



RUMINATING ON

Hilary Povey and members of the All-Attainment challenges and frustrations of

The marking criteria for GCSE handling data coursework puts emphasis on students' ability to plan and carry out a statistical project and to make meaningful analysis of the data they collect. Yet there are also marking criteria that demand a certain level of statistical manipulation – charts and calculations – without which it is impossible to gain the higher marks for analysis. In my department, all students do the 'Read all about it' coursework, where they compare two written sources. In departmental discussions we have shared ideas about how we can help our students to achieve the highest grades:

'Comparing word lengths is enough to get them a grade C.'

'To get the higher grades they need continuous, or at least grouped, data – so they could collect sentence length data because it makes more sense to group that than it does to group word length data.'

'For it to make sense to draw a histogram, they need to group the data in unequal class intervals.'

We then expect students to be able to justify the sort of statistical analysis they have done from the point of view of the project; eg, 'I decided to compare the length of sentences because I found that the word lengths were not significantly different.' Yet the truth is that the student has chosen to compare sentence length because the teacher has told them they can score higher marks by doing that. And I can't think of any justification for unequal class intervals for sentence length data – but I do want my students to draw histograms because they are in the Grade A indicators!

This article is particularly interesting in the light of the announcement in October by the Secretary of Education, Alan Johnson, that GCSE coursework in mathematics is to be abolished. To contribute to this discussion go to www.atm.org.uk/mt.

I am expected to teach data-handling in KS3. At KS4, this continues and I am expected to enable students to produce a piece of coursework as part of their GCSE assessment. I have done this for the last few years but I am aware of a number of important aspects of my work which seem riddled with conflicts:

- I would like students to work with real and up-to-date data relating to significant issues but I question whether my quest to make it accessible trivialises it.
- I would like students to be confident in carrying out calculations and drawing statistical diagrams. Students at my school often achieve a high level of proficiency in these skills but are severely lacking in their ability to interpret what they have done and make simple statistical inferences.
- I would like all students to select their own area of research but I feel responsible for checking the accuracy of their work – a very time consuming activity!
- I could hand over the marking to the board but I am not convinced that students' work will be given the time and attention it deserves.

The 'handling data cycle' now embedded in the KS3 strategy helps to frame the ways in which we move from hypothesis to conclusion. One of the most difficult issues that the curriculum does not address is how you make a final decision about whether the data supports the hypothesis. Many students will interpret even the slightest of differences in bar chart height as definitive 'proof'.

COURSEWORK

Teaching and Learning Group on the GCSE handling data coursework.



I have been thinking about psychological barriers to teaching statistics in a relevant and meaningful way. I recently read an article about an innovative statistics project and very much liked the way in which it made statistics relevant to the real world and inspired the interest of the learners. Yet I was not entirely happy about the whole thing and I couldn't quite identify why I was worried. I began to think about the way I've taught maths in the past and the way I'd like to teach maths.

When teaching maths at A level and GCSE, I've always felt under pressure to 'cover everything on the syllabus'. I found this particularly difficult when I taught a one-year course for students retaking GCSE maths. Our scheme of work involved ploughing through 36 problem sheets, covering everything on the intermediate GCSE syllabus, plus coursework and revision in 32 weeks, and I always felt that just as the students started to make progress on one topic we moved onto the next. The previous year, when I was doing my PGCE, an experienced teacher had said to me, "I always cover everything on the syllabus; then the students have no excuse." I just can't agree with this. Not if you rush through each topic so fast that nobody has time to make any progress.

GCSE students have to be able to draw a bar chart, pie chart, histogram, scatter diagram, box plot and stem-and-leaf diagram. I wanted evidence that this statistics project gave the learners an opportunity to do all of these. But it didn't. When I started teaching I lacked confidence and I didn't want to be accused of failing my students by missing bits out. This was tapping into my old fears about how I couldn't cover everything on the GCSE specification in one year.

Is there a problem here, or is it just in my mind? If the project doesn't provide suitable data for drawing a histogram then let's just admit this.

That's not a problem because we can do histograms on another day with a different set of data. But is there enough time left to cover everything on the syllabus? Is there enough time left to go through every possible type of exam question? The project might not cover everything on the syllabus, but it was still a very good learning experience for the students and covered a large proportion of what needed to be taught. More importantly, it got them interested in statistics.

When I've taught the S1 module for A-level statistics, I've used three sets of data for most of my examples. The first was a set of made up data giving the heights of 50 plants. Nice and convenient, but hardly inspiring. The second consisted of the masses and lengths of a population of giant tortoises in the Seychelles, data I got from some friends who had done a research project there. This was a bit more interesting - I could talk about the difficulty of weighing a 100 kg tortoise and the possibility of a rule for estimating its mass from its length using linear regression. My third set of data was from the National Office for Statistics and gave the distribution of people's earnings. This wasn't so easy to handle and even drawing a histogram was pretty fiddly. But this data wasn't just interesting, it was *inflammatory*! Do you know how much more, on average, men earn than women?

Statistics can be interesting and statistics can be boring. Innovative teaching methods require a lot of work and are controversial. It's much easier to go through the text book topic by topic and exercise by exercise. If you've got a ridiculously heavy workload then there's a pretty strong argument for keeping things as simple as possible. I'd like to put statistics into context by doing an interesting project, but it's easier to say to myself, "I haven't got enough time; I've got to cover everything on the syllabus."





Surely our stropky adolescents should be exactly the right people to really argue about and critique the statistics that describe our world. A long time ago I used a newspaper headline: “55% of Youths Commit a Crime”. What is a youth? What is crime? Was this a sample or a census?

Although we may be keen to make the handling of data, at least some of the time, relate to important aspects of our students’ lives and the lives of those around them, it can sometimes lead to difficulties. We may be challenged about bringing data connected to live issues of national and international concern into the mathematics classroom. A contribution by Jonathan MacKernan to *MT172* (‘Not for the classroom’) is a thought-provoking article which addresses this dilemma. It also contains lots of useful ideas for sources of statistical data.¹

GCSE Handling Data coursework should be a golden opportunity to engage students in meaningful ‘real-life’ mathematics. Why do we end up asking students to count the number of letters in words in two different newspapers? Is it because we have become deeply cynical about coursework in general and just want to get it over and done with? Or is it because we find handling data so difficult to teach and the students struggle to understand it? Statistics is a subtle ‘art’. It appears so clear with neat bar charts and pie charts, but in reality everything from the planning of the data collection is fraught with problems that lead to subjective and often inconsistent decisions being made.

The data handling project, a compulsory component of GCSE mathematics, is the most intellectually demanding task that 16-year-olds have to complete.

See Gwen Tresidder’s article in *MT197* (July 2006) *Data handling and citizenship* for a description of how she tackled some of these issues.

¹ Go to www.atm.org.uk/mt/ to read this article

There are sources of good material around for supporting the teaching of handling data in KS3 and KS4. The ones the group explored and recommend include web resources, books and a regular newspaper article.

Some useful web resources:

- Census at School
www.censusatschool.ntu.ac.uk
- Vision of Britain
www.visionofbritain.org.uk/index.jsp
- The Office of National Statistics
www.statistics.gov.uk (they produce a free downloadable magazine called horizons)
- Data about the Olympics (eg, hypothesis: ‘The larger your population, the more medals you will win.’) www.olympic.org
- Cyberschool bus – information from around the globe
www.un.org/Pubs/CyberSchoolBus/
- You can also get data about winning lottery numbers at www.projects.ex.ac.uk/trol/trol/.

Some useful books and CDs:

Smith, D. J. (2004) *If the world were a village*, A&C Black

SMILE Mathematics, *Real Data Projects: Statistical Projects for Key Stage 3* (includes CD)
<http://smilemathematics.co.uk>

SMILE Mathematics, *Discussing Data: Suitable for Key Stages 3 and 4*, (includes CD)
<http://smilemathematics.co.uk>

Amnesty, *Human Rights in the Classroom: Mathematics*, Amnesty
www.amnesty.org.uk/library/books/curriculum.shtml

Regular newspaper article worth checking out:

Each week, on Mondays, the *Guardian* produces an A3 spread with statistical information and graphics on one of the current issues in the news.

The *All-attainment teaching and working group*, is an ATM Working Group. For more information on its work or future meetings, contact Hilary Povey at workinggroups@atm.org.uk