The School and University Partnership for Educational Renewal in Mathematics
An NSF-funded Graduate STEM Fellows in K–12 Education Project
University of Hawai'i at Manoa, Department of Mathematics

Robot Programming II: Think Like a Robot

Grade Levels

This activity is intended for students grades 3rd-6th

Objectives and Topics

This purpose of this activity is to introduce students to robotics, programming, and how robots (computers) interpret commands. Students learn the necessity of the precision of their statements (Mathematical Practice #6) and must cooperate in tandem to complete a task.

Materials and Resources

- Note cards with robot commands (see below)

- NXT simple wheeled vehicle (optional)

- Computers with NXT Mindstorms Programming software installed (optional)

Introduction and Outline

To lead this activity, please read through and have a thorough understanding of the forthcoming activities to motivate discussion.

As in the first part of this series, students will program a "human robot" to carry out simple tasks. The difficulty is increased, since the program must be planned out ahead of time (as is done in real life). The possible instructions are given on the note cards. Split students into small groups, and give a set of note cards to each group.

Allow some time for students to re-familiarize themselves with the commands on the cards.

Give a task to be completed. All teams will write a program to complete this task by placing the desired note cards in a stack. The program will be executed by completing the commands in the order that theyÕre stacked up. The stack must be made before the robot carries it out, so the groups need to plan the entire process out ahead of time.

At various intervals (5-8 minutes), groups can test their program by having one member act as the robot and

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another reading the commands from the note cards. It is important to only allow a small number of tests, otherwise the programs can be put together on the spot.

After several tests (20-25 minutes total), groups will demonstrate their programs. One at a time, groups will read their program to a "robot body" student selected from another group (so that he/she does not know the exact commands about to be given).

Small modifications can be made to the program so that groups can have some success, but emphasize the importance of pre-planning, and that in real life a robot will only do exactly what it is told.

Upon successful completion, briefly discuss the outcome, and repeat if time permits.

Problems

Discussion

Lead a class discussion on the activity. What went right/wrong? Other interesting points?

In the first part, we saw how to translate a task into something a robot can understand. In this part, we experience that programs must be written first and executed later. In real-life robot programming, people write the program on a computer and load it on to the robot, then the robot completes the tasks. So the entire procedure has to be planned ahead of time. If there are mistakes in the program, the robot will make these exact mistakes.

Simple NXT Programs

This section is optional purely based on the availability of resources.

Once the student activity is finished, the students may then be given more complex (but still simple) tasks for the NXT simple wheeled vehicle to execute. This can be similar tasks to those the students were previously handed as the robot body and brain, or tasks where the sensors must be used. If the students are new to the NXT programming software, this would also be an appropriate time to give them a tutorial on using the software.

For Instructions on how to build NXT vehicles, check out the Lego NXT Constructopedia:

http://www.education.rec.ri.cmu.edu/content/lego/building/media/Constructopedia%202.pdf

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Turn_____ for _____ degrees	Go forward/ backward for _____ steps
Turn_____ for _____ degrees	Go forward/ backward for _____ steps
Turn_____ for _____ degrees	Go forward/ backward for _____ steps
Wait for _____ seconds	Keep going until _____ _____
Repeat the next _____ cards _____ times	Repeat the next _____ cards _____ times