

Lesson 9

Mountain Rescue

Suggested Time

One 30-minute session

Lesson Overview

Students will build and program a LEGO car that uses gears to travel up a steep incline. Students will explore the use of gears to give their car more power as well as car design to increase the amount of friction between the wheels and the incline.

- Class discussion of different building methods.
- Building of sturdy car with gears.
- Overview of programming the car to move forward.
- Testing car designs on the incline.
- 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.
- Be familiar with gears.
- 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.

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.

Friction – the force that opposes the motion of a surface that moves against another surface. This is what reduces slipping between the wheels of a car and the road it travels on. The force of friction is extremely dependent on the weight of the moving object.

Gearing Down – a small gear to a big gear. This results in the follower rotating much slower than the driver.

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

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

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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

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.

*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

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Motor This Way Block



Motor That Way Block



Motor Power Block



Motor On For Block



Motor Off Block



Play Sound Block



Display Block



Add to Display Block



Subtract from Display Block



Multiply by Display Block



Divide by Display Block



Display Background Block

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Send Message Block



Wait For Block



Repeat Block



Text Input



Number Input



Random Input



Record Stop Play



Motion Sensor Input



Tilt Sensor Input



Tilt Up



Tilt Down



Tilt This Way



Tilt That Way



Any Tilt



Sound Sensor Input



Display Input



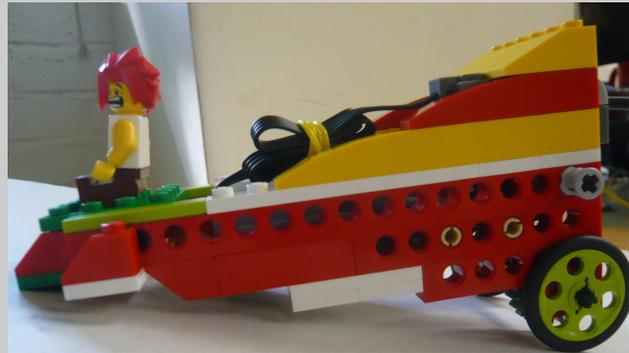
Bubble

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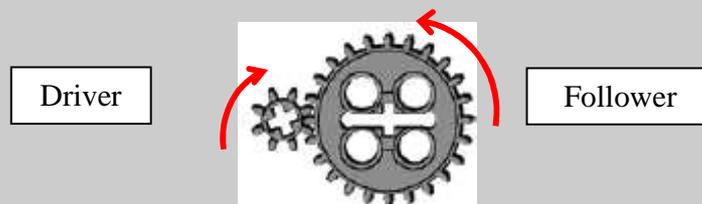
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Preparation

- Distribute Engineering Journals
- Prepare an example car and program
- Set up a ramp to do the incline testing

Instructions for Teachers**Mountain Rescue**

1. Begin with a class discussion about gearing down. Remind them of the Exploring Gears lesson where they discovered that gearing down results in a slower motion of the follower gear.



2. Also discuss the effects of friction and how it reduces slipping between two objects. Friction is what allows a person to walk across a floor and allows a car to travel across a road and up an incline. Explain how friction is also dependent on weight.
3. Tell the class that they will be building and programming a car to travel up a steep incline. Show them your example car and how you geared down. Also point out how you shifted the weight of the car to increase friction at the wheels.
4. Allow 10 minutes for student pairs to build their cars. Have students program their cars to accelerate from rest. This will insure that their cars don't slip at the base of the incline.

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5. Have students test their designs one at a time. If they come across any problems, students may redesign their cars and retest them.
6. Gather the students to discuss their design methods. Ask them what worked and what did not work in their car designs. Ask what they did to fix any problems they came across.
7. Allow time for students to record their design and the race results in their Engineering Journals.