What Statistics do budding teachers learn and is it adequate?

Penelope Bidgood, Neville Davies,
Richard Gadsden, Paul Hewson, John Marriott

Project: Statistics Content and Delivery in British Teacher Training Courses funded by the Teaching Statistics Trust

Aims

1 Survey the extent and form of UK postgraduate and undergraduate teacher training courses in mathematics and other relevant subjects with respect to the delivery of statistics content and pedagogy.

2 Survey newly qualified teachers, trainee teachers and education lecturers about their attitudes to, and knowledge of teaching statistics.

Objectives

- Identify and catalogue mathematics teacher training courses and highlight those that pay attention to statistics knowledge and/or pedagogy;
- Classify the entry profiles of students to such courses, particularly their statistics backgrounds;

Objectives cont'd

- Identify how the statistics content is delivered and the nature of the attention paid to statistical thinking and reasoning for teacher training courses in mathematics and other relevant subjects;
- Identify and synthesise elements of good practice in statistics knowledge and pedagogy delivery within UK teacher training courses and disseminate findings

Background

- UK Government set up the post-14 Mathematics Inquiry (Smith Report, 2004) into the teaching of mathematics in schools
- In response, the Royal Statistical Society (RSS) recommended that
    - Statistics should be a part of the 14-19 core curriculum to which everyone has some exposure
    - Appropriate CPD programmes are required, and there are also important requirements for initial teacher training

"At the heart of the debate is the notion of what it means to be statistically literate"

Background cont'd

The RSSCSE was commissioned to undertake a review of the place of statistics and data handling in the national curriculum. Amongst its findings

- Just over 20% of heads of mathematics had qualifications that did not include statistics (over 50% for Heads of Science and 30% for Heads of Geography)
- About one third of Heads of Maths did not think that their knowledge of statistics was "excellent" or "very good" and about 25% declared themselves to be "not fully confident" at teaching statistics at KS3.

Worldwide Concern

- Joint International Congress for Mathematics Education/IASE Conference 2008

"Statistics Education in School Mathematics;

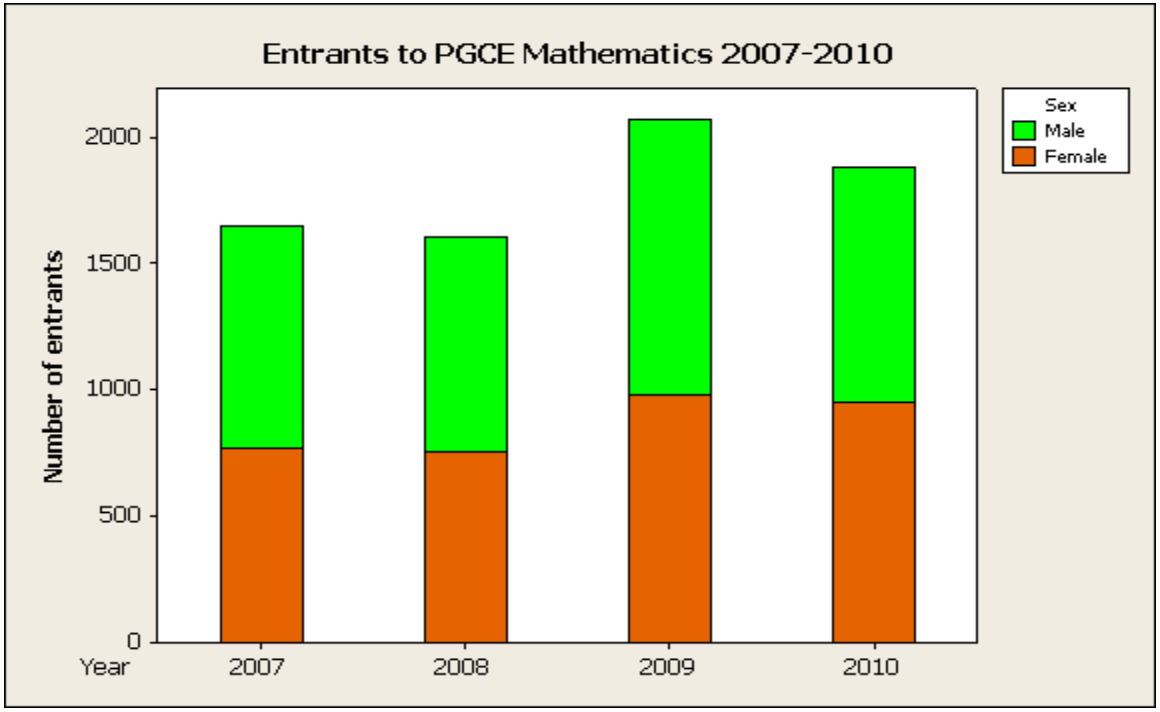
Challenges for Teaching and Teacher Education"

- The school level GAISE report from the US (2005)

Routes into teaching secondary maths

- Post-graduate Certificate of Education (PGCE)
- PGCE and Mathematics Enhancement Course
- Bachelor of Education (Bed)
- School Centred Initial Teacher training (SCITT)
- BA/BSc with Qualified Teacher Status
- Graduate Teacher programme
- Teach First
- Overseas Trained Teacher Programme

PGCE Secondary Mathematics

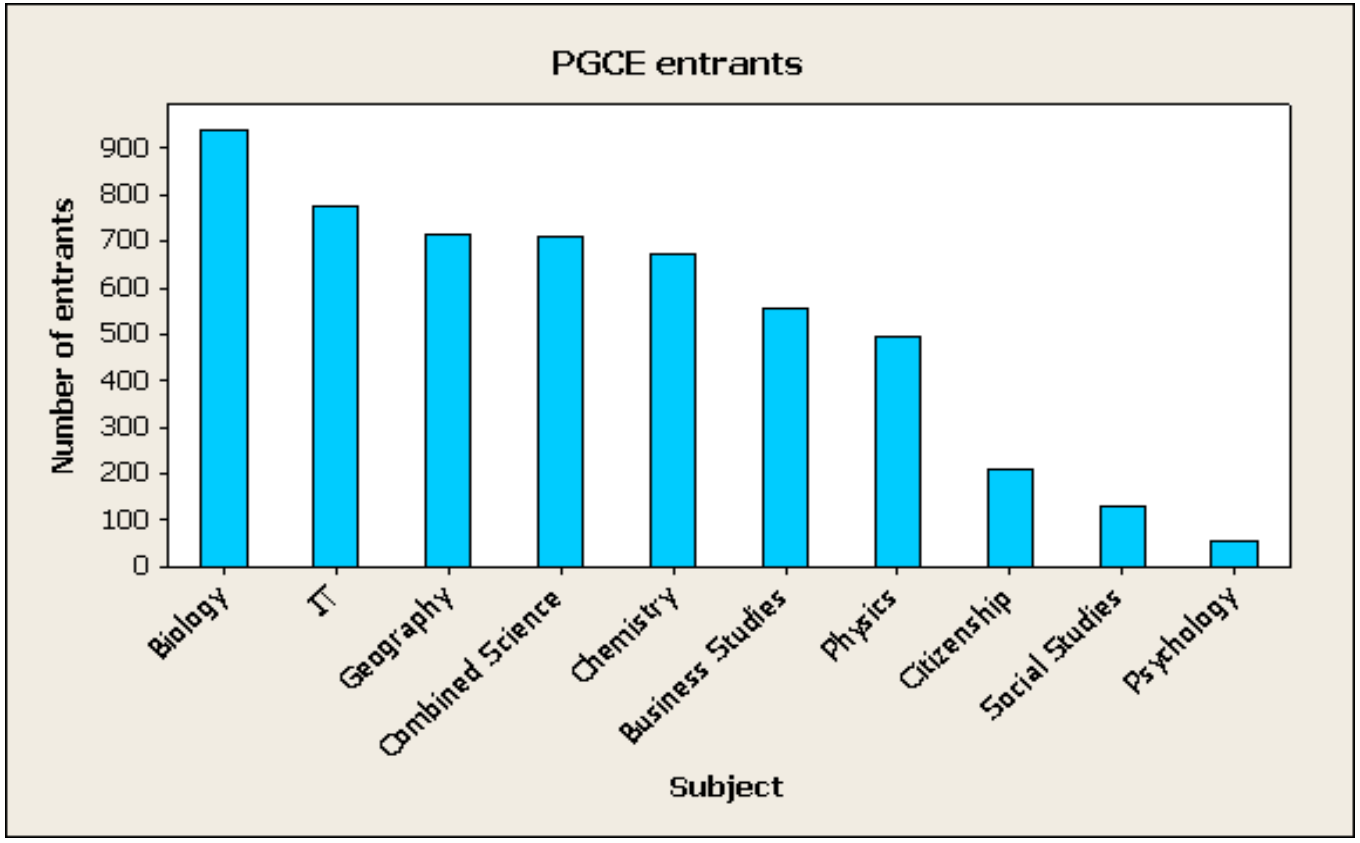


In 2010

1821 (96%) studied at one of the 70 HE institutions;

1390 (74%) were White, 10% Indian/Pakistani/Bangladeshi

Other subjects with statistics content



NQTs (A) and PGCE (B)

Q1 What was the title of your first degree?

	A (27)	B (42)
Mathematics	12	17
Mathematics combined	3	7
Engineering	2	8
Computer Science	2	2
Social Sciences	4	2
Other	4	6

Q2 Approx. what percentage of the content of your first degree course consisted of statistics?

	None	<5%	6-10%	11-25%	26-50%	50-75%	>75%
A	4	3	9	7	2	2	0
B	1	11	7	16	5	1	0

Q4 How much statistics have you acquired on the PGCE?

None 30 Not much 3

Q3 For each topic listed below please indicate whether
a) you knew about it on entry to the PGCE course
b)you feel confident in working with the technique

	A (27)		B(42)	
Topic	Knew before	Confident	Knew before	Confident
Data handling cycle	18 (67%)	22 (81%)	31 (74%)	30 (71%)
Sampling/surveys	24 (89%)	24 (89%)	37 (88%)	36 (86%)
Data collection	23 (85%)	25 (93%)	37 (88%)	37 (88%)
Data presentation	23 (85%)	26 (96%)	36 (86%)	36 (86%)
Measures of location	12 (44%)	12 (44%)	19 (45%)	13 (31%)
Measures of variation	16 (59%)	17 (63%)	24 (57%)	11 (26%)
Regression	16 (59%)	12 (44%)	23 (55%)	14 (33%)
Time series	14 (52%)	15 (42%)	23 (55%)	14 (33%)
ANOVA	16 (59%)	16 (59%)	29 (69%)	17 (40%)
Inference	14 (52%)	18 (67%)	22 (52%)	15 (36%)

Q6 How would you describe your knowledge of statistics and data handling?

	Excellent	Very good	Good	Some	Little
A	4	7	11	5	0
B	4	15	15	8	6

Q7 Do you know what the data handling cycle is?

A 21 (78%) B 34 (81%)

Q8 (If Yes to Q7) How frequently would you use the data handling cycle in your teaching of statistics ?

	Always	Often	Sometimes	Seldom	Never
A	2	6	10	1	0
B	2	16	12	2	2

Interview results – perception of statistics

- Part of maths
- One of the areas of maths used in real life
- Bombarded with statistics in press and on TV
- Need to understand stats so that you can tell when media etc are telling the full story/truth
- Not exact – open to interpretation
- Can’t have stats without maths

Should stats be taught separately to maths?

- Stats appears in other subjects, but needs mathematical understanding
- Science uses the same skills (experiments)
- Put the data in context
- Project work goes down well

How should stats be taught?

- Data handling cycle stops it coming to a dead end – never really finishes
- Session on data handling cycle within course
- Told to use data handling cycle if teaching statistics
- Had seen something on Teachers TV about the data handling cycle
- Use the data handling cycle instinctively

Experience on PGCE course

- Need to be taught pedagogy – different ways of teaching the same topic
- Should be more focus on training in teaching and practicing teaching
- Sessions were better when teachers spoke about actual experiences

Comments on teaching statistics

- Make it functional, create a “hook”
- How to interpret advert claims; pie charts in newspapers. Limitations of charts
- Need to show applications
- Subjects taught from scratch in diffeernt subject areas – boring for pupils
- Pupils did not make connections across subjects
- ICT is a key tool (large datasets)
- Cross-curricular stuff is hard to do!

Next steps

- Survey a further 5 PGCE courses by questionnaire and interview
- Survey the remainder by questionnaire alone
- Use a similar questionnaire with teachers in the first year or two after qualification
- Survey the teacher trainers

- Final report

References

- Franklin C et al (2005) *Guidelines and Instruction in Statistics Education Report (PreK-12)* ASA
- Goldstein H (2005) *Teaching Statistics Across the 14-19 Curriculum* available at http://www.rss.org.uk
- Graduate Teacher Training Registry *Annual Statistical Report 2010* available at www.gttr.ac.uk
- ICME/IASE (2008)*Statistics Education in School Mathematics; Challenges for Teaching and Teacher Education* available at www.ugr.es/~icme/iase_study
- Smith A (2004) *Making Mathematics Count* The Stationary Office, London