

LESSON 12

Is It Likely?

Statistics and Probability

Objectives . . . Students will be able to:

- ◆ Explore the concept of chance/probability.
- ◆ Collect, represent, and analyze data.
- ◆ Make predictions based upon data.

NCTM Standards and NAEP Strand

Concepts learned and applied in lesson 12 correlate to NCTM Standards 1, 2, 3, 4, and 11; and NAEP Strand 4 (Data Analysis, Statistics, and Probability).

Materials List

The Class

- A box of Fruit Loops

Each group

- A small cup of Fruit Loops containing about 35-45 pieces
- graph paper
- coins

Each Student

- A copy of BLMs 12-A and 12-B for the "You Try It at Home" activities.

To Prepare Your Students

Introduce today's video topic and ask questions designed to ascertain if the students are familiar with the Student Prerequisites and Key Words and Terms. Present some simple examples of the type of problem to be explored—e.g., If I had a bag of M&Ms with only six left, and they were of six different colors, what would the chances be of my selecting a blue

one next if I took one without looking? Would it be likely that I would select a blue if two were blue and the rest were green? What if four were blue and two were green? . . .

Video Overview

In the opening sequence, we see a girl pulling an ace from a deck of cards—and another, and another!; children playing a board game with dice; two kids playing odds-even. Probability is part of everyday life!

Student Prerequisites

- ◆ Ability to count and tally sets of information.
- ◆ Ability to classify a given set of information/materials into subsets.
- ◆ Experience with instruments of chance: coins, dice, cards, games like odds-evens or scissors, paper, rock.

Key Words and Terms

likely

chances

probability

Video Lesson

In this lesson students will explore the concept of chance. The first section of the video allows them to relate prior experiences they have had with instruments of chance like cards, dice, and raffles with the material of the lesson.

Bike Raffle

A girl enters a contest for a new bike and is sure she will win! Do you think she is likely to be right?



YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

What do your students think of the girl's chances of winning the bike? What reasons do they have? What would have to be true for the girl to be sure of winning? Do they have comments about the first situations (dice, cards, odds-evens game) shown on the video tape? Try to reinforce uses of the chance/probability vocabulary.

Play

The girl is disappointed to find that several other students in her class entered the same contest! Have her chances of winning decreased?

Fruit Loops

Sheila Eller of Baker Demonstration School asks her students to try something special. They have already made graphs showing the number and color of Fruit Loops in boxes for each group, then consolidated their results for the whole class. She then asks them to perform the following experiment: Working in pairs, shake the Fruit Loops box, predict what color you think you will pull out, then draw out one Fruit Loop without looking. Record your prediction and data on a graph and put the selection back. Each pair should do this 12 times.





YOUR CLASS MAY WANT TO TRY THIS NOW

Provide each group with a small cup of 35-45 Fruit Loops from a box (use the entire box if possible). Have each group collect the initial data by counting the number of each color and graphing the results. Then compile this data into a master graph and display it on the blackboard or on construction paper. Then, working in pairs, ask your students to play the prediction game: shake a small box of the Fruit Loops, predict what color you will pick, select one, record the results and return your selection. Repeat this twelve times.

After they have worked out the problem, but before they present their solutions, play the video showing how other kids solved the problem.

Play

Watch the ways the children on the video solve the problem. The video then asks:

WERE THESE SOLUTIONS LIKE YOURS?

Note: Question is on-screen but there is no stop sign. Teachers should pause at this point and ask each group to present its solution. Encourage your class to think about all the solutions and remind them that there are many possible solutions.

Some questions to help your students discuss their answers: Why were the results from the trials different from the graph which shows the data from the whole box of Fruit Loops? Does the size of the sample matter? If you were to keep selecting Fruit Loops, when you got to a thousand would the two graphs look exactly alike? What if you didn't put the Fruit Loops back each time? What would happen?

Play

As the video continues, we see students using a candy machine that dispenses M&M's. Then the students are asked if they think every quarter will give them the same number and colors of candy as the first.



YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

You may want to discuss this experience with your class. At this point they should use their own personal experiences outside of class as well as their classroom activity experiences to justify their predictions. As with all the other pause points, look for concise and logical reasoning and justification of their predictions.

Play

Two boys are flipping a coin and are amazed when it comes up repeatedly "heads." The second boy examines the coin and the video suggests . . .

You Try It!



**FREEZE
FRAME**

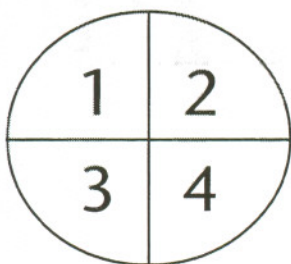


Why is it unusual to have heads come up six times in a row? Have your students test their predictions and intuitions. Put them in pairs and give each pair a coin. Have them toss the coin six times and record heads or tails. Did anyone in the class have 6 heads? How about 6 tails? Try the activity again and repeat the questions. How many times does the class as a whole have to flip before 6 of something (heads or tails) appears on anyone's sheet?

EXTENDED ACTIVITIES

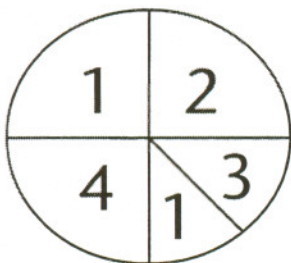
These activities are designed to extend the mathematics learning introduced in this lesson.

1. Place ten similarly sized and shaped colored chips, e.g., 5 red and 5 blue, 6 red and 4 blue, 9 red and 1 blue, in a bag and have the students draw out the chips one at a time, record the color of the chip and return it. After a number of draws (at least 10) have them predict how many chips of each color are in the bag.
2. Have the students roll two dice, sum the results, and tally the sums. After 20 or 30 rolls, have each individual make a prediction of the most likely sum to be rolled. Then put the class data together and use the data to refine the predictions.
3. Fair or unfair? Play a game of odds-evens by using the sums when a pair of dice are rolled. Vary the game by using the product rather than the sum. Let students discuss what happened and if they think the game was fair or unfair. (Sum is a fair game . . . there are 18 even and 18 odd sums when two dice are used. Products have twice as many even as odd products, so when products are used the game is not fair.)



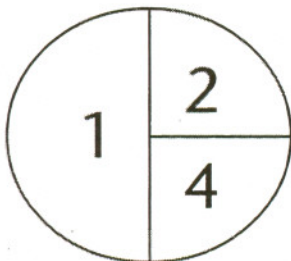
Cross-curricular Activity

Have the students construct spinners (see examples to the left) and play games or experiment with spinners of various designs. Have them predict the results and explain what their prediction is based on, then compare the actual results over several trials with their predictions.



Writing Activity

Have your students roll two dice, sum the results, and tally the sums. After ten rolls have each student write a prediction of the most likely number to be rolled. Then have them roll another ten times, sum the results, and tally the sums. Then put the class data together and have students write a new prediction about what they think would happen in ten more rolls, why this may be different from their first prediction (i.e., sample size may affect results), and a justification of their reasoning.



You Try It At Home

Two handout masters, numbered 12-A and 12-B, are provided in a booklet accompanying the Teacher's Guide; reproduce as many of these as you need. Reduced examples are also provided at the end of this lesson. These activities are designed to extend and reinforce concepts taught in the lesson, and to enable parents or other caregivers to become more involved with students' mathematics learning.

Assessment and Criteria for Scoring

The following four proficiency categories may be used to evaluate student performance in response to Lesson 12. You may use these evaluation categories to assess student classroom performance and extended activity performance.

Advanced Response: The graph is done correctly with clear labeling and appropriate representation of the number of each color of Fruit Loops. In addition, at least one of the following is true:

- There is reflection on the work.
- The results are presented in more than one way (in words, a chart, a table, or a second kind of graph).

Proficient Response: The graph is done correctly with clear labeling and appropriate representation of the number of each color of Fruit Loops.

Nearly Proficient Response: The graph is an adequate representation of the number of each color of Fruit Loops, but the labeling is not clear or the number of items represented is obviously too large or too small.

Minimal Response: The graph is not set up to adequately represent the data gathered when counting the Fruit Loops and/or is confusing to interpret.

References and Resources

National Council of Teachers of Mathematics (1989) Curriculum and Evaluation Standards for School Mathematics. Reston, VA: The Council.

Standard 1 : Mathematics as Problem Solving.

Standard 2 : Mathematics as Communication.

Standard 3 : Mathematics as Reasoning.

Standard 4 : Mathematical Connections.

Standard 11 : Statistics and Probability.

NAEP Strand 4 (Data Analysis, Statistics, and Probability).



Suggested Children's Literature

Rose Wyler and Mary Elting, *Math Fun, Test Your Luck*

Whoopi Goldberg, *Alice*

Judi Barrett, *Cloudy with a Chance of Meatballs*

Jean Cushman, *Do You Wanna Bet? Your Chance to Find Out about Probability*

You Try It At Home 1 and 2

Chances Are

Find something that comes in a variety of colors and/or shapes and/or sizes (Lucky Charms cereal, Skittles or M&Ms candy, jelly beans, mixed nuts, assorted screws, etc.). Ask an adult at home or other care-giver to help you with this project.

Try to find the item (color, shape, size) which you would be most likely to get if you took just one out of the package.

Take a handful out of the package and record the different items below.

Put your handful back.

Do this 10 times and see if you can decide which item is most likely to be drawn.

Whether Weather is Wetter

Watch the news on television with someone in your family. Listen to the weather prediction for tomorrow. What are the chances for rain? For snow? For a clear sunny day?

Talk to your partner about what that means. What clothes should you plan on wearing tomorrow?

Watch the extended forecast on TV (these predictions are usually for 3-5 days ahead). Keep track from day to day how the predictions for those days changed. In the space below, record the predictions and what the actual weather was for that day.