

ROBOT GAMES (LEVEL 1)

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| Description | Learners will become familiar with the basic concepts of programming such as sequencing and repetition. They will then apply the concepts to solve challenges in a maze. |
| Leading Question | How can you create a robot that follows instructions and wins puzzles? |
| Total Time Required | ~ 1.15 hours over 5 days |
| Supplies Required | Paper, pen, pencils, small toys |
| Subjects | Computer Science, Literacy, Numeracy |
| Supervision | Medium |
| Learning Outcomes | By the end of this project, learners will be able to: <ol style="list-style-type: none"> 1. Understand basic principles of robotics 2. Write code/instructions that give robots commands on what they should do 3. Practice the coding/programming skills of “counting” and writing functions 4. Solve puzzles 5. Reflect on the relationship between robots and issues in their community |
| Previous Learning | None |
| Topics/Concepts Covered | <ul style="list-style-type: none"> • Sequencing • Instructions and algorithms • Functions • Repetition and loops • Problem-solving • Logical thinking • Counting and numeracy |

DAY 1- Today you will be learning about steps and creating instructions.

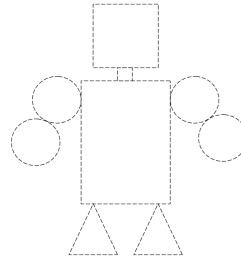
| Suggested Duration | Activity and Description |
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| 15 minutes | <ul style="list-style-type: none"> • Have you ever used a phone/tablet/computer? • What happens when you press a button on the phone/tablet/computer? (e.g., you start seeing pictures and images, the screen changes, it performs an action - calling, sending a text, reproducing a video, etc.) • How do you think these devices work? • Most electronics work by following a code or a program – a series of exact instructions, that are followed step-by-step. |

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| | <ul style="list-style-type: none"> ● Can you give me the instructions to walk from one place, say your home, to another place, say a friend/relative's house? ● Can you give me even more specific instructions, to, for instance, stand up and walk? <i>Explain that in order to walk, they need to follow the following steps:</i> <ul style="list-style-type: none"> ○ Lift one foot, ○ Move that foot forward ○ Place their foot down ○ Lift their other foot, ○ Move it forward, ○ Place the other foot down ● What happens when they miss a step? <ul style="list-style-type: none"> ○ Potential answer: They get stuck or fall ● The same thing happens with code when a step is missed. ● Break down/give the instructions on how to perform another regular task: picking up something, turning a page, etc. ● Ask the learner to try to break down another regular task: picking up something, turning a page, etc. <i>Try to break down the steps to another task, such as a popular dance routine; for example, the Hokey Pokey needs the following steps:</i> <ul style="list-style-type: none"> ○ Put right foot in, ○ Pull right foot back, ○ Put right foot in, ○ Shake right foot around, ○ Put right foot out, ○ Do the hokey pokey ○ Turn around in a circle. ● Explain that they will be learning to program their own robot and using it to solve puzzles! |
| <p>15 minutes</p> | <ul style="list-style-type: none"> ○ Have you ever seen a robot? ○ What is a robot? ○ What are some characteristics features of a robot that you may know of? Some common features of a robot may include sensing (ability to sense their surroundings), movement (ability to move around their environment), energy (ability to power themselves), intelligence (know what to do or how to perform its role). ○ Why do people create robots? |


You can ask your parents or an adult within your community/family if you have never seen a robot or ask them the same questions listed above. .

Next, design and draw your own robot – they can decorate their robot as they like. *Tip: The robots they design can be as simple as a box that they decorate, cubes stacked on top of each other or a 2D cutout (see Appendix 2 for sample robots).*

- o **Numeracy activity:** As a first draft of their robot, have them sketch out a design using shapes that they already know of – shown on the left.
- o Tip: The robots they design can be as simple as a box that they decorate, cubes stacked on top of each other or a 2D cutout (see Appendix 2 for sample robots).



- o **Learning how to code:**
- o Learners will now create a grid of 5 by 5 squares, an example is attached below – (a sample is attached under Appendix 1). The grid has to be large enough to accommodate the robot to stand in a single space
- o Additionally, cut out 2 or 3 other squares and mark them differently (using either different colored paper or coloring them)
- o Pick one square to be a start square, draw a green arrow on it
- o Pick another square to be the end and draw a red circle on it
- o Place an object or a toy as a “prize” on any square or use a colored square
- o *Tip: You could also use any existing space: tiles on the floor or mark out a space in sand/mud and mark the start/end square with a different colored paper/toy*
- o Here is an example of what a set up could look like this:

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| | <ul style="list-style-type: none"> o Explain to the learner that they have to list all of the commands/instructions that can help the robot to: <ul style="list-style-type: none"> o Move from the start o Pick up the object o Move to the finish o For their first try, help the learner “code” by making a list of the commands. o For the sample set up, the code will could be: <ul style="list-style-type: none"> o Start o Move forward o Move forward o Turn right o Move forward o Move forward o Pick up toy o Move forward o Move forward o Turn right o Move forward o End o Tell the learner to move the robot they created through the different steps to confirm that they work very well. o Have the learner try different versions of the code – if their robot falls out of the grid, they’ve “broken” the code |
| <p>20 minutes</p> | <ul style="list-style-type: none"> o Move the prize around and have the learner write code to reach the end point to reach and pick up the toy |
| <p>10 minutes</p> | <p>Reflection: Educator/parent meets with the learner(s) and have them reflect on the following questions:</p> <ul style="list-style-type: none"> - What have you learnt from today’s activities? - What do you remember the most from today’s activities? - What do you still have some questions about? <p>Educator/parent ensures to respond to any questions the learner(s) may still have on what they have learnt about today.</p> |

DAY 2 - Today the learner will learn how to shorten code by learning repeating functions

| Suggested Duration | Activity and Description | | | | |
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| 15 minutes | <ul style="list-style-type: none"> ● Literacy extension: Have the learner think about the different tasks that are already done by robots and how they make their lives easier – what tasks would the learner like to have a robot do for them? Invite the learner to imagine possible tasks and write a few words with them. | | | | |
| 10 minutes | <ul style="list-style-type: none"> ● Invite the learner to look closely at the “code”you. developed yesterday. ● What do you realize about the code developed? Brainstorm with the learner some ideas and orient their attention to the fact that some steps or instructions are repeated several times. ● Ask the learner to further identify the different steps that had to be repeated several times. ● Explain to the learner the concept of “counting” in code: that a code can be repeated for a set number of times. Example: move forward for 2 steps | | | | |
| 20 minutes | <ul style="list-style-type: none"> ● Use the example set up (from the previous day) and explain that counting could accomplish the same goal <table border="1" data-bbox="561 1150 1409 1619" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="561 1150 883 1192">Original code:</th> <th data-bbox="888 1150 1409 1192">New Code:</th> </tr> </thead> <tbody> <tr> <td data-bbox="561 1192 883 1619"> <ul style="list-style-type: none"> ● Start ● Move forward ● Move forward ● Turn right ● Move forward ● Move forward ● Pick up toy ● Move forward ● Move forward ● Turn right ● Move forward ● End </td> <td data-bbox="888 1192 1409 1619"> <ul style="list-style-type: none"> ● Start ● Repeat 2 times: move forward ● Turn right ● Repeat 2 times: move forward ● Pick up toy ● Repeat 2 times: move forward ● Turn right ● Move forward ● End </td> </tr> </tbody> </table> | Original code: | New Code: | <ul style="list-style-type: none"> ● Start ● Move forward ● Move forward ● Turn right ● Move forward ● Move forward ● Pick up toy ● Move forward ● Move forward ● Turn right ● Move forward ● End | <ul style="list-style-type: none"> ● Start ● Repeat 2 times: move forward ● Turn right ● Repeat 2 times: move forward ● Pick up toy ● Repeat 2 times: move forward ● Turn right ● Move forward ● End |
| Original code: | New Code: | | | | |
| <ul style="list-style-type: none"> ● Start ● Move forward ● Move forward ● Turn right ● Move forward ● Move forward ● Pick up toy ● Move forward ● Move forward ● Turn right ● Move forward ● End | <ul style="list-style-type: none"> ● Start ● Repeat 2 times: move forward ● Turn right ● Repeat 2 times: move forward ● Pick up toy ● Repeat 2 times: move forward ● Turn right ● Move forward ● End | | | | |
| 30 minutes | <ul style="list-style-type: none"> ● Set up the grid with the prize in any chosen square and have the learner go from start to finish while picking up the prize. | | | | |

DAY 3 - Today the learner will be encouraged to improve their robot by creating their own functions.

| Suggested Duration | Activity and Description |
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| 15 minutes | <ul style="list-style-type: none"> ● Explain that a function is a group of code, so for example: ● Walk: <ul style="list-style-type: none"> ○ Lift one foot, ○ Move that foot forward ○ Place their foot down ○ Lift their other foot, ○ Move it forward, ○ Place the other foot down ● So now, every time you need the robot to move, you can use the Walk function, instead of writing 7 lines of code – which makes it easier to code! |
| 15 minutes | <ul style="list-style-type: none"> ● Ask the learner to come up with their own functions for their robot navigate the grid ● <i>Encourage them to think of functions that would help them navigate the grid faster, such as “Jump 2” or “Turn Around” – let them get creative!</i> |
| 30 minutes | <ul style="list-style-type: none"> ● Set up the grid again and have the learners use their own functions to pick up the prize and navigate the grid |
| 15 minutes | <ul style="list-style-type: none"> ● Literacy activity: Have the learner make a list of the activities they perform in their daily lives. Can they convert those activities into functions? |

DAY 4 - Today the learner will be given new obstacles to code

| Suggested Duration | Activity and Description |
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| 10 minutes | <ul style="list-style-type: none"> ● Introduce new obstacles to the grid such as walls or holes or cracks that would affect the movement of robot around the grid ● <i>Tip: The grid can be expanded in size to accommodate more obstacles.</i> |
| 15 minutes | <ul style="list-style-type: none"> ● Work with the learner to decide on what new functions they would need to navigate and help them create new functions |
| 35 minutes | <ul style="list-style-type: none"> ● Reset the grid with the new obstacles and the prize and have the learner navigate the code, make it an obstacle course they have to solve. |

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| | <ul style="list-style-type: none"> For every time the learner gets the code right, either increase the number of prizes or obstacles to make the levels harder |
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DAY 5- Today the learner will use their new coding skills to create a story and a mission for their robot to complete

| Suggested Duration | Activity and Description |
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| 10 minutes | <ul style="list-style-type: none"> Together with the learner, create a story around the robot having to solve a mission. For example: <ul style="list-style-type: none"> The grid contains items causing pollution, such as trash, plastic bags, etc which need to be picked up to clean up the space. The learner creates a mission to find a gem/key – they need to find the object (which can be hidden under an obstacle) in order to open/unlock another obstacle and get to the end, etc |
| 5 minutes | <ul style="list-style-type: none"> Help the learner design and set up their own obstacles/prizes/boosters These can include: <ul style="list-style-type: none"> small boxes to hide prizes under A booster could special function that helps them overcome the grid (such as “break rocks”, “melt obstacle”, etc. |
| 45 minutes | <ul style="list-style-type: none"> Without the learner looking, set up the grid including the new obstacles, prizes and boosters Have the learner write the code to solve the mission and keep track of the different attempts. <i>This might take several tries</i> Once they have successfully solved the mission, have them build a story around the mission, including how they had to restart the mission, what new boosters they found on the way, etc |

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| Additional Enrichment Activities | <p>Advanced Coding Challenges:</p> <ul style="list-style-type: none"> Introduce more complex coding challenges using the grid, such as loops and conditional statements. Encourage learners to optimize their code by using fewer steps and functions. <p>Storytelling with Robots:</p> <ul style="list-style-type: none"> Extend the storytelling element of the project by having learners create narratives around their robots. |
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| | <ul style="list-style-type: none"> • They can write short stories or create comic strips depicting their robots' adventures. |
| <p>Modifications for Simplification</p> | <ul style="list-style-type: none"> • The learners can convert the whole project into a game where they are the robot themselves – making it one where physical activity is encouraged. They can then play the grid, where they jump over obstacles. |

ASSESSMENT CRITERIA

A majority of my learners were able to:

- Demonstrate a clear understanding of coding concepts, such as sequencing, repeating functions, and creating custom functions.
- Write accurate and functional code to navigate the robot through the grid and complete the given missions.
- Show effective problem-solving skills when encountering obstacles or challenges in the coding process.

APPENDIX 1 – SAMPLE GRID

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APPENDIX 2 – SAMPLE ROBOTS

