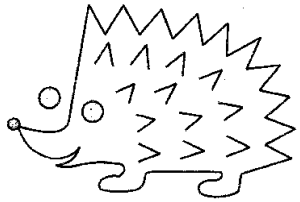
Teacher Notes Randomness



Hedgehog Mathematical Sheets

Objectives:	Carry out investigations with coins and dice Derive greater understanding and awareness of the nature of randomness
Key Words:	fair test, random, average, mean, die,
Prior Learning:	Use of tally charts and bar graphs
Resources:	Sheets from singinghedgehog [blog page], [squared paper, ICT]

Lesson Notes:

Both coins and dice have H&S implications; you will know the best way to manage your class.
With teenagers you will need to use the word ‘flip’ and not ‘toss’.
Children need to know that ‘die’ is singular and ‘dice’ is plural as both are used in exams.
Cross-curricular opportunity to mention WWII POWs/Jews recording thousands of flips.

Sheet 1 – The first part often needs discussion to promote ‘random’ responses but do not feed them too much. If you get pupils filling in all heads/tails or all alternate, ask them if that is likely.
Help them to fill in the first part of the run length chart BEFORE handing out the coins. That way the quick pupils will have something to be doing while you help the less coordinated ones and retrieve coins from under furniture.
The coins should be of sufficient size to allow smaller hands to use them such as a British 2p coin.
Being able to toss a coin is a life skill; they should be encouraged to persevere.
Some children find it easier to use thumb and middle finger rather than the more usual index finger.
You will rarely get run length of greater than five on the ‘human’ coin; you are unlucky if you do not get at least an eight on the ‘coin’ coin.
This should promote good discussion on the true nature of randomness especially that long sequences are to be expected but are still truly random.
Graphing is good here especially with collated class data from each table. The second set of data can also be collated to consider fairness of the set of coins.
[Extension: use probability trees to calculate likelihoods of increasing run lengths]

Sheet 2 – For the first task sixty or ninety rolls work well as means of 10 or 15 allow for easy comparison with the totals in the tally chart.
Graphing is effective here either ‘old school’ on squared paper, as is still required in various examinations or electronically; the latter allows for easier collation of a class set of data which should come closer to one sixth.
The written responses must relate the fairness of their die to their data. Many pupils incorrectly correlate ‘normal’ with ‘fair’, use personification, “the dice just went like that” or some form of supernatural activity, “it was just luck.”
The second task is much more straightforward although you should expect some pupils to get into the twenties before they hit a six.
This leads to a good graphing task; leaving gaps for zero values is vital and the whole class data will be useful as it creates a non-linear graph.
They should continue with the same die as they know its ‘fairness’.
This should also promote good discussion on the true nature of randomness especially that each event is independent; coins and dice have no memory.

Follow-up – sheet 2 with other dice, either d4, d8, d10 etc or d6 with non-standard values.
combination activities with two dice: four rules on the numbers; 2D tally charts.
chances of winning in lotteries, scratchcards, casinos etc.
misuse/misrepresentation of probabilities in the media especially around medical matters; Daily Mail cancer articles are good for this.
exam-style questions from singinghedgehog.