The Mathematics of Head Lice

‘There is no topic on earth that doesn’t lead to mathematics eventually,’ we maths teachers are proud of saying (maybe overlooking theology and one or two other areas). It is also true that sometimes the least attractive subject-matter offers good chances to mathematise; let us see if we can turn head lice into such a opportunity.

Before we do, it might be as well to puncture any notions with your class that there should be a stigma attached to having head lice, which are just as fond of clean hair as dirty. You are more likely to pick up the wee beasties if your head touches plenty of other heads – by this index, your likelihood of having head lice is a measure of your friendliness. There is also the theory now that having head lice as a child gives you some immunity from having body lice as an adult. This is a good thing, since while head lice cannot carry any serious human diseases, body lice can. So when it comes to having head lice, there may be something in it for us too.

Could we model the spread of head lice mathematically? The good news is that the epidemiology of head lice is about as simple as it gets; they only have one host (humans) and can only spread from human to human. It is easy to ask our students to simulate this scattering of the population by using dice. Each student is responsible for one head, and monitors the presence or absence of head lice over ten weeks. There are a number of probabilities we can vary – the starting chance of being infested (a), the chance of picking up the infestation if you are currently clear (b), and the chance of recovering once you are infested (c). The conclusion on collecting together the class results? That the proportion of the population infested tends to a limit as time goes by, and that the limit depends on b and c but not a (the limit is in fact b/(b+c)).

Dice seem a little old-fashioned these days. The temptation is to click on a spreadsheet to introduce randomness into our lesson, and indeed, that is how this activity ends – sometimes the donkey work for counting thousands of throws can only sensibly be done with a computer. Yet rolling dice at the start does give students a genuine feel for the random nature of the activity, and it is a fun social activity that encourages engagement.

This activity gently introduces the idea of a limit, a vital idea for later work on calculus and sequences and series. The spreadsheet models 100 people – is this enough? How many people would be enough to make a good stab at the limiting value? Students can now be invited to research some statistics for themselves – how prevalent in fact are head lice in the population? If we treated the problem with the same urgency as smallpox and polio, could we eradicate head lice completely?

If you would like to access a full set of resources for teaching this lesson, that is

1. Instructions (pdf)
2. Worksheet (pdf)
3. Spreadsheet (Excel 2007)

please visit TES Resources at www.tes.co.uk and search for 'lousey-lousey'.

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