WHY ISN'T IT 50-50

Performance Standard 10C.H

Understand the difference between the outcome of the experiment, and the outcome that they expected:

- *Mathematical knowledge*: Analyze outcome of probability experiment and compare theoretic and empirical results;
- *Strategic knowledge*: Solve problem using systematic process; and
- *Explanation*: Explain completely what was done and why it was done.

Procedures

1. Provide students with sufficient learning opportunities to develop the following in order to determine, describe and apply probabilities of events.
   - Discuss the difference in empirical and theoretical probability.
2. Provide students with the assessment task worksheet. Have students work individually.

   Jenny complete a probability experiment by flipping a coin 100 times. She obtained 52 heads and 48 tails. She was disappointed in her results, and thought she did something wrong. When asked why she was disappointed, she said that she thought it should have come out 50-50. What would you say to Jenny? How would you explain what happened to her in terms of empirical and theoretical probability?
3. Use the standard scoring rubric. Give each student a score in each of the three categories. A score of 4 should indicate complete description of the differences in empirical and experimental probability using correct terminology. A three should represent nearly complete discussion that demonstrates the correct ideas, but they may not have communicated them clearly. A two should indicate that students have some idea about how to answer the question, but miss important points that effect their answers. A one generally shows little understanding in their discussion, but at least show some understanding of probability. A score of zero generally reflects no understanding of probability.
4. Computation is not really a component of this task.
5. Solution should demonstrate clear understanding of theoretical and empirical probability results. Students may use charts to clarify their explanation.

Examples of Student Work follow

Time Requirements

- One class period

Resources

- Copies of the "Why Isn't It 50-50" task sheet
- Writing utensil
- Mathematics Rubric

NAME _____ DATE _____

WHY ISN'T IT 50-50

Student Task Sheet

Jenny complete a probability experiment by flipping a coin 100 times. She obtained 52 heads and 48 tails. She was disappointed in her results, and thought she did something wrong. When asked why she was disappointed, she said that she thought it should have come out 50-50.

What would you say to Jenny? How would you explain what happened to her in terms of empirical and theoretical probability?

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"Meets"

Student Task Sheet

Jenny complete a probability experiment by flipping a coin 100 times. She obtained 52 heads and 48 tails. She was disappointed in her results, and thought she did something wrong. When asked why she was disappointed, she said that she thought it should have come out 50-50.

What would you say to Jenny? How would you explain what happened to her in terms of empirical and theoretical probability?

The reason why she didn't get a perfect 50-50 is because it is just probable that you will get 50-50. This means that most of the time you will get it, but sometimes you will get very close. It is just theoretical that you will get 50-50, a theory. One flip of the coin does not effect the outcome of another. You could get 100 heads and 0 tails, but the theory is 50-50. What Senny did was empirical, based solely on theory and experiments. What she did was not incorrect but she jumped to conclusions based on her observations. She should just know that empirical probability is not 100% accurate, but it is based on theoretical probability. What it all boils down to is that one flip of the coin doesn't affect the outcome of the next, so everything is independent. Everytime the results will change, but it should come out 50-50 according to theoretical and empirical probability.

"Exceeds" (page 1)

WHY ISN'T IT 50-50

Student Task Sheet

Jenny complete a probability experiment by flipping a coin 100 times. She obtained 52 heads and 48 tails. She was disappointed in her results, and thought she did something wrong. When asked why she was disappointed, she said that she thought it should have come out 50-50.

What would you say to Jenny? How would you explain what happened to her in terms of empirical and theoretical probability?

The first thing I would tell Jenny is the difference between empirical and theoretical probability. Empirical is the factual thing that happens. Theoretical is the theory and what should happen. The reason Jenny didn't get 50-50 was because of this. She was off four flips. Two being heads and two being tails. This can be took divided by 100 since that is how many times Jenny flipped the coin. That comes out to 0.04. You multiply that by 100 to get a percentage and that is 4%. This tells you the chance she had to get 50-50. The more times Jenny flips the coins, the bigger chance there is to get the theoretical probability.

This chart will explain how flipping more times becomes more of a chance to get the theoretical probability.

Times you flip the coin	Results	Percent of getting theoretical prob.
50	23 heads 27 tails	8%
100	52 heads 48 tails	4%
150	73 heads 77 tails	$2\frac{2}{3}$%
200	102 heads 98 tails	2%
250	123 heads 127 tails	1.6%

As you can see, the percentage becomes smaller and smaller the larger times you flip the coins. Therefore, the more times Jenny flips the coins, the bigger chance there is for the theoretical probability.