

## Ideas for Teaching Statistics at A Level

These outline teaching ideas have been submitted by teachers of A Level Mathematics and Statistics. If you have any ideas to add to this list, contact Stella Dudzic [stella.dudzic@mei.org.uk](mailto:stella.dudzic@mei.org.uk) .

### Data display

#### Mazes

Students do the Castle Bromwich maze and the Hampton Court maze.

Mazes from <http://www.cbhgt.org.uk/maze00.html>

The obvious question is: how do times compare on the two mazes?

A back to back stem-and-leaf diagram is one way to display the data visually.

### Averages, spread and interpretation

#### Median, shape of distribution and poverty

Poverty is defined as an income 60% below the median. There is more information and an interactive distribution of 11 people here:

<http://news.bbc.co.uk/1/hi/magazine/8177864.stm> Can you have all 11 people earning wages which mean that none of them are in poverty? How many of the 11 can you have in poverty? Compare the distributions.

#### Does chocolate improve your memory?

(a) Read 10 random numbers out at the start of the lesson and then get students to write them down in the correct order. Read out the right answers and the students mark themselves out of 10.

(b) Give out the mars bars - one to each student who then consume them. Repeat (a) 10-20 minutes later.

(c) (a) can be repeated at intervals throughout the lesson. You now have an interesting discrete data set that can be explored and compared at the different times. You usually find that memory levels peak around 20-25 minutes after consumption.

(d) Suggested investigations – compare medians, mean, IQR values and ranges at each of the time intervals. Use MINITAB, AUTOGRAPH or graphical calculators to draw comparative boxplots (not on syllabus, BUT a useful tool in comparing data discrete sets quickly).

**Fair shares of chocolate** – distribute squares of chocolate (could use any chocolate/fruit/sweets which are easy to distribute) around the room, but ensure that it is **very uneven**, with several getting none, some e.g. 8 squares, some 4, some 2, some 1 etc. The idea is to demonstrate the difference between mean, mode and median, with a discussion as to which measure is best in this context. Can also lead in to discussion of things like aid to developing countries and mismatch between 'haves' and 'have nots'.

Students can then be asked to redistribute the squares in order to achieve a particular median, mode etc. Graphical calcs can be used to find quartiles and other measures if desired. Can clearly be used for numeracy and GCSE students as well.

**Pulse Rates** – get students to do some simple piece of exercise e.g. running round the field, pressups etc, taking pulse before and then immediately afterwards. Time to return to previous pulse can also be measured. For each student doing the exercise the increase in pulse rate can be measured from resting rate to post-exercise. The data can then be explored using mean, median, IQR etc. An extension is to group separately by smokers and non-smokers and compare – the sporty students who also smoke often get a

shock. Some students I have done this with in the past have subsequently given up smoking as a result of what the data showed!

### **Bivariate data: correlation and regression**

**Get students to bring in data** e.g. handspans of left and right hands, headspans, heights and arm lengths (can measure in class with sufficient tape measures) Now compare eg left and right hands – there are often big differences – You can use mean, also sd. Split by gender and repeat. Repeat for other measurements above.

**Newspapers/magazines** – there is a theory that colour adverts for more expensive goods have a greater proportion of the colour black in them. Use a grid to approximate the proportion of a series of magazine adverts which is coloured black and record the price of the item. The data can be analysed graphically and correlation can be brought in as well. You can categorise the adverts by the kind of goods being sold – clothing, electrical, food etc etc and compare prices and proportions of black in different categories.

### **Probability**

#### **Factorials, permutations and combinations**

#### **Discrete random variables**

#### **Continuous random variables**

#### **Binomial distribution**

#### **Poisson distribution**

#### **Normal distribution**

#### **Hypothesis testing using the binomial distribution**

##### **Introducing hypothesis testing**

Students do the “True art or fake?” quiz:

[http://reverent.org/true\\_art\\_or\\_fake\\_art.html](http://reverent.org/true_art_or_fake_art.html) Before telling them the answers, ask them what the pass mark should be if we want to be fairly sure that people who are guessing won't pass – stress that there are no right or wrong answers; you just want their opinions. If they are doing the quiz online, get them to do this before they press “submit”. Answers are here:

[http://ecclesiastes911.net/properly\\_prescribed.html](http://ecclesiastes911.net/properly_prescribed.html) Now use a binomial distribution on Autograph, calculator or from tables to see how likely it is that someone guessing on every question would get the pass mark they suggested just by chance.

#### **Hypothesis testing using the Normal distribution**

#### **Hypothesis testing using the t-distribution**

#### **Chi squared tests for contingency tables**

**Mobile phones** – get students to text the word COLLEGE (but not send it) with left and right hands and a partner times them to do so (switch predictive texting off first!). Record data for class and compare main and non-main

hands – is there a difference or are they ambidextrous? Students will need to decide on suitable categories for time taken. Alternatively, the data can be analysed using averages and measures of spread for each hand.

**Rulers** – drop a ruler through your main hand and record the distance dropped. This is a measure of reaction time. It may be easier if one student drops and the other catches. Repeat and take the result on third drop. Now repeat with other hand and then compare results for the whole class. Students will need to decide on suitable categories for time taken. Alternatively, the data can be analysed using mean, sd, median etc.

### Confidence intervals

#### Wilcoxon tests

**Taste Tests** – get students to rate on a scale of 1-10 the test of say Sainsbury's own choc chip cookies versus Maryland cookies (labelling them as brand A and B and randomizing which cookie is eaten first using the toss of a coin – students to drink some water between cookies and possibly blindfold them as well – done in pairs). You can then compare brand A and B to see if they can tell the difference.