

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
- Theory
 - What is worth knowing?
 - How does it develop?
 - How powerful are 'weak' methods?
 - when do qualitative and quantitative analyses clash?
- Research
 - 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 Association
 - 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 methods?
 - 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?
 - Can 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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