Rock, Paper, Scissors

STRAND: Probability and Statistics

STRAND CONCEPT: Outcomes and Probability

SOL 5.15, 7.8a,b

Remediation Plan Summary

Students use the game Rock, Paper and Scissors to build an understanding of sample space and how it relates to theoretical probability. Throughout the lesson, there are opportunities for students to compare theoretical and experimental probabilities as well as discuss the law of large numbers.

If remediation is only targeting SOL 5.15, have students only complete 1-5 on the first page and question 8 and 11 on the second page.

Common Misconceptions

- Some students will add instead of multiply when applying the Fundamental Counting Principle.
- Converting fractions to decimals and percents is a struggle for some students.
- Once a probability is found, some students struggle to simplify the fraction.

Materials

- Calculator and attachments

Introductory Activity

Give each student the Why are they not the same? Introductory Activity and have them answer the questions independently. Once done, have students discuss with a partner or group of three. Next have a whole class discussion on why the two were not the same, and lead in to a discussion of experimental verses theoretical probability and the law of large numbers. Students should write down the part of the situation that represents the experimental and theoretical Probabilities and give a description of what each probability represents.

Plan for Instruction

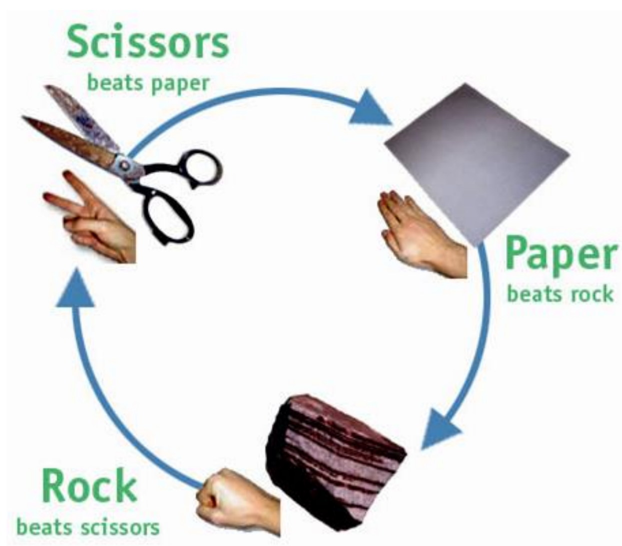
1. Explain how the game Rock Paper Scissors is played and ensure that all students understand it. (See Teacher Resource on the next page if you need a description of the game.) Have students play the game several times with a partner.
2. Distribute copies of the "Rock Paper Scissors" Activity. Explain to the class that Rock Paper Scissors is a popular way to resolve a minor dispute between two parties or to decide which of two people might gain some favorable reward, like going first in a game. It is widely considered to be a fair way to make simple decisions because each of the two participants has an equal chance of winning.
3. Read the directions on the worksheet with the students. Answer any questions, and allow students time to complete the activity. Monitor student involvement as well as accuracy.
4. After students have completed the first 5 questions, pause and have a discussion about the results. Have students share their observations including the comparison of the number of times each item was a winner. Ask the students why the number of ties was three while the others were only two. Tell the students that being able to look at all possible outcomes of an event is important when it comes to analyzing the event.
5. Next discuss the Fundamental (Basic) Counting Principle. Show the students questions 3, 4, and 5 show this principle (multiply 3 times 3 to arrive at 9 possible outcomes, which is the same number of outcomes obtained by using the tree diagram). Explain that the advantage of the Fundamental (Basic) Counting

Principle is that the number of possible outcomes of an event can be obtained very quickly. Discuss how we use the possible outcomes to find the theoretical probability of an event. Ask, "how could we show the fractional relationship of the paper winning a round?" Students should be able to explain that the paper has 2 ways to win out of the 9 so the fractional relationship is 2/9.

6. Have students complete the last two questions on the first page.
7. Discuss the students' findings.
8. The last two tasks introduce a fourth item, Water, into the Rock Paper Scissors game. Students are asked to play the game, find the total outcomes and answer a few questions. Have student stop after completing the 10 rounds of play.
9. Discuss how to find the experimental probability and then let the students continue answering the questions.
10. Close the lesson by having the students share their results of the Rock Paper Scissors Water tasks. Ensure that students have correct answers, and clarify any misunderstandings.

Teacher Resource

Rock Paper Scissors is regarded as a way to make a decision between two alternatives when the decision to be made is of relatively low significance. This method of decision making is similar to flipping a coin or drawing straws. There are, however, certain mathematical principles associated with the game that make it fair.



The game is called a "hand game" in that the two players make hand signals or hand "throws." Traditionally, there are three hand signals:

- Closed fist = rock
- Open palm = paper
- Pointing finger and middle finger = scissors.

To play the game, each of the two players makes a fist with one hand. Together the players move their fists in an up and down motion four times while saying "Rock...Paper...Scissors...Go!" On "Go!," each player makes one of the hand-signal outcomes (rock, paper, or scissors) of their choice. The three possible outcomes have the following meanings:

- Rock breaks scissors.
- Paper wraps rock.
- Scissors cut paper.

Online Resources:

The World RPS Society. http://www.worldrps.com/. This official Web site for the game explains that The World RPS Society is dedicated to the promotion of Rock Paper Scissors as a fun and safe way to resolve disputes.

Pulling It All Together (Reflection)

Have students answer the reflection questions, share their answers with a partner, and then have a whole class discussion.

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

Virginia Department of Education 2018

Why are they not the same?
Introductory Activity

Sonja flipped a coin 10 times and got heads 3 times. She recorded her findings as 3/10. Sonja was confused. She had heard that heads should occur ½ of the time. Help Sonja understand why the two values could be different.

What part of the situation is…
Experimental Probability-

Theoretical Probability-

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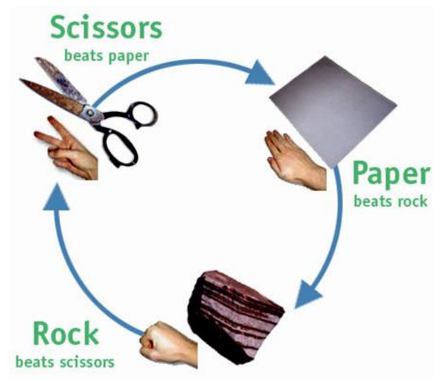

Rock Paper Scissors

Finding Sample Space

Complete the tasks below. Record the answers in the spaces provided.

1. After you have played Rock Paper Scissors with a partner, do you think it's a *fair* game? That is, does each player have an equal chance of winning? To see whether this game is fair, create a tree diagram and a list of all possible outcomes. The first parts of the tree diagram and the list are done for you. Also, list the winner for each outcome.

Tree Diagram (Sample Space)		List of Possible Outcomes (Sample Space)	Winner
	Rock	Rock Rock	(Tie)
Rock	Paper	Rock Paper	Paper
	Scissors	Rock Scissors	Rock
	________	________________	________
______	________	________________	________
	________	________________	________
	________	________________	________
_______	________	________________	________
	________	________________	________

Number of Wins &Ties

Rock _____ Paper _____ Scissors _____ Ties _____

2. How many possible outcomes are there? ___

3. How many choices does Player A have to make? ___

4. How many choices does Player B have to make? ___

5. How many total choices are there for both players? ___

Finding the Probability

6. How many times can paper win? ______ How many total outcomes are possible? ____ How could you write this as a fractional relationship (Theoretical Probability)? ______

7. How many times will a tie occur? _____. What is the theoretical probability of a tie occurring? ______

Rock Paper Scissors Water

Rock Paper Scissors can be changed to Rock Paper Scissors Water. In this games, water can win twice because it can dissolve Paper and rust Scissors. Water can lose once because Rock can divide it. To signal Water, you cup your palm as if you were holding some water in it.

8. Play Rock Paper Scissors Water with a partner 10 times to see how it works. Record the results of your game in the chart at right and fill in the number of times each item won a round.

Play	Player A Choice	Player B Choice	Winner
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Number of Wins &Ties
Rock _____ Paper _____ Scissors _____
Water _____ Ties _____

10. What is the fractional relationship between the number of times water won to the total number of trials (Experimental Probability) ___________

11. In the space below, create a samples space and a list of possible outcomes. Also, list the winner for each outcome.

12. How did the theoretical probability change when water was added?

13. What is the theoretical probability of water winning a round? Was your experimental probability close to this value? Explain why or why not.

Lesson Reflection

Answer the following questions.

1. How does determining the sample space help you when finding the theoretical probability of an event?

2. Compare and Contrast theoretical and experimental probability.

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