

Title: Dog Treat Slinger Challenge

Grade Level 3rd Grade

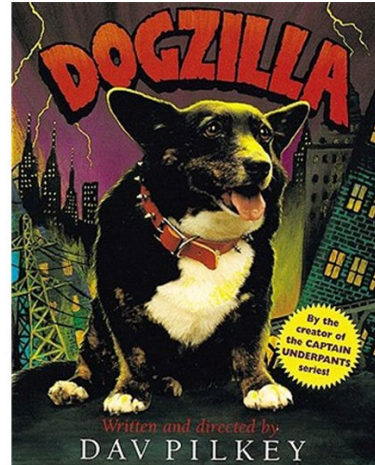
Literacy Connection: *Dogzilla* by Dav Pilkey

STEM Content Standards:

Science

Physical Science

- 3-PS2-1 - Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2 - Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.



Technology and Engineering

Engineering, Technology, and Applications of Science

- 3-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Standards for Technological and Engineering Literacy

- Standard 2: Core Concepts of Technology and Engineering
 - L. Create a new product that improves someone's life.
- Standard 5: Influence of Society on Technological Development
 - E. Explain how technologies are developed or adapted when individual or societal needs and wants change.
- Standard 7: Design in Technology and Engineering Education
 - I. Apply the technology and engineering design process.
 - M. Evaluate the strengths and weaknesses of existing design solutions, including their own solutions.
 - N. Practice successful design skills.
 - O. Apply tools, techniques, and materials in a safe manner as part of the design process.

Mathematics

Measurement & Data

AR.Math.Content.3.MD.B.4

- Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch
- Show the data by making a *line plot*, where the horizontal scale is marked off in appropriate units—*whole numbers, halves, or quarters*

English Language Arts

ELA-Literacy.SL.3.1

- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

“Big Ideas”

- Forces affect the motion of an object
- Making observations and measurements of an object’s motion can be used to predict future motion
- A line plot can help me visualize data
- The engineering design process can help me collaborate to solve real-world problems

Essential Questions

How can you design a machine that will shoot a dog treat to keep Dogzilla’s puppies distracted from invading the town?

How can you make observations and measure things that will help you identify patterns?

How can you create a line plot to display the data collected (distance that the dog treat is thrown) during the testing of your device?

Scenario

The mice of Mousopolis have realized they need a new plan of attack in order to defeat the dreadful puppies who threaten to ruin their beautiful city and precious second annual barbeque cook-off. They devised an idea to use a machine that will shoot dog treats as far away as possible so that the pups will chase them and never return. The only problem is that the mice don’t know how to build such an incredible machine.

The Challenge

Your challenge is to help the mice by building them a machine that can fling dog treats as far away from the city as possible while still remaining easy enough for a mouse to operate (meaning the least amount of human interaction). Your team will be given a budget of \$10.00 to complete the project.

Materials

1 - Rubber band - .25 cents	1 - Plastic spoon - \$2.00
1 - Sheet paper - .25 cents	1 - Cardboard piece - \$1.00
1 - Clothes hanger - \$2.00	6” - Duct tape - \$2.00
4 - Small dowel rods - \$1.00	12” - Masking tape - \$1.00
1 - Small cup - .50 cents	12” - String - \$2.00

Tools

Scissors Canary cutter tools Wire cutters Rulers *other tools we have used this semester

Teacher Notes:

Additional found and recycled materials may be added or substituted by the teacher. The design challenge will be completed by teams in groups of 3- 4 students using the resources available above. Encourage students to be creative in their ideas and planning and using their resources wisely. Remind students that they must plan their ideas, budget, and complete sketches in their design journal before they visit the store to purchase materials. The store is an important feature in this design challenge. Students will have the opportunity to learn, apply, and improve their basic computational skills by developing a budget and recording the transfer of money as they purchase materials for the project.

After reading the book, you might consider showing the *Dogzilla* video:

<https://www.youtube.com/watch?v=A5u96lvVB-g>

Content Information

Science

According to Newton’s first law of physics, an object in motion will stay in motion and an object at rest will stay at rest unless acted upon by an outside, unbalanced force. This means that any object will not accelerate on its own

or decelerate on its own. An object will actually resist change in its motion. It could be said that an object will keep on doing what it is doing. This tendency is called inertia. However, as stated earlier, an object will change its motion if acted on by an external unbalanced force.

To understand an unbalanced force, we must know that there are always two forces acted upon an object at rest, gravity (the force that pulls all objects down towards Earth's surface) and the force from the base of the object (such as the floor) pushing it up. These two forces are balanced and allow the object to stay at rest. Whenever a new force is introduced though, such as a push from the side, there is no force to compensate for it, or balance it. Therefore, the force is unbalanced and the object will move. This is also true when an object is in motion. This is why a ball that is rolling will eventually stop. The force of friction is acting upon the ball causing it to slow down.

(Source: <http://www.physicsclassroom.com/class/newtlaws/u2l1a.cfm>)

Technology and Engineering

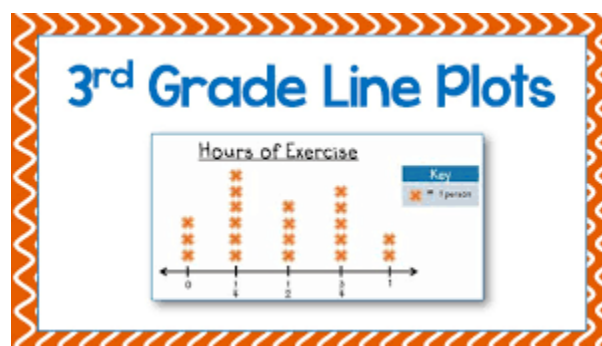
Problem-solving strategies are critical to any instruction aimed at improving all levels of STEM skills. The design process is a purposeful method of planning practical solutions to problems, but to be an effective problem solver, students need to be able to do the following:

- Understand cause-effect relationships (e.g., what parts of systems affect and are affected by other parts?)
- Make comparisons (e.g., what commonalities and differences do systems have?)
- Recognize probable outcomes (e.g., how will the system react to a specific action?)
- Predict what should happen next (e.g., based on what has been observed, what is known about a specific system, and what is known about related scientific principles, make a prediction about what will happen next.)
- Judge spatial relationships (e.g., visualize how a system operates and mentally rotate system parts to solve problems within a given system.)
- Notice what appears out of place (e.g., observe a malfunctioning system in operation to determine what is not working correctly.)

The teacher may lead a discussion about the role of society in the development and use of technology. Consider discussing how products are made to meet individual needs and wants. As the needs and wants of people change, new technologies are developed, and old ones are improved to meet those changes. Additionally, students need to understand the influence of technology on history. For example, throughout history, people have made tools to provide food, to make clothing, and to protect themselves—and, to trap or deter mice!

Mathematics

A line plot is a graph that shows frequency of data along a number line. It is best to use a line plot when comparing fewer than 25 numbers. A line plot is a quick, simple way to organize and view data. See sample line plot.



Results/Deliverables

In your designated teams, design and create a machine using the materials given that effectively launches a dog treat as far as possible from the machine. Each design will be tested in a competition to see which machine would best be suited for the mice of Mousopolis. Each team will turn in the following items:

1. Design journal including a completed budget
2. Completed machine
3. Line-plot created from testing data

4. Presentation to the class

Limitations

The completed machine must:

- use only the provided materials within the \$10.00 budget.
- be capable of shooting a dog treat as far as possible from the machine
- be easy to operate with the least amount of human interaction (a mouse should be able to operate)
- be submitted to the teacher along with documentation for the design process (showing that the ideas were purposeful, thoughtful, and creative)
- demonstrate the knowledge of force and motion through design

Evaluation

Constructing a Dog Treat Slinger Grading Sheet

Machine Name: _____

Group Members: _____

Assessment Criteria:

Machine was submitted along with the completed design journal.	_____/20
Machine demonstrated creative, thoughtful and intentional use of materials to carry out design	_____/15
Members of the team clearly and effectively presented their project to the class demonstrating their knowledge of force and motion and a display of the data collected during testing.	_____/15
Machine launched the dog treat some distance across the room	_____/15
Machine was easy to operate (demonstrated how a mouse could operate the device)	_____/10
Demonstrated understanding of learning; completed all activity sheets including reflection on forces, number line, and budget	_____/25
	Total_____/100

DOGzilla

Dog Treat Slinger Design Challenge



The city of Mousopolis is in trouble once again now that Dogzilla's puppies are free! The Big Cheese and all the other mice must find a new way to keep the puppies away from their precious city and of course the Second Annual Barbeque Cook-Off! They decide to create the incredible Dog Treat Slinger to run the pups far, far away from the city. The only problem is that the mice don't know how to build it!

The Big Ideas:

- balanced and unbalanced forces affect the motion of an object
- making observations and measurements of an object's motion can be used to predict future motion
- visualizing data using a line plot
- using the engineering design process to solve real-world problems

Essential Questions:

How can you design a machine that will shoot a dog treat to keep Dogzilla's puppies distracted so that they will not invade Mousopolis?

Challenge:

In your assigned engineering design team, you will help the mice design the most incredible Dog Treat Slinger. Using the design process and the materials below, create a machine that is easy to operate and will fling dog treats as far away as possible from the city.

Each team will be supplied with an additional piece of cardboard to use as a base.

Remember - your machine must be easy enough for a mouse to operate (meaning the least amount of human interaction). It must also be easily transportable, free-standing, and able to launch from the testing table.

Materials:

Rubber band - .25 cents Plastic spoon - \$2.00 Paper - .25 cents Cardboard piece - \$1.00
Clothes hanger - \$2.00 6"-duct tape - \$2.00 12"-masking tape - \$1.00
Pencils/small dowel rods - \$1.00 Small cups - .50 cents 12" string - \$2

*see budget sheet

Tools:

- scissors
- Canary cutter tools
- wire cutter
- ruler
- other tools we have learned to use this semester

*Tools may not be used as part of the solution to the problem.

Limitations:

The completed machine must:

- use on the provided materials
- be capable of launching a dog treat as far as possible from the machine
- be easy to operate (meaning the least amount of human interaction)
- be designed using the engineering design process
- be submitted to the instructor along with the design journal, budget, and line plot
- Must demonstrate ideas that are purposeful, thoughtful, and creative
- demonstrate the knowledge of force and motion through design

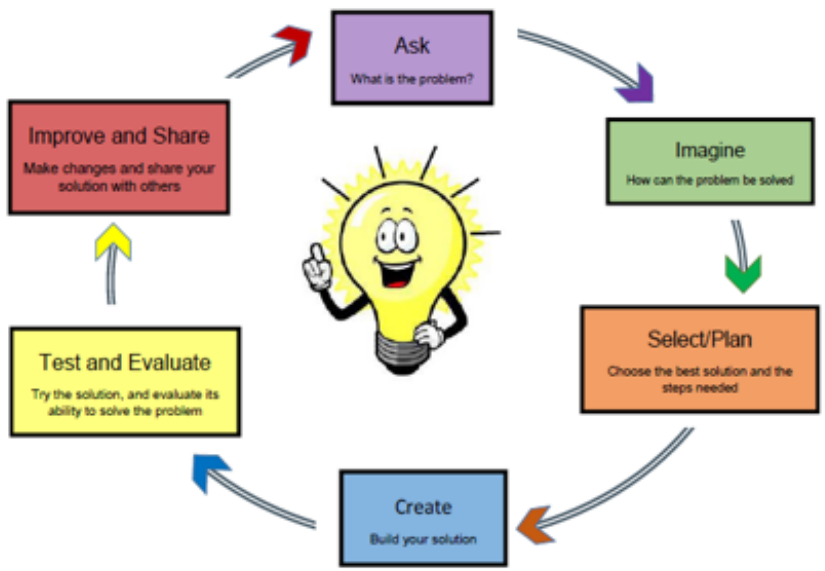
Testing:

1. Test your solution and make any needed adjustments.
2. Once your design is at its very best, your group will present to the class.
3. Then we will put all the designs to the test and see which group's Dog Treat Slinger can consistently launch the treats the farthest distance.

Ask - What is the problem?

What are my limitations?

Imagine - How can the problem be solved?



Engineering Design Journal

Collaborate to **Select and Plan**

Team Idea Sketch (final design)

How much money will it cost to bring my idea to life?

Materials Available	Amount	Total Needed	Total Amount Spent on Each Item
Rubber band	.25 cents		
Paper	.25 cents		
12" masking tape	\$1.00		
6" duct tape	\$2.00		
Small cups	.50 cents		
Pencils/small dowel rods	\$1.00		
Clothes hanger	\$2.00		
Plastic spoons	\$2.00		
12" string	\$1.00		
Cardboard piece (6" X 6")	\$1.00		
Total Amount Spent:			

Create the design solution

Test and Evaluate

Trial launch distances?	Create a number line with your test data
1. _____	
2. _____	
3. _____	
4. _____	
5. _____	<hr/>
6. _____	
7. _____	
8. _____	
9. _____	
10. _____	

Improve and Share – How can we make improvements? What things should we share with the group?

Reflection

What types of observations did you make?

How did that allow you to make predictions about how your device would operate?

What did you learn energy and forces?

How did this understanding contribute to your design?

Draw a picture of your completed design and describe.

What did you contribute to your team's design?