Two-Color-Counter Toss

Strand: Probability and Statistics

Topic: Exploring the concept of probability

Primary SOL: 3.14 The student will investigate and describe the concept of probability as a measurement of chance and list possible outcomes for a single event.

Materials

- Two-color counters (e.g., red-yellow)
- Two-Color-Counter Toss Recording Sheet (attached)
- Probability Statements activity sheet (attached)
- Two-Color-Counter Toss with One Counter Recording Sheet
- Two-Color-Counter Toss with Two Counters Recording Sheet
- Scissors
- Glue

Vocabulary

certain, event, equally likely, impossible, likely, predict, probability, possible outcome, unlikely

Student/Teacher Actions: What should students be doing? What should teachers be doing?

Two-Color Counter Toss with One Counter:

1. Hold up a red-yellow counter, and ask, *"Which color will be facing up when I toss the counter and it lands?"* Guide students to reason that there are two *possible outcomes* of tossing the counter—red side up or yellow side up—and that the *probability* of each outcome is *equally likely.* Make sure students understand these vocabulary terms as they apply to this situation.
2. Group students in pairs, and tell students that each pair is going to experiment with tossing a counter 10 times to see which of the two outcomes happens the most. Ask students whether they think there will be (a) more red than yellow results, (b) more yellow than red results, or (c) the same number of red and yellow results. One of these three *possible outcomes* will be the experiment's result. Have each student predict the experiment's result individually and record it. Then, have each pair discuss their individual predictions of the experiment's result.
3. Distribute the Two-Color-Counter Toss Recording Sheet, and give each pair a red-yellow counter. Direct partners to toss their counters 10 times and tally the tossing results on their individual recording sheets in the Experiment 1 Results table. Then, direct them to total the red results and the yellow results, determine the experiment's result, and discuss these questions:
    - Did our prediction match the experiment's result? Why or why not?
    - If we were to repeat the experiment by tossing the counter 10 more times, do we think the experiment's result would be the same or different? Why?

4. Have partners repeat the experiment, tallying the tossing results in the Experiment 2 Results table, totaling the results, determining the experiment's result, and discussing these questions:
    - Did our prediction match the experiment's result? Why, or why not?
    - If we were to add the tossing results of both experiments, would the experiment's results be the same as or different from the results of Experiment 1 or Experiment 2? Why?
    - If we were to add all students' tossing results, do we think the experiment's result would be the same as or different from the results of our own experiments? Why?
5. Record all students' tossing results in a class chart similar to the one shown on the recording sheet. Have students total the red results and the yellow results. Ask whether the combined totals lead to a result that is closer to their predictions than their own experiments' results. Discuss why.

Two-Color-Counter Toss with Two Counters:

6. Ask students how many possible outcomes there are when tossing *two* two-color counters. Students will most likely agree that there are three possible outcomes: (a) red & red, (b) yellow & yellow, or (c) red & yellow. Have each student predict and record individually which of these three outcomes will happen most frequently when tossing the two counters 10 times. The experiment's result will be one of three outcomes: (a) red & red most frequent, (b) yellow & yellow most frequent, or (c) red & yellow most frequent. Again, have each pair discuss their individual predictions of the experiment's outcome.
7. Give each pair an additional red-yellow counter, and have partners toss their pairs of counters 10 times and record the tossing results on their individual recording sheets in the Experiment 3 Results table. Then, direct them to total their results, determine the experiment's result, and discuss these questions:
    - Did our prediction match the experiment's result? Why or why not?
    - If we were to repeat the experiment by tossing the two counters 10 more times, do we think the experiment's result would be the same or different? Why?
8. Have partners repeat the experiment, tallying the tossing results in the Experiment 4 Results table, totaling the results, circling the experiment's result, and discussing these questions:

Result	First Counter Side No.	Second Counter Side No.
Red & Red	1 (red)	3 (red)
Yellow & Yellow	2 (yellow)	4 (yellow)
Red & Yellow	1 (red)	4 (yellow)
	2 (yellow)	3 (red)

    - Did our prediction match the experiment's result? Why, or why not?
    - What resulted the more times the two counters were tossed?

- If we were to add all the students' tossing results, do we think the experiment's result would be the same as or different from the results of our own experiments? Why?

9. Record all students' tossing results in a class chart similar to the one shown on the recording sheet. Have students total the results and then discuss the class chart, first with their partners and then with the whole class. Students may be surprised to discover that the "red & yellow" outcome occurred most often. (If this did not happen, you may want each pair to toss 10 more times so that a larger sample is obtained.) If you choose to explain this, explain that the three outcomes do not have an equal chance of occurring—they are not *equally likely* to happen. To help students understand this, label the sides of both counters with unique numbers: 1, 2, 3, or 4. The possibilities can be recorded in a table, which may help students see that red & yellow can happen in *two* ways, while each of the other two outcomes can happen in only one way.

   Note: Third-grade students may not be ready to fully appreciate this concept. A full understanding of this information is not essential; an intuitive understanding is fine.

Assessment

- **Questions**
  - What are the outcomes if we toss a penny? What are the outcomes if we toss two pennies? How is this activity similar to the two-colored-counter toss?
  - What are the possible outcomes of rolling a cube? What is the probability of rolling an even number on a cube?
- **Journal/writing prompts (include a minimum of two)**
  - Draw the possible outcomes when you toss two two-colored counters.
  - Draw a bag containing 10 marbles. Color some of the marbles green and some of the marbles blue. Write a statement about the probability of getting a green marble if you were to draw one marble from the bag without looking.

Other Assessments (include informal assessment ideas)

  - While students are carrying out each experiment, circulate around the room and listen to their discussions. Correct any misconceptions and encourage them to do further experimentation.

Extensions and Connections (for all students)

- Because students need multiple opportunities to explore possible outcomes of an experiment, do the same activity with two pennies or with a penny and a dime.
- Discuss with students the concept of mathematical probability, or the chance of an event occurring. Reinforce the meaning of the terms *impossible* (cannot occur: zero probability) and *certain* (will definitely occur: complete probability). Share some probability statements with students, asking whether they think each would occur "for certain" or whether it would be "impossible" for it to occur. Distribute scissors, glue, and the Probability Statements activity sheet. Have students cut out, sort, and glue the statements in order to focus on the mathematical vocabulary *certain* and *impossible*.

Strategies for Differentiation

- **Technology**
    - Have students create a spreadsheet on the computer to tally and analyze the results of their experiments.
    - Use larger counters for students with gross-motor deficits.
    - Use counters with indentations for students with visual deficits.
- **Multisensory**
    - Have students make their own manipulatives that they decorate and use for the tossing activity.
- **Community Connections**
    - Invite the manager or owner of a toy store to the class to demonstrate games and toys that use probability.
- **Small-group Learning**
    - Divide the class into two teams. Have each team create five to 10 probability questions on which to quiz an opposing team.
- **Vocabulary**
    - Make sure students know the following vocabulary: *tally, record, counter, possibility, experiment,* and *prediction.*
    - Display the vocabulary on a word wall with each word accompanied by an example or picture to demonstrate the word.
- **Student Organization of Content**
    - Display predictions on the classroom wall.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Probability Statements

Name: ___________________________________ Date: ___________________

1. Cut apart the statements at the bottom of the page.
2. Sort them, and glue each one in the correct column below.

IMPOSSIBLE	CERTAIN

It will snow 3 feet tomorrow.
Only cake will be served for lunch.
The sun will rise tomorrow.
You will have two birthdays this year.
Your teacher is over 18 years old.
Your school has a principal.
You will go to bed after 3:00 p.m. tonight.
You will flip tails every time you flip a coin.

Two-Color-Counter Toss with One Counter Recording Sheet

Name: ___________________________________

Experiment 1 Results

Result	Toss 1	Toss 2	Toss 3	Toss 4	Toss 5	Toss 6	Toss 7	Toss 8	Toss 9	Toss 10	TOTAL
Red											
Yellow											

(Check one)

___ a. more red than yellow results ___ b. more yellow than red results ___ c. the same number of red and yellow results

Experiment 2 Results

Result	Toss 1	Toss 2	Toss 3	Toss 4	Toss 5	Toss 6	Toss 7	Toss 8	Toss 9	Toss 10	TOTAL
Red											
Yellow											

(Check one)

___ a. more red than yellow results ___ b. more yellow than red results ___ c. the same number of red and yellow results

Two-Color-Counter Toss with Two Counters Recording Sheet

Experiment 3 Results

Result	Toss 1	Toss 2	Toss 3	Toss 4	Toss 5	Toss 6	Toss 7	Toss 8	Toss 9	Toss 10	TOTAL
Red & Red											
Yellow & Yellow											
Red & Yellow											

(Check one)

___ a. red & red most frequent ___ b. yellow & yellow most frequent ___ c. red & yellow most frequent

Experiment 4 Results

Result	Toss 1	Toss 2	Toss 3	Toss 4	Toss 5	Toss 6	Toss 7	Toss 8	Toss 9	Toss 10	TOTAL
Red & Red											
Yellow & Yellow											
Red & Yellow											

(Check one)

___ a. red & red most frequent ___ b. yellow & yellow most frequent ___ c. red & yellow most frequent