mobile inquiry technology
Teacher Notes

Rolling Cubes Introduction

In this activity, students should have had some experience with the notion of probability as an expression of the likelihood of an event occurring given a "fair test". In addition they will need to have developed some facility with finding the equivalencies between fractions and percents and representing data using fractions.

This activity will develop two key ideas in the mathematics of probability:

- relating the difference between expected (or theoretical probability) and experimental (or actual probability);
- realizing that when the number of actual events increases the experimental outcome will tend to get closer to the theoretical outcome.

CLOSE

mobile inquiry technology
Rolling Cubes Teacher Notes

Discussion Guide

Begin the class discussion by asking students to recall instances when they would want to make a prediction about the probability of an event occurring. Examples might include choices related to the likelihood of a weather event or condition, chances in card games, buying a present for a boy or girl before a birth. As the students give examples, ask what evidence they would use to make a decision. As the discussion ensues it should be clear that some calculations of probability are intrinsic to the event itself. For example, the probability of the birth of a boy or girl is about 50% and is determined biologically. On the other hand, the chances of snow on January 10 in Boston can be determined by collecting data about weather on January 10 over a long period of time.

Adolescents are entering a period of life when they are faced with choices sometimes related to risky behavior such as whether to smoke. Their understanding of probability and whether or not they make decisions based on evidence can significantly alter their lives. Young people sometimes erroneously assume that one example can be used for guidance. For example, they might express that they know a close friend or relative who smoked heavily but led a long healthy life. Hence, they decide the risk is worth taking. They do not consider the probability calculated from large amount of data on the life span of individuals who smoke and those that do not. Posing situations such as these to students can be interesting and make the discussion of probability relevant to their lives.

Show the class a spinner from a game that contains a number of possible outcomes. Ask each group to discuss the probability of getting a particular result. Ask them to express the results both as a fraction and percent. For example, on a dial that contained four colors, the probability for any one color would be 1/4 or 25%. Discuss their ideas and reasoning briefly.

Spin the dial once and ask them to predict the result of the next few spins. Then let the students try it out.

Introduce or review expected (or theoretical probability) and experimental (or actual probability) outcomes. For example, the theoretical outcome in coin tossing is 50% heads and 50% tails. If children flip a coin 10 times, the results may vary considerably from 50% for each possibility. Conversely, when the number of events is small, then there can be a wide variation between theoretical and experimental results. If the coin was flipped 1000 or 10,000 times the results will tend to get closer to 50%.

The results will probably vary from the expected outcome, such as a result occurring multiple times within a few spins. Ask students to explain this variation. Pose the following question: "Would the result change if we were to spin the dial 100 or 1000 times?" After discussing their ideas propose that a computer can be used to test out the idea that larger numbers in a trial will affect the outcome---closer to that of the theoretical outcome. This is called the Law of Large Numbers.

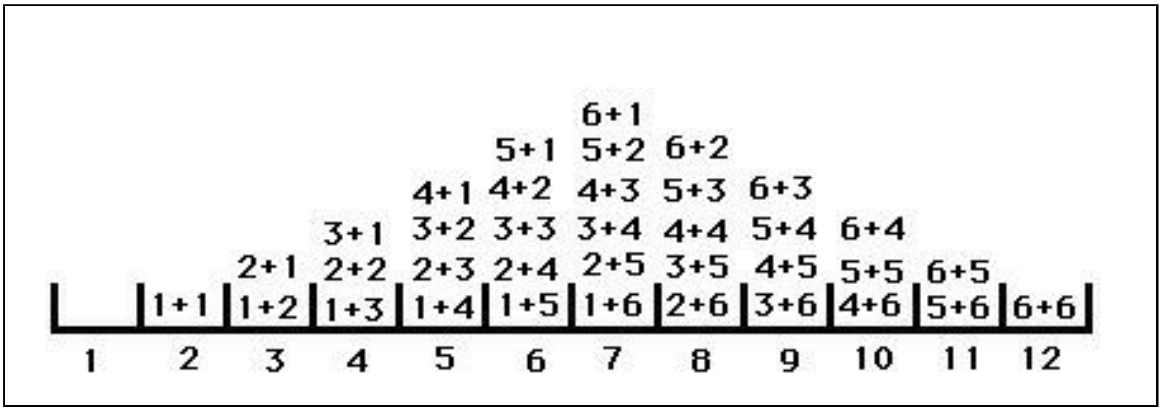
Direct the student to read and discuss "Thinking About the Question". After a few minutes hold a brief discussion with the students. Two big questions should be provoked by the discussion: If the likelihood of an event occurring is random, does one trials effect the next? Does the Law of Large Number hold true?

Once these questions have been clarified direct the students to "Investigation I", providing guidance as needed as they proceed through each step.

mobile inquiry technology
Rolling Cubes Teacher Notes

Additional Teacher Background

You may want to provide a model for the students to make the histogram of possible sums they can make by rolling two cubes. Here is a sample of a histogram:



CLOSE

mobile inquiry technology

Rolling Cubes Suggested Timeline

The amount of time you spend on introductory discussions, data collection, and analysis, will determine your overall timeline. The following represents a possible timeline.

- One class period - Introductory Discussion
- One class period - Investigation I: Listing the possibilities
- One class period - Investigation II: Simulating random rolls
- One class period - Investigation III: Creating your own experimental data
- One class period - Analysis

Additional days can be used for further investigations.

CLOSE