Using Multivariate Data as a Focus for Multiple Curriculum Perspectives

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Structure

- Professional statistics and school statistics
- Ambitions and Barriers
- MV data analysis for 13 year-olds
- Towards powerful weak methods

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Statistics and School Statistics

- Statistics
 - data and problem driven
 - modelling targeted towards particular problem areas (biometrics, demography, and econometrics)
 - creating models to fit interesting problems NOT fitting interesting problems into standard models

from (da Silva 2006)

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Statistics in School

- From Teaching statistics despite its applications

 (Ridgway et al 2007)
 - In England, 'statistics' = 'technical mastery'
 - Uni or bivariate data ONLY
 - Analyses toy data via standard (1920s) models
 - Little use of computers
 - Quite unlike 'real' statistical practice
- · i.e. difficult, dull, and pretty useless

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Barriers

- Access to technology
- · Beliefs about what is 'hard'
- (maths) teacher concerns about 'messy data'

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SMART Centre

- BIG ambition to promote statistical literacy at school and in adults
- Engage everyone on the process of 'reasoning with evidence'
 - To support the democratic process
 - For better political decision making
 - For better personal decision making

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SMART Centre

- Creating novel interactive displays

 Generic shells as freeware

 Uploading interesting data sets
- - What is worth knowing?

 - How does it develop?
 How powerful are 'weak' methods?
 when do qualitative and quantitative analyses clash?
- - Studying user interactions Studying user understandings Empirical studies on difficulty
- Collaborating with data providers on better data displays

 Raising adult literacy via Web 2.0 activities
- Curriculum development Embedding MV data into curriculum materials

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Our Ambitions

- · Working with teachers with very limited mathematical skills (and little confidence)
 - use *realistic data* to aid understanding
 - engage students to aid understanding and personal behaviour
 - (promoting statistical literacy across the curriculum)

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Curriculum Development and Research

- Wellcome Trust project with the Geographical
 - Reasoning with BioMedical Evidence -**Understanding Risk**
- CCEA project
 - Data focussed cross-curricular materials for new curriculum for 11 - 14 year olds
- Becta project
 - What are the barriers to reasoning with multivariate data presented via ICT, and how can they be overcome?

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Contexts and Data Sets

- Alcohol
- Poverty
- Drugs
- Obesity
- Pensions and savings
- Sexually transmitted diseases
- Tobacco
- Voting systems

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Pupil Responses

- Yes, between 11 & 15 the level of drinking goes up and there is a big difference. At the ages of 12-13 the girls start to catch up with the guys.
- Boys drank more than the girls when they were younger but as they got older the girls drank much more than boys. There is a big difference between 11 & 15 year olds. Because girls are trying to act more grown up.

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Informal Feedback

- Pupils
 - High levels of engagement observed
 - Prefer 'discovery' over 'preaching' about sex, drugs and alcohol
- Teachers
 - High levels of pupil engagement
 - Much more focussed discussions on 'difficult' topics
 - Much better written work than before BUT still big gaps between oral and written explanations

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Conceptual and Research Issues

- What is the 'right list' for literacy?
 - What key ideas are needed to understand different data sets?
- For any data set
 - What are the vices and virtues of applying quantitative
 - What are the vices and virtues of applying qualitative methods?
- Defining and describing attainment
- How do ideas develop?
- Student (and teacher) misconceptions are?
 - diagnostic actions should be?

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Towards Statistical Literacy

Describe and explore before you explain and model

- Critique the quality of the data
 Check that the effect size is a lot bigger than the likely error of measurement
- Focus on effect size not significance level
- Identify variables that have the strongest effects Look at absolute levels are they big enough to be worth worrying about?
- Look for non-linear relationships

 Explore the effects over different values of each variable
- Look for changes over time
 Look for interactions, and think about 'data surfaces'
- Think about possible confounding variables Disaggregate data, are the patterns the same? Is it worth quantifying?

- To an you justify your strong assumptions?
 Look for the 'dog that didn't bark'
 Be cautious of claims about causality especially in observational data

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Data references

- Alcohol data in Drug use, smoking and drinking among young people in England in 2005.
 - http://www.ic.nhs.uk/datasets
- Pension annuity rates available from:
 - http://www.fsa.gov.uk/tables/

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