

Lesson 7

Going the Distance

Suggested Time

One 60-minute session

Lesson Overview

Students will build and program a LEGO car to travel across a table. In doing so, they will explore the WeDo programming language. They will learn how to program with motor speeds, wait statements and loops.

- Class discussion of different building methods.
- Building of sturdy car with gears.
- Overview of programming the car to move forward.
- Exploration of acceleration, deceleration, loops, wait statements and motor speeds.
- Recording design and test results in Engineering Journal.

Learning Objectives

By the end of this lesson, students will be able to:

- Define WeDo programming terms.
- Be familiar with the WeDo programming language.
- Define engineering design as the process of creating solutions to human problems through creativity and the application of math and science knowledge.

Teacher Background***Introduction to Programming***

Start Block:

This is the initiation of the program. This is needed to make the program go or commence.

Wait Statements:

This is used to stall the program in the state that it is currently in. This activity will use the wait statement to keep the motor running for a specific amount of time.

Power Levels:

When the motor is running, different levels of power, that relate to motor speed can be selected. The higher power level relates to a higher speed.

Motor “This Way” or “That Way”:

The direction of the motor is controlled by the direction of the arrow on the motor programming block. The best way for students to determine the forward direction is to test it.

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Loop:

Loops are used to repeat a section of programming. This is useful in the acceleration and deceleration challenge in that it repeats the motor forward code, but adds or subtracts to the speed for each loop.

* info & technical terms*

Engineering Design

Engineers typically work together to solve the problems that face society. Engineering design is the process of creating solutions to human problems through creativity and the application of math and science knowledge. The basic steps within the design process include:

- i. Identifying a problem** – Observing a problem and seeing a need for a solution.
- ii. Researching possible solutions** – Coming up with ideas to address the problem.
- iii. Picking the best solution** – Determining which idea best addresses the problem. This decision may involve monetary, practicality, material, and property concerns.
- iv. Building a prototype** – Build a working model of the chosen design
- v. Testing the prototype** – Be sure the working model solves the problem and holds up to any important material property tests.
- vi. Repeating any steps needed to improve the design** – The engineering design process is not always a step-by-step process, as engineers often repeat steps or go back and forth between the other five steps.

Vocabulary

Engineering – the process of creating solutions to human problems through creativity and the application of math and science knowledge.

Start Block – the start block is used to begin or start the program.

Speed – the distance traveled over a specific time. $V = d/t$

Motor Statement – turn the motor on in a specific direction. Other motor commands include: Motor On For Block, Motor Power Block, and Motor Off Block.

Power Level – the power level is the speed at which the motor will spin. This is used with the Motor Power Block

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Wait Statement – this causes the program to continue in its current state until a specified time has elapsed.

Loop Statement – this repeats a section of code. Use this when you are going to need to do the same thing over and over again.

Add or Subtract Block – add or subtract numbers to the current display number. This is useful when increasing or decreasing power levels or changing wait statement times.

***more terms related to activity**

Materials

For each student

- Engineer’s Journal Part 1

For each student pair

- WeDo kit

For the class

- Handout with program terminology of the programming blocks.

	Start Block
	Start On Key Press Block
	Start On Message Block
	Motor This Way Block
	Motor That Way Block
	Motor Power Block
	Motor On For Block
	Motor Off Block

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Play Sound Block



Display Block



Add to Display Block



Subtract from Display Block



Multiply by Display Block



Divide by Display Block



Display Background Block



Send Message Block



Wait For Block



Repeat Block



Text Input



Number Input



Random Input



Record Stop Play

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Motion Sensor Input



Tilt Sensor Input



Tilt Up



Tilt Down



Tilt This Way



Tilt That Way



Any Tilt



Sound Sensor Input



Display Input



Bubble

Preparation

- Distribute Engineering Journals
- Prepare an example program for acceleration and deceleration

Instructions for Teachers**Going the Distance**

1. Begin with a class discussion about programming. Explain why programming is important and what it is used for. Robots are programmed to carry out a specific task.

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2. Show students the basics of programming. It would be helpful to do this on a projector with the students. If this is not possible, show the students before they get on the computer.
3. Make sure students understand the terms of the WeDo programming language. Also, clarify any questions they may have.
4. Gather students again, and tell them that they will be building and programming a LEGO car to travel across the table. When they program the car, they should be able to make it accelerate or decelerate in addition to it traveling at a steady speed.
5. Allow 20 minutes for students to build a LEGO car.
6. Allow 5 minutes for students to program their car to travel at a constant speed. When students are ready, have them demonstrate this and record their program in their Engineering Journals.
7. They can move on to the acceleration and deceleration challenges. Have them demonstrate and record their program in their Engineering Journals. If they are having trouble with this, explain how they can use loops and the addition/subtraction statements to change the speed of the motor.
8. Gather students to discuss what they learned. Make sure to point out any problems that students ran into while programming their cars. Demonstrate your car accelerating and decelerating. Also display your program for the class to see.



When “A” is pushed, the motor will turn at a power level of 5 for 1.5 seconds and then stop.



When “D” is pushed, the display value begins at 8. The motor will turn at a power level of 8 for 0.5 seconds. The display also subtracts 1 from 8 to display 7. For each consecutive loop, the power level will be one less than it was in the previous loop. Thus the motor is decelerating.

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When “D” is pushed, the display value begins at 1. The motor will turn at a power level of 1 for 0.5 seconds. The display also adds 1 to 1 which displays 2. For each consecutive loop, the power level will be one more than it was in the previous loop. Thus the motor is accelerating.