

**Topic: Ratios and Proportions**

**Teacher:**

**Genre: Math**

**Grade Level: 6th grade**

**Unit: Ratios & Proportions**

**Duration:**

**Essential Question**

**(Domain 1: Planning and Preparation-Component 1c: Designing Coherent Instruction)**

- How do you recognize and represent proportional relationships between quantities.

**Background Knowledge**

**Background Summary:** Students will be introduced to gears as a simple machine and learn how to solve ratios and proportions from the use of the gears. Students will understand the proportional relationship between different size gears and how it affects the distance their robots will travel.

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**Lesson Objective:**

- Students will be able to identify proportional relationship and gear ratios.
- Students will be able to understand the proportional relationship between gear sizes and how it affects the distance the robots travel.
- Students will identify proportional relationships in a real world scenario .

**Standards**

**(Domain 1: Planning and Preparation- Component 1a:Demonstrating Knowledge of Content and Pedagogy)**

**Connection to Common Core Math Standards**

- 6.RP.A.1 - Using proper language to describe ratios.
- 6.RP.A.2 - Understanding a unit rate.
- 6.RP.A.3.A - Make tables of equivalent ratios relating quantities with whole-) number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
- 6.RP.A.3.D - Using units properly
- 7.RP.A.1 - Computing unit rates of fractions
- 7.RP.A.2 - Recognize and represent proportional relationships between quantities.
- 7.RP.A.2.B - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- 7.RP.A.2.C - Represent proportional relationships by equations.
- 7.RP.A.2.D - Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate

<b>Vocabulary</b> <b>(Domain I: Planning and Preparation - Component 1e: Demonstrating Knowledge of Students.)</b>	<b>Prep Work/Materials</b> <b>(Domain 1 Planning and Instruction- Component 1e: Designing Coherent Instruction, Domain 3 Instruction- Component 3c: Instruction Engaging Students in Learning)</b>	<b>Cross Curricular Connection</b> <b>(Domain I: Planning and Preparation - Component 1a: Demonstrating Knowledge of Content and Pedagogy, Component 1b: Demonstrating Knowledge of Students.)</b>
Ratios Proportions Proportional Relationship Unit Rate Distance Gear Speed Torque Ultrasonic sensor input output Simple Machine Unit rate	Lego mindstorm kit and program Lego mindstorm robot with ultrasonic sensor notebook pencil video - Gear and wheels part 1 tape measure computer calculator SMART Board	Math Science Technology
<b>Differentiation</b> <b>(Domain I Planning and Preparation-Component 1e: Designing Coherent Instruction, Domain 3: Instruction - Component 3b: Using Question and Discussion techniques Domain 3: Instruction - Component 3c: Engaging Students in Learning)</b>		
<ul style="list-style-type: none"> <li>• Visual: video</li> <li>• Auditory: Lecture and Class Discussions</li> <li>• Verbal: Worksheets</li> <li>• Kinesthetic: robot activities, active participation</li> <li>• Students will be working in small groups 3-4 per groups</li> </ul>		

<p><b>Procedure:</b>  <b>(Domain I Planning and Preparation-Component 1e: Designing Coherent Instruction, Domain 3: Instruction - Component 3b: Using Question and Discussion techniques Domain 3: Instruction - Component 3c: Engaging Students in Learning)</b></p>	<p><b>Student Engagement (Teacher Assessment)</b></p>
<p><b><u>Introduction:</u></b></p> <ul style="list-style-type: none"> <li>Teachers will have students read the scenario and discuss.</li> </ul> <p>You are building a few difficult vehicles for different situations. You need to decide which gear ratio works best for what you want the vehicle to do.  (different groups will receive different situations for their vehicles)</p> <ul style="list-style-type: none"> <li>Discussing Gear Ratio Activities (distance, speed, and torque) expectations for students, and showing students the way these robots work that are put together</li> <li>Students will watch a short video on Gears to gain understanding and a visual perspective of ratios and proportions.</li> <li><a href="https://www.youtube.com/watch?v=D_i3PjIYtuY">https://www.youtube.com/watch?v=D_i3PjIYtuY</a> watch first 5:39</li> <li>Students and teachers will discuss the video and how it was helpful.</li> <li>The teacher will explain the class robot activity to the students and then the students will break up into groups.</li> </ul> <p>(In groups of 3-4)</p> <ol style="list-style-type: none"> <li>1. Using built robot, students need to start the gear ratio program.</li> <li>2. Measure the distance traveled with a tape measure, and using the ultrasonic meter on the robot. Put ultrasonic distance in a table</li> <li>3. Change the gear ratio for both of the back wheels. (from 1-1 to 1-3, etc)</li> <li>4. Repeat steps 1-3 until all gear ratios have been tested. Make sure to test each gear ratio more than once in case something goes wrong in data collection.</li> </ol> <p><b>Circulating and asking students to talk through their thinking as they analyze data:</b></p> <p>*(In groups of 3-4)</p> <p>Analyzing their results through group discussion</p> <p>Writing down their analysis, discussing why they think the robot moved differently with different gear ratios. Which ratio made the vehicle move the farthest? What about the shortest distance? Why? What does this tell you about gear ratios? Do you notice a pattern in the distance traveled and the ratio? How is it related to the gear ratio?</p> <p><b>Facilitating a discussion about the data analysis for this activity. Asking questions like:</b></p> <ul style="list-style-type: none"> <li>- What does this tell us about gear ratios?</li> <li>- Did your results fit with your predictions? Why or why not?</li> <li>- How are the different gear ratios related to the distances?</li> </ul>	

<b>Assessment (Formative or Summative)</b> <b>(Domain 1 Planning and Instruction- Component 1e: Designing Coherent Instruction, Domain 3 Instruction- Component 3c: Engaging Students in Learning, Domain 3 Instruction- Component 3d: Using Assessment in Instruction)</b>	<b>Student Engagement (Teacher Assessment)</b>
<b>Additional Resources</b>	
<b>Homework:</b> <a href="http://www.depts.ttu.edu/tstem/curriculum/robotics/docs/gear_ratio_worksheet.pdf">http://www.depts.ttu.edu/tstem/curriculum/robotics/docs/gear_ratio_worksheet.pdf</a> <b>Video:</b> <a href="https://www.youtube.com/watch?v=D_i3PJIYtuY">https://www.youtube.com/watch?v=D_i3PJIYtuY</a> Play first 5:39.	