What happens if non-overlapping universes collide? - Reaching out into the statistical unknown.

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Some of the arguments in this presentation are more fully presented in the article 'Visualise then Conceptualise' which appeared in the June 2011 issue of the ATSS e-Journal Social Science Teacher.

Non-overlapping universes?

Mathematics & Statistics

Social Science

At early secondary school stages pupils seem to divide into almost non-overlapping universes – those good at maths don't encounter much 'real data' which says – you can change the world. Those interested in changing the world, don't seem to get the message that maths and stats would be of help in doing that.

I don't believe this is right, and I do believe this perception is harmful to the cause of both areas of study.

Statistics in the mathematics curriculum (plus probability)

- Data handling cycle, bias, design an experiment or survey
- Descriptive statistics
- Graphical displays - one variable, or two with a straight line relationship
- Find patterns in data, interpret, make inferences

- How much of the real world does this curriculum cover?

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Not a lot is the answer!

Assessment ……..

- We know assessment drives a lot of the delivered curriculum – so how does the assessment illuminate what is expected?
- ICOTS8 paper: *Statistics assessment: the good, the bad, and the ugly*
  - Real world but irrelevant or uninteresting
  - Context irrelevant
  - Unrealistic context

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Mathematics educators can set very bad examples

- David Burghes is one of the UK's best known mathematics educators
- Recently produced a major report funded by CfBT:
  - *International comparative study in mathematics teacher training*

What's wrong with this picture?

Chart 8: Attributes of an effective Mathematics Teacher

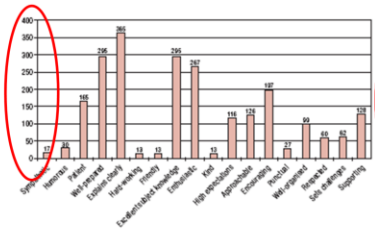


Chart 10: Trainees' main concerns about maths teaching that they hope will be addressed by their training course

Chart 9: Topics in which trainees did not feel confident

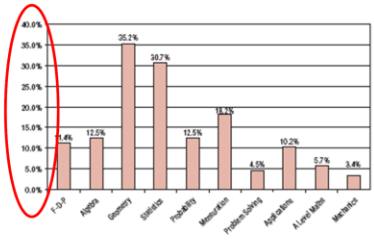
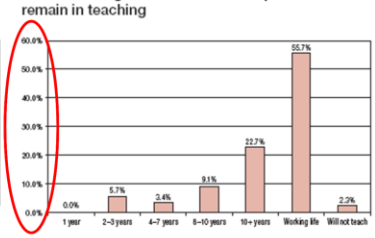
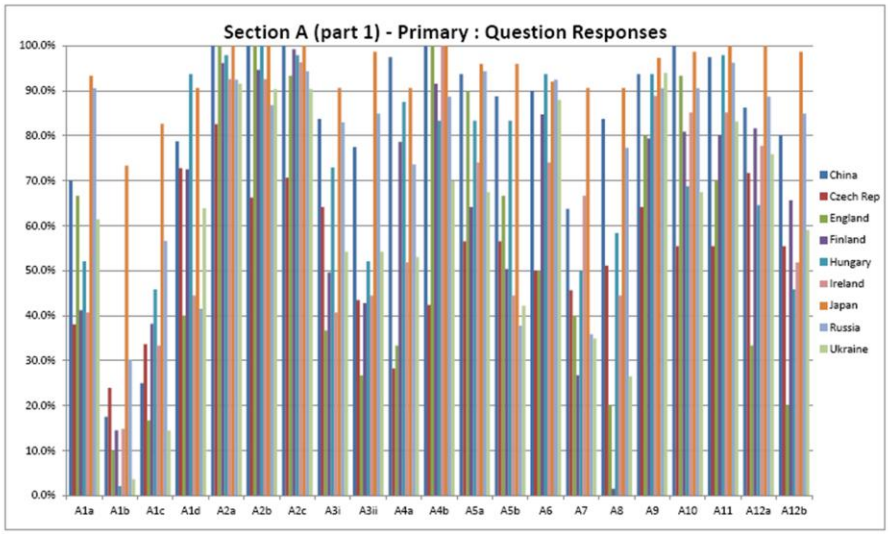


Chart 11: Length of time trainees expect to remain in teaching



The inconsistency in the vertical scales here is awful ....

How to communicate outcomes?(???)



There are 9 countries and 21 question responses (= 189 bars!) in this graphical display …..

Could we do better?

- Dealing with the real world – where things are messy!
- Pretending things are simple – that maths problems always have a right answer and often one method of analysis – does not seem to be successful.

Reaching out into the statistical unknown:

- Use data in mathematics and statistics teaching which offer real insights into social issues
- Support the teaching of other subjects by offering relevant and up-to-date data in an accessible form
- Support teachers in other disciplines to be comfortable with using multivariate data representations

New Zealand

- New mathematics and statistics curriculum has running threads in statistical enquiry and statistical literacy which start in earliest years of school and develop in sophistication as pupils get older – and multivariate data contexts appear from the start.

South Africa

- New curriculum introduces statistics into mainstream curriculum for first time
  - real issues in teacher preparation, particularly among black teachers, and specifically those teaching in rural schools
- Still the new curriculum embraces real social statistics as an important ingredient

Sociology A-level project

- Funded by The Nuffield Foundation
- Providing data resource which has simply not been accessible to students on these courses previously

Research methods – explicit area of study in Sociology course

- The nature of the data we develop for these sections can be used then to illustrate and illuminate some of the ideas in the section on research methods
- Where the students have actually engaged with real, complex, data – concepts such as reliability, validity and representativeness should be more meaningful.

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Research methods – explicit area of study in Sociology course

- Issues of what is being measured and how can best be addressed by exemplification
  - In education data, measurement and categorisations include:
    - Did the pupil pass 5 GCSEs at grade or above, including English and Mathematics?
    - Gender (easy, peasy …… isn't it?)
    - Elegibility for free school meals
    - Ethnicity

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The 'numbers' tab in the education data interface has metadata available through the ? Symbols which gives the details of definitions used by DfES in collecting this data.

Education

- Differences in educational achievement
  - by social class, gender, ethnicity, region
- If you overlay patterns of achievement in various categorisations you DO NOT tell the right story
- Let's look at it: http://www.dur.ac.uk/resources/smart.centre/nuffield/GCSEdata_08_06_11.swf

Hyperlink will load in a new window the GCSE data interface – full url is http://www.dur.ac.uk/resources/smart.centre/nuffield/GCSEdata_08_06_11.swf

Opportunities

- Recent reports (by the Nuffield Foundation Is the UK an outlier?, ACME – on mathematical needs of pupils and of employers, the Mathematical Task Force report) all suggest many more students should do some mathematics post-16.

- That debate also offers an opportunity to influence concurrent discussions about the scope and content of the National Curriculum (the statutory education up to age 16)

A final thought:

- Current structure of qualifications means these sort of interfaces can not be used in assessment.
- Subjects like Sociology seem to value their contribution in illuminating data relating to core concepts, so the interfaces are not needed in actual assessment ……
- But can assessment really afford to lag so far behind in the use of technology?