SUMMARY:
Learners will explore programming.

GRADE LEVEL:
This activity has been used successfully with 1st to 3rd graders.

TIME:
This activity takes approximately 30 minutes with 1st to 3rd graders. Depending on learners' prior experience this time may need to be extended or shortened.

SUBJECTS:
Programming, Logical thinking.

LEARNER BACKGROUND:
None needed

LEARNING OBJECTIVES:
Completing this activity will allow learners to:

- ❑ understand that a program is a series of instructions.
- ❑ understand how to order instructions to perform an activity.
- ❑ understand that

Discover Question:

Using just a few commands can you create a program for a robot to find and dispose of the toxic waste in a contaminated room?

Background:

This activity encourages learners to explore introductory programming concepts.

Learners will be challenged to think logically step by step to develop a program that will.

Many commands can be accomplished using other commands. For instance, instead of using TURN RIGHT you could use 3 TURN LEFT commands to accomplish the same movement.

The educator needs to facilitate the sharing of observations and ideas. Try to avoid answering questions directly. Instead, ask questions like what have you tried? What do you notice? What else could you try? These types of questions encourage further exploration.

Materials:

- ❑ Waste (glue bottle) and containment vessel (box)
- ❑ Create a simulation area consisting of a grid that is at least 8 squares by 15 squares. If you have tiles then you can use masking tape to just highlight the edge of the grid.
- ❑ You may want multiple simulation areas so that teams do not have to wait to try out their programs.

Resources and Handouts:

- ❑ Programming Commands
  - ✓ Some assembly required. The cards can be printed, cut out and used either as-is or laminated. If you do not have access to a laminator you could just put some clear contact paper on them.
  - ✓ Turn Left, Turn Right, Forward 1, Backward 1, Pick Up Object, Put Down Object, Forward 10, Backward 10

Procedure:

1 You can introduce the activity any way that is appropriate for your class. I have told learners that there has been an accident and that we need to send in a robot to clean up the toxic waste.

2 All we know is that the room with the toxic waste is this big and that the waste is sitting here and the containment vessel is sitting over here. Using these instruction cards create a program that will allow a robot to retrieve the waste and move it into the containment vessel. The only rule is that you are not allowed to walk into the room with the toxic waste. We have a simulation area where we can try out your programs.

3 Divide your class into groups of 2 to 4 learners. Give each group member a task. I find 3 to a group is a reasonable number (programmer, a debugger/card reader and a test robot). With larger groups you may want to give each member a stack of commands (*i.e.* FORWARD and PICK UP OBJECT for 1 member *etc.)* .

4 Have test robots (which can be one of the group members) try the group's program in the simulation area.

5 When robots misinterpret programs encourage learners to fix programs by asking open-ended questions "What went wrong?" "Why do you think the robot got confused?" "What could you do differently?"

6 As each group successfully completes the task have them write out their program to share with the other groups. Discuss the differences and similarities in the programs.

7 Once a group has successfully completed the task, remove a set of cards and have them complete the task again. I like to remove all the turn right cards from one team, all the turn left cards from another team and the move forward cards from another team.

MODIFICATIONS/ ADAPTATIONS:

Older learners typically find this just as challenging as younger students.

Younger learners (pre-readers) can use the pictures on the cards to remind them what each instruction will make the robot do.

HELPFUL HINT:

Have a member of another team read the instruction set to the robot. Learners will be able to see exactly when the program needs to be fixed.

EXTENSIONS:

✓ Have different teams position the waste and containment vessel in the simulation area. Challenge other teams to make a program.

8 Challenge groups to remove other commands from their programs.

9 Discuss the differences and similarities in the programs. Which program uses the least number of instructions? Which program uses the least number of steps (instruction cards)?

10 Use one of the programs (or make up a program) and challenge the whole class or the individual teams to reduce the number of instructions.

11 Discuss results from other extensions you may have explored.

Safety Considerations:

None.

Assessment Ideas:

❑ Has the group created a working program stack?
❑ Individually, has the learner participated?
❑ Can the learner create a program stack to make you walk forward turn around and continue walking in the same direction?

Internet Resource:

This is part of a NatureShift unit introducing programming that can culminate in controlling the Mars Rover telerobot.

Extensions:

✓ Try to write a program for a room where you do not know exactly where the waste is located. What additional commands might you need? This can be used to introduce conditional statements (if/then or do/while type commands).

Credits:
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