Classroom and Worksheet Activities across the Curriculum

Doreen Connor and Peter Holmes
The Royal Statistical Society Centre for Statistical Education
Nottingham Trent University
Nottingham NG1 4BU UK

Abstract

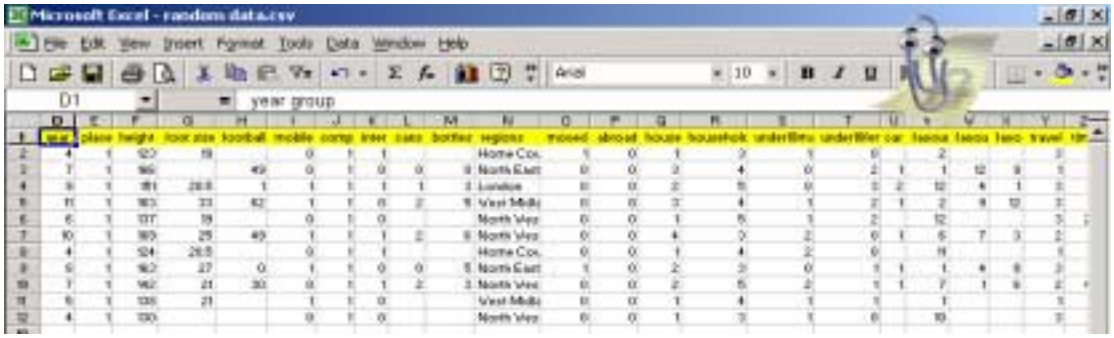
We show how teachers can create useful classroom activities to underpin data handling methods for pupils aged 7 – 19. We use the database of responses from the UK *CensusAtSchool* project that are available for pupils and teachers.

1 Context

The key to successful classroom activity is that participants make real progress from their current learning position. To achieve this, a spark of enthusiasm must be ignited within the pupils and they must clearly see the need to investigate, and actually *wish* to proceed. In terms of data handling it is the nature of data itself which can often make the vital difference, as *Maddern & Crust* (1989) say: *The analysis of real data which is of some personal significance can be much more rewarding for students than the completion of exercises containing second hand data.* The UK National Numeracy Framework (Dept. for Education & Skills, 2001) also emphasises that real data should be used if at all possible and that the context of the work is identified and understood. Although many of the learning objectives that follow within it seem fairly dry, they can be brought to life by real data such as those in the *CensusAtSchool* project, where there are real contexts to investigate and children can compare themselves with their peers and give a personal input.

2 *CensusAtSchool* Data Opportunities

The project (see for example, Connor et al, 2000) offers a variety of data in a plethora of different situations to enable teachers to incorporate real data into a multitude of learning opportunities. On the UK website http://www.censusatschool.ntu.ac.uk there are summary tables of data, many Excel spreadsheets and a Random Data Selector where you can select your data and obtain a CSV file of data containing between 1 and 200 randomly selected pupils. This data set in particular lends itself to the sorting and classification side of handling data that is often overlooked by textbooks. The data set comprises original rows of data sent in to us but with all individual identifiers removed. The following screen snap shows the first 10 rows in a returned .csv file, opened in Excel.



It is a mixture of data from the two slightly different versions of the *CensusAtSchool* forms, one designed for 7-11 year olds and the other for 11-16 year olds. This means that some columns will have blanks, not due to non-response, but because the question did not appear on that child's form. This is true of the pets question, which was only asked of 7-11 year olds and also of the cans/bottles question, in columns L and M, which was only asked of 11-16 year olds. Other questions such as Type of Accommodation (Column Q) was asked in different ways on the two versions; 7-11 year olds were asked if they lived in a house, flat or other, while 11-16 year olds were asked if they lived-in a detached, semi-detached or terraced house, flat or other. All of this, along with the fact that the data are still in coded form means that just looking at the raw data and understanding exactly what they are saying is a major task in itself.

This skill of understanding the data is one that children will often come across in the workplace but very rarely in school, as data in lessons are usually presented already sorted out and summarised. This is very unrealistic as Moore (1997) says: *Like words, data do not interpret themselves but must be read with understanding. Just as a writer can arrange words into convincing arguments or incoherent nonsense, so data can be convincing, misleading, or just irrelevant.*

A classroom task can involve pupils working in groups to discuss and sort out what their data means. One challenge for them would be to interpret just one line of data to come up with a description of that particular person. This could be a simple written description, possibly with a mixture of art and descriptive writing or even a web page about the person. Younger children would enjoy this activity working in pairs and writing a short biography, while older children could design a web page or even construct a PowerPoint presentation based on the data. For example:

'Hello my name is Paul. I am a 11 year old Everton Supporter from the North West of Britain. I live in a nice detached house with my brother Mark and sister Shelly (and Mum & Dad plus Tiger the cat of course). We have a great computer at home which connects to the Internet so that I can get into the Everton FC website and do all my homework well. As to School, it is about 4 km away and we catch the school bus from the end of the road every day. It takes about 40 minutes to get there because it goes all round the houses picking up people. I am 142 cm tall with feet sized 21 cm and at school my fav subject is PE which we have all Wed afternoon although I do like Art and Maths as well.'

Children will quickly come to see that raw data need to be examined and understood well before any sense can be made of them and any information extracted. Following this, tables and charts can be drawn and statistics worked out and then conclusions drawn with reference to the original data with errors and outliers identified.

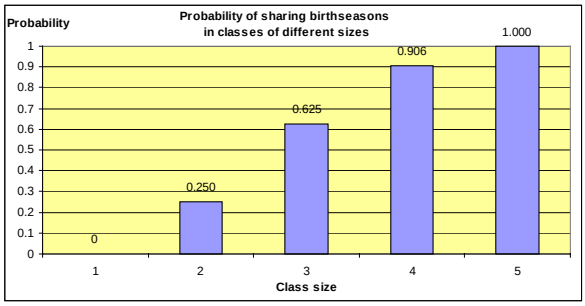
3 Cross-curricula data handling

Allowing children to make the decisions relating to how and what they are investigating will improve motivation and interest. For example 'Investigate the hypothesis that Australian girls are more likely to cycle to school than British ones'. Students can explore the social and cultural differences within the data using our International database from Queensland and South Africa, and once their interest is sparked they will want to interrogate the data, thus generating the need for statistical techniques to explain their findings. This is how data handling should always be taught with the problem to be explored providing the stimulus for using the statistical techniques and presentation. As

Moore (1997) says: *It is very important to form the habit of asking "What do the data tell me?", rather than just concentrating on making graphs and doing calculations*.
As well as the data, the website offers a variety of curriculum worksheets in the areas of Mathematics, Geography, History, Science, ICT and Key Skills. These are offered in either PDF or Word format giving the opportunity for teachers to take the basic task idea and adapt and change them to suit their individual classroom requirement. They can replace data with data personal to the class involved, or remove a question they don't like or add in extra ideas. This flexibility, combined with some new or different ideas, should enhance the diet of data handling that students receive.

4 Ideas across other Statistical areas

A number of time-honoured problems can also be revisited through the *CensusAtSchool* data. One such is the Birthday Problem that can be explored with practical reference to the dates of birth. The problem can be simplified to look not just at coincident birth *days* within a group but at coincident birth *weeks*, *months* and *seasons* and the underlying probability examined within the classroom in a practical way that even younger pupils could grasp. For example, possibly using 4 posters of the 4 seasons in corners of the room, the first pupil in a group could be sent to their season or birth and the second would then have a choice only of 3 out of the four seasons if their season of birth were to be different from the first. The probability that the second was not born in the same season as you is ¾=0.75.
Since pupil one could either be born in a different season from you, or in the same season, the probability that your friend was born in the same season as you is the complement of 0.75, (1-3/4) = 0.25. Add a third student who now has only two seasons to chose from if they are also to be born in a different season The probability that none of you was born in the same season is (3/4)(2/4)=0.375 and therefore the probability of at least 2 of you being born in the same season is 1-0.375 = 0.625. This can then be expanded with the *CensusAtSchool* data used to experimentally look at real data to see if this reflects the probabilities worked out. This is particularly relevant in relation to the effect of real data that may well have a non - uniform distribution of births throughout the year.



5 Conclusions

It is our view that classroom activities for data handling need to use real data, have a context that is understandable and interesting for the pupil and involve them fully while giving opportunities for both statistical discussion and statistical techniques to be utilised.

We conclude with a list of the worksheets available from the CensusAtSchool website http://www.censusatschool.ntu.ac.uk/curriculum.asp

MATHEMATICS & STATISTICS

Are Height and Foot Size Related?
Cleaning up your data
Just how old are you
Inductive Statements
Measuring in Feet
Data with no name
Data with sex but still no name
Is our height data Normal?
Box and Whisker Plots
Do we need to ask Everyone?
Biased Households
You are Important!
Drawing Simple Tally tables, Pie Charts and Bar Charts
Means, modes & medians
Pet Survey
Is Your Foot One Foot Long?
Cars
Census or Sample
Do you have Big Feet?

SCIENCE

How much have you Grown today?
Empty Drink Cans
Do you have Big Feet?
An Italian Feast
Sugar and Spice and all things nice

GEOGRAPHY

South African CensusAtSchool
BIG Schools
Dividing up the Country
Housing
Postcodes (English)
Postcodes (Welsh)
Water, Water Everywhere

HISTORY

Old English Censuses
Censuses across the Globe
150 years ago
A Victorian CensusAtSchool
Queen Victoria's Census Form
Charles Darwin's Census Form
What is A Census?

ICT

Lists and the Graphic Calculator
Using Computers
Living in the Computer Age

KEY SKILLS

Application of Number
What Happens to your Empty Drink Cans?

Plus a number of ideas, activities and lesson plans in the Teachers Notes and Ideas section

6 References

Connor, D., Davies, N. and Holmes, P. (2000). CensusAtSchool 2000. Teaching Statistics, 22, 66-70.

Maddern, S & Crust, R (1989) *Extended Tasks for GCSE Mathematics – Statistics and Probability - Finding Out* Midland Examining Group/Shell Centre for Mathematical Education.

Moore, D. S. (1997) *The Active Practise of Statistics: a textbook for multimedia learning* New York: W.H. Freeman & Co.

Department for Education and Skills(2001) *National Numeracy Strategy*. London: available on http://www.standards.dfes.gov.uk/numeracy