Rock, Paper, Scissors Probability

Grade Level: 5-8

Duration: 40-50 minutes

Classification: Classroom

Subject(s): Statistics, Math

Categories (STEM): Math

Keywords: Probability, statistics, math, chance

Introduction

- Summary: Students will learn about probability, independent events, and dependent events by holding a Rock, Paper, Scissors tournament and studying the probability of each choice.
- Description:
    - Students will play two rounds of Rock, Paper, and Scissors 30 times with a partner and record their results. Playing with eyes closed, and with eyes open.
    - The class will combine all results and discuss how these were independent events and if the game was fair, if there was a way to beat the odds, and how having their eyes open affected their strategy.

Vocabulary

- **Probability -** how likely an event is to occur; a number between 0 and 1 where 0 indicates impossibility and 1 indicates certainty
- **Statistics** - the mathematical study of the likelihood and probability of events occurring based on known quantitative data or a collection of data
- **Independent events** - Two events, A and B, are independent if the fact that A occurs does not affect the probability of B occurring.
- **Dependent events** - Two events are dependent if the outcome or occurrence of the first affects the outcome or occurrence of the second so that the probability is changed.

Materials

Materials	Quantity	Reusable?
Paper	1 sheet per student	No
Pencils	1 per student	Yes
Coin (for activity extension)	1 per student	Yes
Data Sheet Handout	1 per group	No

Commented [1]: might want to think about adding a calculator, the dividing by 30 might be a little difficult to do in it.

Directions

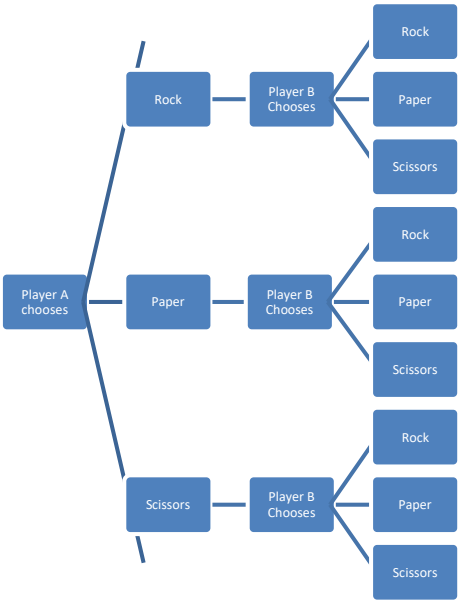
1. Lead opening discussion.
    a. What is probability?
    b. What are independent events? What are dependent events?
    c. Why is it useful to know the probability of something?
2. Divide the class into groups of three and have them play rock, paper, scissors 30 times. The non-player should record the data. **Students should have their eyes closed as they play during this round.** The recorder should not tell the players who wins each game.
3. Play the game 30 times with a partner, and tally the results in the table. After all 30 games are played, have students calculate the frequency by dividing the number of tallies in each category by the total number of tallies (total should be 30).

4. Lead a brief discussion with the class.
    a. On the basis of your results, do you think the game is fair? Why, or why not?
    b. What does fair mean from a probability perspective? (Answer: each player wins an equal number of times)
    c. Do you believe there's a way to beat the odds in this game? Let's try it!
5. Switch group members and play the game 30 times. Make sure the students who recorded results in the first round aren't recording results this round. **Students should play with their eyes open during this round.** Tally the results in the table. Optional: In the last column, compile your results from both trails.

6. Lead a brief discussion with the class.
    a. Did playing with your eyes open affect the outcome of the game? Explain.
    b. Did switching partners affect the fairness of the game? Explain.
    c. Did anyone win more in this round than in the first round? What did you do differently?
7. Ask the groups to then draw a tree diagram to show all possible outcomes.
    a. Have the students create a tree diagram like the one below and record the theoretical probability for each choice by each player.
        i. Each choice of rock, paper or scissors should add to 1.
        ii. Theoretically, they would be equally likely, so Rock=0.33, Paper=0.33 and Scissors=0.33. (0.33=33%)

8. Have students use the tree diagram to calculate the probability of a tie.
    a. Look for all of the paths where both players choose the same thing and then add the probability of each branch.
    b. EX: The probability when Player 1 chooses Rock and Player 2 chooses Rock is 0.33 x 0.33 = .1089). Is this probability close to what they observed in their games?

9. Ask the students how their probabilities for the paths would change if Player 1 decided to always choose Paper.
    a. The branches that contain Player A chooses Rock or Scissors would have probability 0, and the other paths' probabilities would increase



Activity Extension

Test the fairness of flipping a coin. Give each pair of kids a penny and have one student flip it 100 times. Have the other student record the results. Calculate statistics like the average and standard deviation, and have the students graph their responses.

Closing Discussion Questions

- Do you think each game of Rock, Paper, Scissors was an independent event or dependent event? Which round could be argued to be dependent events?
    - Answer: the second round could be argued as dependent since the players may try to predict the next opponent's action based on their previous choice
- What are ways we use probability in everyday life?
    - Predicting weather patterns, Stock market, Card games, Sporting events (such as baseball statistics)

What is happening?

- Each choice of rock, paper or scissors should be normalized to 1 with equal probability. Theoretically, they would be equally likely, so Rock=0.33, Paper=0.33 and Scissors=0.33.
- The Law of Large Numbers: the more trials we perform, the closer we get to the expected probability. Therefore, if the class's results are not equally likely, it is most likely due to too small of a sample size.

Applications:

- Majors
  - Mathematics, Statistics, Accounting, Industrial Engineering
- Jobs
  - Mathematician, Market Research Analyst, Meteorologist, Statistician, Operations Research Analyst, Financial Analyst
- Hobbies
  - Baseball, tennis, other sports
  - Geocaching
- Real-World applications
  - Predicting weather patterns
  - Stock market
  - Card games
  - Sporting events (such as baseball statistics)