EDUCATOR'S GUIDE

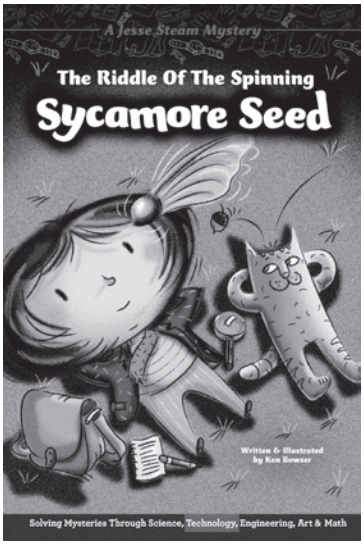
Jesse Steam: Solving Mysteries through Science, Technology, Engineering, Art & Math

Title: *The Riddle of the Spinning Sycamore Seed*

Series Overview

Ten-year-old Jesse Steam's curiosity about how the world works leads her to one mystery after another as she pedals around town, often with Mr. Stubbs, her tabby cat, keeping her company in the bike basket. Using simple scientific tools and their powers of observation, Jesse and her friends analyze, test hypotheses, and conduct experiments. If the kids get stuck, they know they can count on Professor Peach, a retired college science educator, to step in with a clear explanation.

Each title in the Jesse Steam series focuses on one **STEAM** subject: Science, Technology, Engineering, Art, or Math.



Lexile: 850 GRL: R 4,233 words

About This Book

In *The Riddle of the Spinning Sycamore Seed*, Jesse discovers the principles of aerodynamics when a gust of wind sends her kite crashing into a sycamore (maple) tree. Watching a winged sycamore seed spin slowly away, Jesse and her friends start to discover that flying objects, both human-made and from the natural world, travel through the air in very different ways.

This title focuses on **technology**.

Next Generation Science Standards Alignments and Activities

The activities and learning ideas in this guide have been correlated with the **Next Generation Science Standards (NGSS): https://bit.ly/2kx58A2**

These standards were developed by the National Research Council (NCR) of the National Academy of Sciences. The NCR's Framework for K-12 Science Education combines practices, crosscutting concepts, and disciplinary core ideas to address relevant science, technology, engineering and math (STEM) concepts that students should learn.

For this book, the Engineering Design standard is particularly applicable: **https://bit.ly/2lzY4mu**

Background and Key Concepts

The Mystery of the Spinning Sycamore Seed is about aerodynamics, or how air moves around objects. Four forces are at work when something flies in Earth's atmosphere:

- **Lift** is a force that tries to move an object upward. As Professor Peach tell the kids in this book, lift is what makes your baseball cap blow off your head when you're moving fast.
- **Drag** is a force that tries to slow an object down. Drag is also called **air resistance**.
- **Thrust** is a force that provides the push to leave the ground. Engines power the thrust airplanes need. Birds flap their wings for both thrust and lift.
- **Gravity** is the force constantly trying to pull everything down to the center of the earth. The less weight for gravity to pull down, the more lift possible.

Class Discussion

Start the discussion by asking students if they've ever been out walking facing into a strong wind. What did it feel like? Explain that the pushing sensation was caused by drag, or air resistance. Now ask what they did or might have done to decrease that pushing (aside from going inside). Did anyone crouch down or turn aside to present less body surface? Explain that they're going to explore how the shape of an object affects the amount of drag it experiences.

DRAG RACE: Student Activity

(Note: This activity makes a good companion to Try It Out! on page 64 of the student book, which gives instructions for building a toy parachute.**)**

Materials You'll Need

You'll be asking students to divide into groups of three. Before that, have these **materials** ready for **each group**:

- Two sheets of 8 ½" × 11" printer paper, one flat and one crumpled into a ball
- Three shapes cut out of large sheets of construction paper: Try a circle, a square, and a diamond. The shapes should be exactly the same size for each group—you might want to use a pattern.
- One stopwatch or device that measures seconds
- A meter stick to measure distance (optional)
- *If you want to extend this activity with the Design Challenge below, have extra printer and construction paper as well as crepe paper (for streamers), pennies (for weight), scissors, and tape handy too.

Each group will also need a **data sheet**. Make copies of our form on page 4 of this guide, or use ours as a model and have students create their own.

Instructions

When you have materials and data sheets ready, have students divide into teams of three. Ask team to select a person for each of three roles:

- The **Dropper** will drop different items from the same place above the floor. The items can be dropped from a desk or shelf or table, but the spot should be at least 2 meters off the ground.
- The **Timer** will start and stop the stopwatch.
- The **Recorder** will record the data and analysis on the data sheet.

When the Timer says "go," the Dropper drops each object. When the object hits the floor, the Timer stops the watch. (You may want to do a few trial runs to get the stopwatch coordination right.)

When all the data is recorded, have students spend some time analyzing it. Then bring them together to discuss their findings. Talk about which objects, materials, and shapes fell fastest. Which were slowest? What does this tell them about the drag of certain shapes?

SLOW IT DOWN! SPEED IT UP! Design Challenge

To extend the activity, challenge the teams to invent ways to break the drag and speed records they've recorded. Show them the extra materials you've assembled and invite them to think of ways to use them for increased or decreased drag. (For instance, they can tape pennies onto paper to add weight; add crepe paper streamers; tape pieces of paper together to make one giant sheet.) Ask them to record results and observations on the data sheet, in their notebooks or on separate sheets of paper.

Guide them with these hints:

1. Narrow surfaces have less drag and fall faster.
2. Wider surfaces have more drag and fall more slowly.
3. Engineers use rounded or pointy shapes to decrease drag, streamlining airplanes and vehicles like race cars.

WING IT! Research Project

Students have learned that shape is important in overcoming or increasing drag. The shape of a wing is a key factor to how an aircraft or a bird flies. The Ornithology Department of Cornell University identifies four main types of bird wings: **Passive soaring, active soaring, elliptical, and hovering.**

The Department has prepared this extremely helpful handout with more information: http://www.birds.cornell.edu/k12/wp-content/uploads/2018/11/Bird-Wing-Types-Handout.pdf

Use the handout for classroom reference or reproduce and distribute to students. Invite students to choose one wing type and research a bird that is an example. Then ask them to prepare a short report, with pictures (online or from magazines), bringing in:

- How the shape and design of the wing help the bird maneuver and succeed in its environment
- How the wing's design affects lift and drag
- Types of aircraft that are modeled on this type of wing.

Additional Online Resources:

https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-aerodynamics-k4.html

https://airandspace.si.edu/exhibitions/wright-brothers/online/fly/1901/wings.cfm

https://kcts9.pbslearningmedia.org/search/?q=aerodynamics

https://airandspace.si.edu/exhibitions/wright-brothers/online/fly/1901/wings.cfm

Videos

https://howthingsfly.si.edu/aerodynamics

How Bird Wings Work (YouTube) https://bit.ly/2kqIC9N

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Data Sheet

DRAG RACE

Names of Students on Team

Date

OBJECT	TIME TO FALL
Paper flat	
Paper Crumpled	
Circle	
Square	
Diamond	

What did you learn? Write your analysis below. Use extra paper if necessary.

OBJECT	MODIFICATIONS	TIME

What did you learn? Write your analysis below. Use extra paper if necessary.