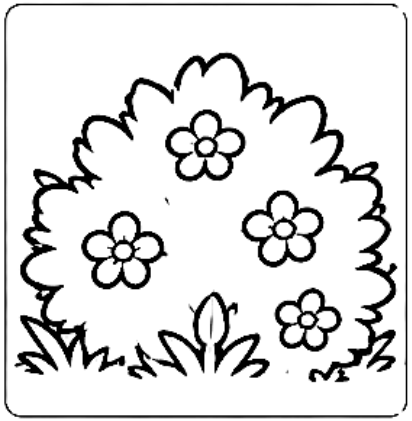
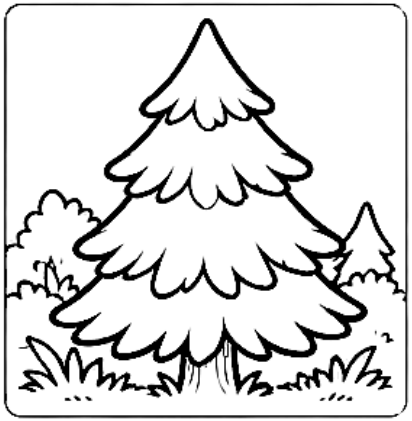








CLASS OBSERVATION GRID

Unplugged Coding – Build and Program Our Robot

Class: _____ Date: _____ Mission: _____

Pupil	Understands instructions	Plans the route	Uses directional commands	Predicts the outcome	Finds and corrects errors	Works collaboratively	Follows roles and rules	Explains choices
1. _____								
2. _____								
3. _____								
4. _____								
5. _____								
6. _____								
7. _____								
8. _____								
9. _____								
10. _____								
11. _____								
12. _____								
13. _____								
14. _____								
15. _____								
16. _____								
17. _____								
18. _____								
19. _____								
20. _____								

Key: 1 = developing · 2 = progressing · 3 = secure · – = not observed. Enter a number or symbol in the cells.

Notes: _____

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