

Teacher Guide: Spin the Big Wheel!



Learning Objectives

Students will...

- Distinguish between events that are certain, likely, unlikely, and impossible.
- Understand that probability refers to the *likelihood* of an event, but does not allow the event to be predicted with certainty.
- Determine the probability of a given outcome, such as winning a prize with a spinner.
- Understand that experimental results will not exactly match theoretical probability.



Vocabulary

certain, impossible, outcome, probability, sample space, trial

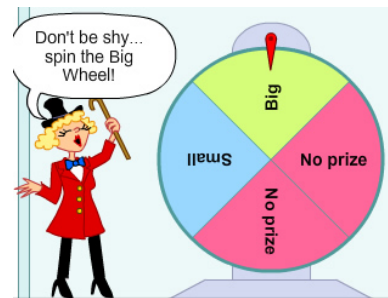


Lesson Overview

The *Spin the Big Wheel!* Gizmo™ takes you to the boardwalk, where carnies beckon you to try your luck on the big wheel. Students can design their own wheel, create a sign that describes the likelihood of winning, and then take a spin. Results are tallied on a table or circle graph.

The Student Exploration sheet contains three activities:

- Activity A – Students use a spinning wheel to explore concepts of probability, certainty, and impossibility.
- Activity B – Students design a wheel, create a sign to describe the probability of winning, and test the wheel with 100 and 1000 spins to see how well results match predictions.
- Activity C – Students create three different wheels to match a requested probability distribution. Students also create a variety of signs to describe the probability of winning.



Will you win the Big Prize?



Suggested Lesson Sequence

1. **Pre-Gizmo activity** (🕒 10 – 20 minutes)
Introduce the terms “likely,” “unlikely,” “certain,” and “impossible” by discussing familiar events. For example, it may be unlikely that it will snow in June, but it is not impossible. It may be likely that a student will have a sandwich in her lunchbox tomorrow, but it is not certain.

Use common objects such as coins, dice, or spinners to demonstrate the concepts of outcomes (results), sample space (all possible outcomes), and likelihood (probability).

2. **Prior to using the Gizmo** (🕒 10 – 15 minutes)
Before students are at the computers, pass out the Student Exploration sheets and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class. At this point, letting students share how they thought about the questions is more valuable than “going over” the correct answers. After the discussion, if possible, use a projector to introduce the Gizmo and demonstrate its basic operations.



Mathematical Background

Probability is a unique and fascinating field of mathematics. Most other topics in mathematics deal with finding the correct solution to a problem or finding a law that has no exceptions. In probability very little is certain. A coin might have a 50% chance of turning up “heads,” but that doesn’t mean that if you flip it 10 times you will get 5 heads; that is just the most likely outcome. Probability is associated with games and gambling, but it also underlies many of the major decisions made by governments, companies, and other decision-makers.

When studying a simple experiment such as a coin flip, two assumptions are usually made:

- The device is *fair*. This means that each outcome is equally likely: heads or tails each has a probability of 0.5.
- Each trial is *independent*. This means that the results of one trial are not influenced by the results of a previous trial. Even if there are three heads in a row, the next flip has a 0.5 chance of heads and a 0.5 chance of tails.

On a fair device, the probability of an event is the number of favorable outcomes divided by the total number of outcomes. Consider a fair wheel with 8 sections and 2 sections marked “Big Prize.” The probability of winning a big prize is the number of favorable outcomes (2) divided by the total number of outcomes (8). So the probability of winning is 2 out of 8, or 0.25 (25%). If you spun this wheel many times, you could reasonably expect that about 25% of the spins would result in winning a big prize.



Students may come to probability with a wide variety of misconceptions. One of the most common is that past events influence present probabilities. For example, if you are rolling a normal six-sided die and it’s been a long time since you’ve rolled a 1, you may think you are “due” for a 1. But the probability of rolling a 1 never changes; it is always 1 out of 6.

Another fallacy is to think that middle values are more likely than the extremes. Students may think it is more likely to roll a 3 or 4 on a die than it is to roll a 1 or 6. In fact, when rolling one die, all six numbers are equally likely. (However, if you roll a *pair* of dice, middle values are most likely—for example, with a pair of dice, rolling a 7 is much more likely than rolling a 2 or 12.)

A third common error is to over-generalize from a small sample. For example, a student may flip a coin 10 times and get 3 heads. The student may predict that if you flip the same coin 100 times, it will come up heads about 30 times, rather than 50. It is important to demonstrate that with larger sample sizes, experimental results tend to approach theoretical probability.



Selected Web Resources

Carnies: <http://en.wikipedia.org/wiki/Carny>

Probability: <http://www.teacherlink.org/content/math/interactive/probability/home.html>

Probability misconceptions:

<http://www.teacherlink.org/content/math/interactive/probability/numbersense/misconceptions/home.html>

Probability resources: <http://www.math.uah.edu/stat/>

Probability simulations: <http://www.shodor.org/interactivate/activities/>

Probability games: <http://www.betweenwaters.com/probab/probab.html>