**Gear Effects on Speed of the Lego Robot Car** Mollie Cupp

Purpose: To determine the effects of gears on the speed of a car. To calculate gear ratios and use them to predict speed increase.

Objectives: PS 1, PS 10

Prior Knowledge: How do you use the gears on a bike to increase your speed.

Procedure:

1. Have students review the method they used to find the speed of their robot cars in the previous lesson. Explain that they will use gears in this lesson to increase the speed of the cars. A gear is an application of the wheel and axle- one of the 6 simple machines.

2. Have students get out a variety of gears and identify them by counting the number of teeth. Instruct students to put an axle on an 8 tooth gear and a 24 tooth gear. Place them in a beam so that they mesh. Instruct students to turn the 24 gear around one rotation and count the number of rotations the 8 gear makes. The 8 gear turned three times in the time the 24 turned once. With this gear combination, we would expect the car to go three times faster.

3. Have students repeat this process for various gears.

|  |  |  |  |
| --- | --- | --- | --- |
| Gears Used | Gear Ratio | Number of Rotations of small gear when first gear turned once | Predicted Speed Increase |
| 24 and 8 | 3:1 | 3 | 3 x |
| 40 and 8 |  |  |  |
| 16 and 16 |  |  |  |
| 20 and 12 |  |  |  |

4. Students recall and record the speed of the robot car from previous lesson.

5. Students use the internet page [www.teamhassenplug.org/NXT/Gears/](http://www.teamhassenplug.org/NXT/Gears/) to build an assembly that allows them to attach gears to the motor.

6. Students follow the same procedure as in the Calculate the Speed lesson to find the speed of the car with each of the gear assemblies.

Speed of Car without gears \_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Gears | Gear Ratio | Predicted Speed | Actual Speed | Actual Speed Increase |
| 8 and 24 |  |  |  |  |
| 16 and 16 |  |  |  |  |
| 12 and 20 |  |  |  |  |

Assessment:

Which gear ratio resulted in the greatest increase in speed?

What do you expect to happen to the speed of the car if you attach the motor to the smaller gear?

Why doesn’t the actual speed increase match your predicted speed increase?