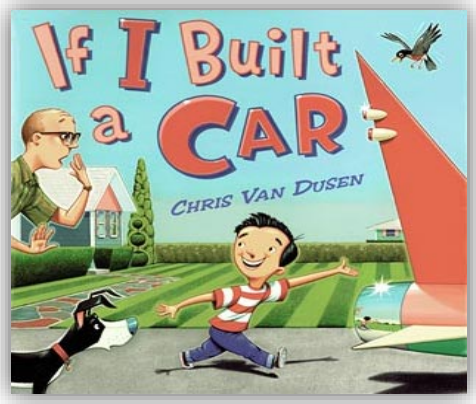
Teacher's Guide

If I Built a Car by Chris Van Dusen



Grade Level: 3rd Grade

Unit: Structures and Models

Science Concepts/Standards

- Motion and Stability
- Forces and Interactions
- Forces and Motion

Mathematics Concepts/Standards:

- Measuring Objects
- Interpreting Data

Engineering and Technology Concepts/Standards

- The Role of Troubleshooting, Research and Development, Invention and Innovation and Experimentation in Problem Solving
- Appling the Engineering Design Process
- Using Tools to Build Artifacts
- Investigating How Objects are made

Big Ideas:

- Engineering design process
- Using brainstorming to solve problems
- Applied creative thinking for innovation
- Understanding the importance of measurements when constructing
- Understanding the concept of motion, force, and energy
- Ability to work with peers
- Understanding the value of money

Essential Question: How can you design a car that will allow Jack and his friends to safely travel down three different ramps?

Scenario: Oh no! Jack thinks his dad's car is boring and plain. He imagines a safe and unique car that he wants to build but Jack can't construct the car without you! Please help Jack build a unique car that will safely carry two or more passengers down a hill.

Pre-Lesson Activity: The students need to read the book *If I built a Car*. After reading the book, the students will be placed into groups of four where they will work as a team to solve the design problem using the engineering design loop provided. To avoid wasting materials, the students will need to develop an idea, present it to the teacher, and then "purchase" the materials using a credit/debit money system. Once the students have built their cars and made any necessary changes, they will then test the vehicle on a ramp to

determine the power of the car. The students will weight their car and record it. Then they will measure the distance that the car travelled and record it. Then the students will add more weight (metal washers) to their cars to see the effects of weight and record it. The team whose car has the most power (most efficient) wins the contest. To calculate power, the teams will multiply force (weight of the car) x distance = work. Then they will divide work by time = power. The highest "power rating" will be the most efficient vehicle.

Parameters: The car must:

- Be completed within the assigned time period
- Be able to safely roll down the ramp with at least two passengers (metal washers)
- Be designed using the engineering design loop
- Be made only using the materials provided
- Be documented by each group member in the engineering design loop
- Roll down a test ramp
- Have an open top where passengers (washers) can be added. The passengers must remain inside the vehicle during testing and cannot adhered to the vehicle.

Materials & Resources: Teams will start the activity with 5 Lei in credit and they may purchase materials from the following list:

(1 Leu) scissors	(3 Lei) Car building kit	(1 Leu) 1 sheet paper
(1 Leu) 10 cm tape	(price negotiable) other recyclables	(1 Leu) 1 straw
(no cost) Washers	(no cost) Testing ramp	

*Each group may have a pair of scissors and (x) amount of metal washers. The students will need to buy the materials using a credit/debit system. *

Content Information:

Students will need to know how to measure and estimate an objects length in order to create a stable vehicle that will propel forward. The value of money would also need to be discussed so that the students will be able to determine what materials they can and cannot afford. The teacher will need to discuss Newton's first law of physics. This will allow the students to understand the reasons why the car starts and stops moving. They will need to be able to understand the effects of friction and other forces that will work against the car while it's in motion.

Newton's First Law: An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

Friction: The resistance that one surface or object encounters while moving over another.

The students will also need to understand how to calculate the efficiency rating of their vehicles after testing. To calculate power, the teams will multiply force (weight of the car) x distance = work. Then they will divide work by time = power. The highest "power rating" will be the most efficient vehicle.

Car Construction

Scenario: Oh no! Jack thinks his dad's car is boring and plain. He has imagined a safe and unique car that he wants to build but Jack can't construct the car without you! It is up to you to help Jack build a unique car that will safely carry at least two passengers down a hill.

Challenge: Construct a car, using the materials provided, that will allow multiple passengers to safely travel down a ramp.

Deliverables: At the end of this challenge, each group will need to turn in the car that they constructed. Each group member will turn in his or her notes/documentation of the engineering design process, and efficiency rating for their car, and the peer evaluation form.

Parameters: The car must:

- Be completed within the assigned hour
- Be able to safely roll the two or more passengers down a ramp
- Be designed using the engineering design loop
- Be made only using the materials provided
- Be documented by each group member
- Roll down a ramp carrying passengers (washers)
- Have an open top and passengers cannot be taped or held down by any materials.

Materials & Resources: Teams will start the activity with 5 Lei in credit and they may purchase materials from the following list:

(1 Leu) scissors	(3 Lei) Car building kit	(1 Leu) 1 sheet paper
(1 Leu) 10 cm tape	(price negotiable) other recyclables	(1 Leu) 1 straw
(no cost) Washers	(no cost) Testing ramp	

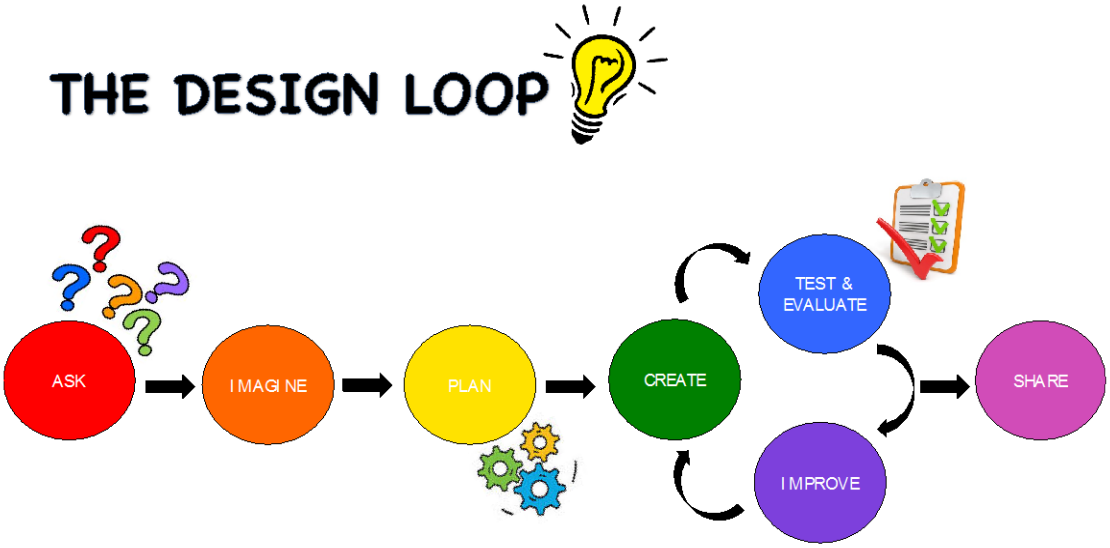
*Each group may have a pair of scissors and (x) amount of metal washers. The students will need to buy the materials using a credit/debit system. *

Test:

1. Test the solution on the ramp and make any adjustments needed.
2. Add passengers (washers), weigh the vehicle, and then calculate an efficiency rating for the car.
3. After finalizing the solution, the group will need to present their cars to the class and discuss the process of building the car.

4. After the first round of testing, the students will add passengers (washers) to their cars to see what effect the weight has on the cars. The students will need to record their findings.
5. Lastly, each group member will need to write 3-4 sentence discussing why or why not their model was successful and what improvements they would make if they were to repeat the assignment.

Documentation: Each team must create Jack's car by using the design loop. Remember to document every step your team makes while completing the assignment.



My problem is:

My goal is:

My model will look like:

Or this…

Or this…

The materials I need are:

The best solution is:

My group member's duties are:

My results are:

The adjustments needed:

The final results are (efficiency rating):

Peer Evaluation

Name: _____

Group Number _____

Rate your group members 1-5
1 = did not participate and 5 = took the lead/extremely helpful

Group Members Name	Brain Storming (1-5)	Creating Model (1-5)	Collecting Data/Testing/ Presenting (1-5)

Why or why didn't your model work? What could you change?

Teacher Evaluation:

Student's name _____

Group Number: _____

Car was submitted on time	/10
The car successfully carried the passengers down the ramps	/25
The car demonstrated uniqueness, creativity, and efficiency	/10
The student's clearly presented their car to the class	/15
The group demonstrated their understanding of the design loop process	/20
Documentation of the design loop and peer evaluation	/20
Total	/100

Additional comments:
