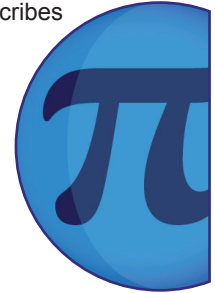




Key Learning Content

This film explores the question of what counts as evidence for or against a statistical hypothesis. It describes an experiment conducted at Princeton University to see whether a machine could be controlled by the power of the human mind. Participants sat in front of a computer which generated random numbers and 'willed' the machine to make the next number higher or lower. Over two million trials were conducted over twelve years. The researchers claimed that the results showed that people were able to influence the machine, but the effect was minute. Thus began a debate about whether the results in the experiment were nothing more than the effects of chance. The detailed statistics that lie behind the debate will be difficult for students to understand, but the general question is relevant to any statistical experiment.



Core Outcomes

Learning Points

- Be able to understand the language of probability in terms such as 'trial', 'experiment', 'event', 'outcome' and 'significance'.
- Be able to understand and use estimates or measures of probability from theoretical models.

Suggested Activities

- Work out the probabilities of correctly guessing the outcome of spinning a coin once, twice, three times and so on.
- Use a spreadsheet and its built-in functions to calculate the probabilities of complex events.

Extension Outcomes

Learning Points

- Be able to understand what is meant by a null hypothesis.
- Be able to understand what it means for an event to be significant at the 5% level.

Suggested Activities

- Use tree diagrams to work out the probabilities of different outcomes when a coin is spun repeatedly.
- Use a spreadsheet and its built-in functions to calculate the statistical significance of an event.



Statistical analysis places significance on trends or averages rather than individual results.

Related Films
 

To use before the lesson plan:

Can Fish Oil Make You Smarter?

This film shows how simply watching someone doing something may influence the results of an experiment.

To use after the lesson plan:

Freak Waves

This film explores the problems in drawing conclusions about extreme events from normal, everyday occurrences.

Chaos By Mistake

This film explains why very small differences can have significant effects.

Guide Lesson Plan

Introduction

Take a coin and tell the students you are going to spin it and make it land the way up you want. Spin the coin, say which way it landed, and say that's what you wanted to happen. Repeat several times and claim success every time. When you are challenged for cheating, ask the students how many times you would have to correctly predict which way it would land for them to believe that you had control over it?

 Show Film
 
Mind Control

Main Activity

Foundation

Explain that the nature of the experiment in the film was similar to trying to influence which way up the coin would land (except that the computer or machine was meant to imply that there was less chance of cheating). Get the students to work out the probability that someone correctly predicted how a coin would land once, twice, three times and so on. Show that there is a less than a one-in-a-thousand chance of predicting how the coin will land on ten consecutive spins. Get students to work in pairs, one spinning a coin, the other guessing how it will land, and record the number of consecutive successes students score.

Advanced

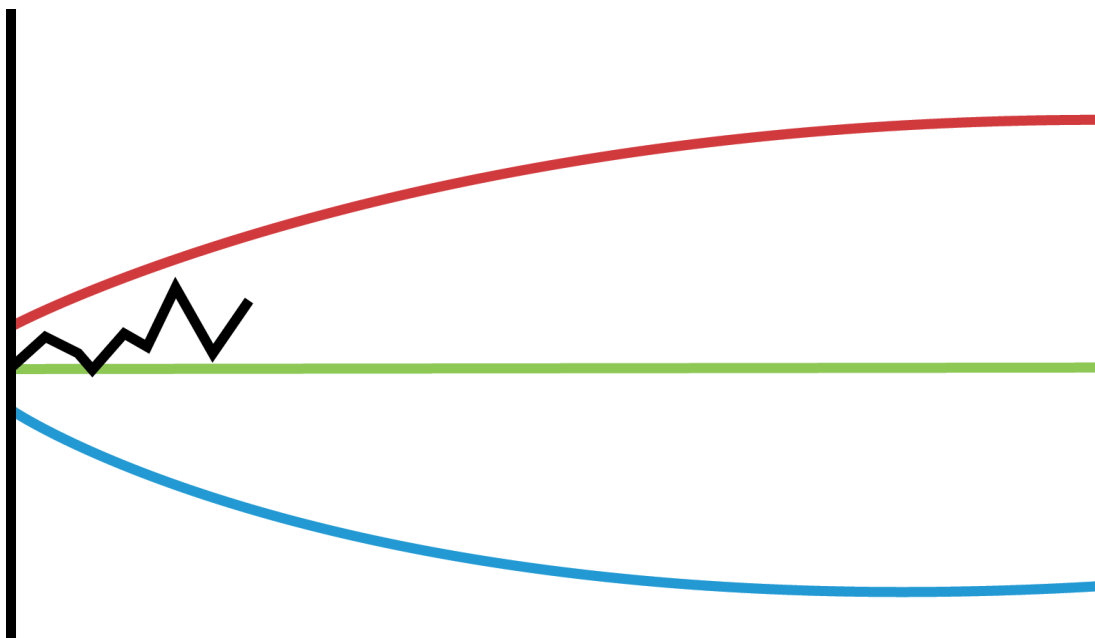
Get students to draw a tree diagram showing the result of spinning a coin five times, landing either heads or tails each time with a probability of $\frac{1}{2}$. Calculate the probability of each of the $2^5 = 32$ different outcomes and then calculate the overall probabilities of getting no, one, two, three, four or five heads. Check that the probabilities sum to 1. Explain that the significance of an event is the probability that an event as or more extreme than it occurs. Work out the significance of five heads when a coin is spun five times, and four heads when a coin is spun five times.

Extension Activity

Show students how the BINOMDIST() function in Excel works and use it to check the calculations made manually earlier. Show how the function can calculate cumulative probabilities. Use the spreadsheet function to calculate the probabilities of 49 or fewer heads when spinning 100 coins, then 490 heads when spinning 1000, then 4900 heads when spinning 10,000 and so on. Relate this to the experiment shown in the film.

Optional Extra

Explain what is meant by a null and an alternative hypothesis and how these relate to significance tests. Explain the difference between one- and two-tailed tests and apply to simple problems.



The data obtained from the Princeton experiment indicated that the random output of the machine could be disturbed when people tried to affect it with thought alone.